ULI Charlotte

ENERGY, RESILIENCY & INNOVATION

Bloomberg Philanthropies American Cities Climate Challenge
City of Charlotte

Technical Advisory Panel Report | JULY 17-21, 2020

Urban Land Institute
Center for Sustainability and Economic Performance

Bloomberg Philanthropies

American Cities Climate Challenge

CONTENTS

CONTENTS

CONTENTS

ABOUT ULI

The Urban Land Institute is a global, member-driven organization comprising more than 46,000 real estate and urban development professionals dedicated to advancing the Institute's mission of providing leadership in the responsible use of land and in creating and sustaining thriving communities worldwide.

ULI's interdisciplinary membership represents all aspects of the industry, including developers, property owners, investors, architects, urban planners, public officials, real estate brokers, appraisers, attorneys, engineers, financiers, and academics. Established in 1936, the Institute has a presence in the Americas, Europe, and Asia Pacific regions, with members in 80 countries. The ULI's mission is to provide leadership in the responsible use of land and in creating and sustaining thriving communities worldwide. ULI Charlotte carries forth that mission by serving the Charlotte, Piedmont, and Western North Carolina's public and private sectors with pragmatic land use expertise and education.

ABOUT ULI CHARLOTTE

ULI Charlotte is a District Council of the Urban Land Institute. The District Council offers ULI services and benefits at a regional level. The mission of ULI Charlotte is to complete the ULI experience at a local and regional level through education, research and the exchange of ideas and experiences.

SUPPORT PROVIDED BY

Support for this program was provided by the Bloomberg Philanthropies American Cities Climate Challenge, Urban Land Institute's Center for Sustainability and Economic Performance, and the Natural Resources Defense Council.

In 2019, the City of Charlotte became one of the twenty-five cities participating in the Bloomberg Philanthropies American Cities Climate Challenge. The initiative aims to accelerate and deepen U.S. cities' efforts to create the greatest climate impact through 2020 and showcase the benefits – like good jobs, cleaner air, and cost savings – that climate solutions bring.

About the Bloomberg Philanthropies American Cities Climate Challenge

The Bloomberg Philanthropies American Cities Climate Challenge is a $70 million program that empowers twentyfive of the largest U.S. cities to implement near-term climate goals and become primary drivers of progress towards meeting America's pledge for the Paris Climate Agreement. Participating cities have committed to specific policy and practice actions which will allow them to achieve ambitious carbon reduction goals.

The Climate Challenge provides technical expertise to participating cities to facilitate the development and passage of high impact policies, training for senior leadership, technical assistance, and activities to facilitate citizen and stakeholder engagement for community buy-in.

ULI's Center for Sustainability and Economic Performance partnered with the NRDC (Natural Resources Defense Council) to facilitate the engagement of ULI members in activities related to the American Cities Climate Challenge. ULI Charlotte received a grant from ULI's Center for Sustainability and Economic Performance to host this Technical Advisory Panel (TAP) and provide guidance to the city of Charlotte on land use and transportation policies.

ABOUT ULI TAPS

The ULI Charlotte Technical Assistance Panel (TAP) Program is an extension of the national ULI Advisory Services program. ULI's advisory services panels provide strategic advice to clients (public agencies, nonprofit organizations, or nonprofit developers) on complex land use and real estate development issues. The program links clients to the knowledge and experience of ULI and its membership.

Since 1947, ULI has harnessed the technical expertise of its members to help communities solve difficult land use, development, and redevelopment challenges. More than 700 panels have been conducted in 12 countries.

TAPs include extensive preliminary briefings followed by a two-day intensive working session in the client's community. This TAP was held remotely via online video conferencing with staff members and stakeholders due to the COVID-19 pandemic. A detailed briefing package and guided discussion is provided by the client to each TAP participant before the working sessions. ULI Panelists were unable to be present in Charlotte due to travel restrictions, but Panelists received a briefing from City staff and used maps and other digital materials to become familiar with the community. ULI Panelists used digital tools to interview stakeholders and address a set of questions proposed by the client about a specific development issue or policy barrier within a defined geographic area. The product of these sessions is a community presentation and a final report. This report presents highlights of the Panel's responses to the client's questions, as well as a diverse set of ideas and suggestions.

TAP PANEL

Members of ULI were selected to provide a wide variety of experiences. Full biographical sketches are included in the appendix to this report. Panelists for the City of Charlotte study were:

Panel Chair

Craig Lewis
Principal, Stantec

Panel Members

Steven Baumgartner, PE, CEM, LEED AP, EcoDistricts AP
Director, Baumgartner Urban Systems Strategy

Shelby Busó
Chief Sustainability Officer, City of Atlanta

Janet Shull, AICP CUD
Strategic Advisor, City of Seattle Office of Planning and Community Development

Walker Wells, AICP, LEED AP, EcoDistricts AP
Principal | Rami + Associates

ULI Project Staff

Theresa Salmen
Executive Director, ULI Charlotte

Laura Stroud
Contract Writer, McAdams Co.

STAKEHOLDERS & PUBLIC DROP IN PARTICIPANTS

Andrew Ausel, City of Charlotte

Amy Aussiker, Envision Charlotte

Kim Hombs, Trees, Bees and All These (CLT Tree Advisory Council)

June Blotnick, Clean Air Carolina

Nancy Carter, County and Charlotte Climate Leaders

Christina Danis, Charlotte East

John Cock, Ulta Planning + Design

Robert Cox

Richard Cuebas, Integra Architecture

Christy Daniel, Duke Energy

Mike Davis, North Carolina Sustainable Energy Association

Mayor Pro tempore Julie Eislet, City of Charlotte (and TAPE Committee Chair)

Meg Fencil, Sustain Charlotte

Geraldine Gardner, Centralina Regional Council

Melissa Gaston, Community Organization

Megan Green, Youth Climate Leader

Clay Grubb, Grubb Properties

Sarah Hazel, City of Charlotte

Rebecca Herbert, Livable Meck

Darryl Gaston, Druid Hill Neighborhood Association and North End Neighborhood Coalition

Jacqueline Jarrell, Charlotte Water

Matt Langston, Landlords Design Group

Mike Lizotte, UNC Charlotte

Mayor Vi Lyles, City of Charlotte

Bert Lynn, Mecklenburg County Parks

Summer Minchew, EcoImpact Consulting

Sara O'Mara, Choate Construction

Kush Patel, Youth Advisory Council

Rob Phocas, AvidXchange (former City o Charlotte Sustainability Director)

Tim Porter, City of Charlotte (urban forestry)

Lisa Richards, Crescent Communities

Katie Riddle, City of Charlotte

Jennifer Roberts, ecoAmerica

Steve Rundle, NAACP Green Jobs

Rachel Stark, City of Charlotte

Tucker Stillman, Youth Advisory Council

John Thigpen, NRDC/American Cities Charlotte Challenge

Jenny Vallimont, Gökotta

Jason Wager, Centralina Regional Council

Colin Walker, Grubb Properties

David Walters, UNC Charlotte

David Ward, Brighthouse Financial

Karen Weatherly, City of Charlotte (environmental attorney)

Martin Zimmerman, City Wise Studio

PLANNING + COMMUNITY CONTEXT

The City's Strategic Energy Action Plan (SEAP) is the catalyst for this TAP. The City is also in the process of creating a Comprehensive Plan and Unified Development Ordinance (UDO) which provide opportunities to advance SEAP goals. Other policies such as Smart Districts and Transit Oriented Developments (TODs) are applied at the neighborhood or district level using a combination of regulatory tool and financial incentives and investments.

Strategic Energy Action Plan (SEAP)

The Strategic Energy Action Plan (PDF Download) is a planning document to guide the City of Charlotte to become a low-carbon city by 2030 and for City buildings and equipment to be zero-carbon by 2050. The plan identifies 11 action areas that "address opportunities for the greatest reduction in GHG emissions for Charlotte." Action Area 4 identifies Resilient Innovation Districts (RIDs) as a key policy infrastructure for achieving the SEAP's desired outcomes.

Charlotte Future 2040 Comprehensive Plan

The City is currently undertaking a comprehensive planning process that includes extensive community engagement. The planning process to date has identified 10 big policy ideas, but final recommendations are forthcoming. Any recommendations for implementing RIDs should integrate into the City's comprehensive plan.

Unified Development Ordinance (UDO)

The City is also working on its first UDO which will bring together multiple existing policies. The UDO will be compatible with the existing zoning code, but the City is interest in exploring sample policy language from case studies related to regulatory or incentives-based policies for implementing the goals of RIDs. The City recently comprehensively updated its standards and expectations for Transit-Oriented Development (TOD).

North End Smart District

Comprised of aging industrial areas surrounded by a number of neighborhoods, many of which are considered fragile by the city, the area was designated as the North End Smart District in 2014 in an effort to identify and pursue the City and neighborhood's shared goals for investment and sustainable energy solutions. The District is intended to accelerate the City's energy and climate goals. Two projects piloted in this area in partnership with Duke Energy include distribution of "smart technology" kits for energy efficient kits that promote energy savings at home, and a program that automatically notifies Duke Energy when streetlights go out. Other programs piloted in this area include a farmer's market, a program that creates new, free community technology access space while providing jobs and training, and a waste reduction program. The North End neighborhood has an active civic life and neighborhood association.

TOD Silver Line Planning

The City is planning an extension of its light rail system running from Matthews in the southeast, through the City Center where it will intersect with the Blue Line and then continue to the airport and eventual termination in Gaston County and is identifying station locations. This project will require significant public investment and the City is interested in maximizing density, sustainability, and energy efficiency using a full palette of tools for development with TODs.

PANEL ASSIGNMENT & PROCESS

The City of Charlotte's Strategic Energy Action Plan (SEAP) creates the framework for the City of Charlotte to become a low carbon city by 2030 and for City buildings and equipment to be zero carbon by 2050. The City requested assistance through the ULI Technical Assistance Panel Program to investigate and refine the City's desire to implement Resilience Innovation Districts (RIDs) as a policy tool for implementing the SEAP.

The SEAP acknowledges the need for collaboration and partnership to achieve this goal, and positions RIDs as a tool for combining public and private investment in certain districts to demonstrate and incentivize projects that promote and help achieve the City's SEAP goals.

Throughout the TAP process, the Panel recognized that designating a specific district in which to implement strategies could too greatly constrain implementation of the desired initiatives. Instead, the panel's line of inquiry explored how the goals of the SEAP could be integrated into the City's forthcoming Comprehensive Plan and Unified Development Ordinance, while depending on the City's robust existing Smart Districts and Transit Oriented Districts as potential hotspots for implementing low-carbon initiatives.

The Panel received a Briefing Book to review before the two-day TAP. Though TAPs are usually in-person events, this TAP was conducted remotely to ensure the safety of all participants during the COVID-19 pandemic. The Panel began with a presentation from the City of Charlotte staff about the existing policies and plans guiding the land development, the zoning process, TOD, low carbon/energy efficient programs, and general sustainability programs. The panel interviewed some members of the City Council, the Mayor, key city staff, as well as dozens of community stakeholders.

The TAP created a final presentation that outlined the planning problem, context, case studies, and specific recommendations and presented to City staff on the afternoon of the second day. Access to the digital meeting was sent to all staff, decisionmakers, stakeholders, and community members who had participated in the TAP.

It is important to note that the charge of this TAP was quite unique given its broad, policy-based focus. The consideration of the RID as an implementation tool became a gateway to a broader discussion about implementing not just energy-efficiency policies but also larger social and economic goals that contribute to a community's resiliency.

UNDERSTANDING THE PROBLEM

The Panelists used information from the Briefing Book and the City of Charlotte planning and community context presentation to establish a baseline understanding of the questions outlined in the Panelist assignment and process section. Additional information from community stakeholders is essentially for ensuring the Panel had a full understanding of the problem context. Stakeholder interviews were held in multiple breakout sessions using teleconferencing software. The following information summarizes information gathered during stakeholder input.

City Decisionmakers

The SEAP was created out of the City's climate change resolution which was adopted in 2018. The "Sustainable and Resilient Charlotte by 2050 Resolution" stated goals include ensuring city fleet and facilities are fueled by 100 percent zero-carbon sources by 2030 and Charlotte becoming a low carbon city by 2050 by reducing greenhouse gas emissions to below 2 tons of CO2 equivalent per person annually. City leadership realized they could not go directly from implementation without putting in place funding and policy structures, so the resolution included a mandate for the Strategic Energy Action Plan. The SEAP is intended to provide that guidance with the RID as one of the key implementation provisions. The City's SEAP was adopted in December of 2018.

The RID is grounded in an idea similar to that of EcoDistricts (https://ecodistricts.org/), LEED for Neighborhood Development (https://www.usgbc.org/leed/rating-systems/neighborhood-development) as well as the work in Charlotte's North End Smart District (https://charlottenc.gov/newsroom/releases/Pages/North-End-Smart-District.aspx), Innovation Districts (https://www.brookings.edu/innovation-districts/) and Transit-Oriented District regulations in the UDO (https://charlotteudo.org/transit-oriented-development/) that define a geography for the implementation of new and innovative programs. This approach provides Charlotte with the opportunity to create learning districts where new policies and ideas can be tested. Charlotte has strong neighborhoods and neighborhood associations, so the City is well-suited to this localized approach. The intent is to focus on energy, which is dependent on partnerships with Duke Energy, the area's energy provider. The City has partnered successfully with Duke Energy in the past including creating a "Smart Homes" program and beginning discussions about creating microgrids in strategic locations. Additionally, the city continues to increase its investment in electrical vehicles in the city's fleet along with charging stations. It has also developed some keep partnerships with Duke Energy, the local utility, including a Memorandum of Understanding (MOU) to develop a 75MW solar farm, a micro-grid pilot project, as well as possible smart city project in partnership with Siemens. Additionally, the city has forged partnerships with UNC-Charlotte, Goodwill Industries, and Envision Charlotte for related programs.

There was frequent mention of the constraints on regulatory innovation imposed by the current state enabling legislation, judicial decisions, and political relationship. Unlike "home rule" cities where the local government has broad discretionary authority, North Carolina cities are subject to "Dillon's Rule", a national legal precedent which limits cities' authority to those activities which are specifically enabled by the General Assembly.

City leaders agreed on the need for broader integration of the SEAP into city decision-making including, perhaps most importantly, zoning decisions. In addition, they stressed that any successful program must also incorporate equity goals, such as affordable housing and transit and ensure that the programs of the SEAP are equitably disseminated.

Stakeholder Groups

The Panel met with more than 20 stakeholders in two separate meetings of about 1.5 hours each. Meetings broke out into smaller groups to easily facilitate discussion. Notes here reflect general themes drawn from all stakeholder discussions.

- **Equity.** Equity is critical in every decision. Stakeholder input identified a need for an emphasis on equity. Participants noted that employment and pathways to homeownership are important elements of community resilience. Policy solutions that reduce carbon emissions should also include opportunities for job creation, housing development, and weatherization of existing homes. Policies should advance affordable housing development and preservation and pathways to home ownership, perhaps disproportionately so to address current and historical inequities. Additional equity concerns include ensuring that benefits of solutions accrue in neighborhoods that have been underrepresented in public engagement efforts and correcting the histories of underinvestment and redlining that have occurred in the City. "The innovation part of the (RID) name implies a discovery process – we don't need to innovate on the residential side – we need to implement." "Could this be a tool for repairing injustice?"
- **Partnerships**. There is a broad but loosely organized partnership among many individual organizations to implement the outcomes of the SEAP. Some efforts include landfill diversion, creating an urban arboretum, community solar, increasing outdoor dining, and building audits conducted by University of North Carolina at Charlotte (UNCC) Students.
- **District-level planning efforts.** Is a RID too specific a tool amidst the other broader planning activities occurring? One of the challenges for developing RIDs lies in the fact that there are multiple district-level planning efforts currently underway. Stakeholders shared some confusion around the relationships between RIDS, Innovation Districts, and EcoDistricts. There was a recommendation that the City define the difference between these programs or streamline the district-level planning efforts.
- **Metrics.** Metrics are critical to track the success of projects. Successful projects in the City depend on data collection showing planning results and the successes of implementation. The most successful programs have been able to measure and communicate their success. Data collection also has the potential to assist with ensuring plans are scalable. Implementing strategies at the district level is intended to create and test strategies that can be implemented more broadly. Accurate data collection will provide the information needed to make these decisions. Funding is a crucial element for ensuring that strategies are scalable, and accurate data collection can determine each strategy's return on investment. Perhaps most importantly, "global equity is looking for projects
- **Incentives.** Incentives may not be sufficient. Stakeholders discussed strategies for implementing a RID and noted that it may be unlikely that developers will provide any of the desired outcomes to access incentives. Many noted that only through minimum regulatory requirements will developers engage with the tools. "Is Charlotte ready to do the hard work?"
- **Tools to achieve SEAP implementation.** Stakeholders and panelists struggled with a RID as a tool for implementing the SEAP. Is a RID

even necessary? Some stakeholders expressed skepticism about the need for a new policy tool, noting that there were already many planning efforts on the table. Panelists noted that people are struggling now with issues that can be addressed through existing tools. "It shouldn't be limited to certain districts."

Public Drop In

At the conclusion of Day 1, a public drop-in session was attended by more than community members. While the discussion was intended to understand the appetite and potential structure for implementation of energy, resiliency, and innovation districts through the Comp Plan, four themes emerged during the session: growth, transportation, projects and structures, and equity. These topics are interrelated, but each requires a unique approach to be addressed and incorporated in any RID policy.

- **Growth.** Community participants noted how important of a consideration population growth will be for the City of Charlotte in the coming years. The Charlotte area has grown consistently with moments of rapid growth, including the current period. This growth creates an additional challenge to implementing incentives-based initiatives. Participants noted that incentives will need to be carefully crafted to ensure they provide enough benefit to be attractive to developers in a competitive area with a high growth rate. The RID is potentially a tool to focus development investment and create innovative solutions, but incentives to advance implementation of SEAP goals must be dynamic and attractive in this competitive growth environment.
- **Transportation.** Transportation solutions are related to population growth as they both are impacted to population growth, and influence where that growth occurs. The City has taken on ambitious transportation planning projects in recent years including the creation and expansion of the light rail line. Long-range infrastructure planning creates an opportunity for creating high-density development zones at transit nodes, but input from participants suggests that the incentives for density have not been appealing enough to developers to take advantage of those opportunities.
- **Projects and Structures.** In addition to the density of development, participants noted that policies can promote the ability for structures themselves to achieve zero-carbon emissions outcomes. A participant shared information about a case in Berkeley, CA in which the city prohibited future natural gas connections in order to reduce use of natural gas. Two noted barriers to this strategy include one, that the building code is administered by the County, and two that solutions implemented at the building level or district level will be most effective as Duke Energy changes their energy mix inputs to rely on renewable or low-carbon sources of energy.
- **Equity.** Community members stated that many residents in Charlotte's North End neighborhood lack basic necessities of life, and that there has been a large number of planning initiatives in the neighborhood, but residents have seen few results. Community leaders are currently working to increase internet access to under-invested neighborhoods and see potential for neighborhood goals of improving infrastructure access to be implemented through the RID. The internet can be a powerful force for building resilience. Many more people can be part of conversations about their future, bringing their ideas and innovations to bear, while being in a position to evaluate alternatives. Stakeholders asked whether the RID could be a tool for repairing the history of racial inequality, including the continuation of historic redlining practices into the present day.

SUMMARY OF KEY FINDINGS

- Comprehensive plan should include carbon neutrality and resilience as either pillars or cross-cutting topic integrated into all pillars.
- Unified Development Ordinance should include an overlay zone to support RIDs by providing flexibility in standards and procedures.
- RIDs should
  - Focus on energy and moving the City toward its 2050 carbon neutrality goal.
  - Be a tool for assisting and accelerating implementation of SEAP Action Areas, especially the following:
    - SEAP Area 5: Zero Carbon Municipal Buildings
    - SEAP Area 6: Zero Carbon City Fleet – SEAP Area 7: Near Zero Carbon Non-Municipal
    - SEAP Area 8: Sustainable Modes of Transportation
    - SEAP Area 9: Energy Generation
    - SEAP Area 10: Workforce Development
  - Be places to incubate and share ideas, places where it is okay to break the rules.
  - Be places to pilot approaches that are not yet addressed by code or regulations.
- The RID name may need to be changed to emphasize energy, rather than resilience.
- Energy resilience should be defined broadly to address a range of social, economic, health, and equity concerns including:
  - Energy cost burden
  - Health impacts from poorly insulated homes or outdated HVAC systems
  - Risk of distribution interruptions
  - Storage
  - Microgrids
  - Community solar
- Equity should be an integral component of RIDs programs, projects, and success indicators.
  - Success indicators may include:
    - Jobs created in green workforce development
    - Number of low-income homes weatherized
    - Energy burden (percent of total homeownership or rental
    - Costs for utilities, primarily energy costs)
    - Operational investment in low income programs
    - Capital investment in historically under-invested communities
- Obtaining and sustaining financing and funding is an essential part of RID. Leverage of City housing fund and publicly owned parcels or buildings, continued partnerships with corporations, philanthropy, combining rebates from Duke Energy with other City programs, reconsidering PACE funding.

- Factors to consider in identifying suitable locations for a RID include:
  - Transit proximity or a TOD district
  - Availability of City owned land or buildings
  - Historically under-invested area of the City
  - Low access to opportunity and/or high risk of displacement
  - Planned infrastructure improvements/investments
  - Community partners who are champions of the area
  - Tech and higher education partners
  - Areas with opportunity for job creation and growth particularly in green economy
- Consider moving from a RID to more geographically dispersed tools that are tailored to the context of the area:
  - Use Place Types (see Figure 1 on page 17) as the foundation for a toolkit
  - Prevent enacting policy barriers that inadvertently limit development, particularly in areas where the City wants to incentivize development (e.g., TOD areas).
  - Consider the impact of VMT on the overall energy demand for the Charlotte region

RECOMMENDATIONS

The Panel created the following recommendations to guide the City's implementation of RIDs. The recommendations in this section include:

1. Establish resilience and innovation as citywide initiatives and shift away from assigning RIDs in specific locations.
2. Embed SEAP principles and strategies in the Comprehensive Plan.
3. Focus relevant energy innovations and investments to increase equity.
4. Enable/Require low-carbon strategies through the development process
5. Continue work in a structured collaborative with private sector, academics, and other partners, to remove barriers and create opportunities for economic mobility.

1. Establish Resilience and Innovation as Citywide Initiatives and Shift Away From Assigning Rids in Specific Locations.

The TAP's discussions identified a key tension with the idea of creating RIDs as geographic areas for applying low-carbon policies and initiatives. First, Charlotte's goals for carbon neutrality are city-wide goal and constraining policies to specific locations may limit the impact and second, identifying locations to apply policies and initiatives can create a critical mass of efforts that leads to long-term success. The Panel's recommendation ultimately addresses both of these concerns. The City should not limit programs and policies that promote carbon neutrality to specific areas, and Charlotte's existing Smart Districts and TOD Districts are likely prime locations for piloting policies and programs.

The programs and policies that would be associated with a RID should be shifted to immersive programs citywide that focus on implementation of the SEAP, rather than identifying geographic areas to constrain these approaches. The panel recognized that creating the RID as a District would limit the ability to achieve SEAP goals by limiting initiatives to a specific district. Resilience and equity should be embedded in policies and applied throughout the City.

Stakeholders and City Staff informed the Panel that Charlotte has strong neighborhood associations, and they are experiencing success with their current Smart District and TOD District designations. Some stakeholders expressed concern about the creation of yet another designation that would compete for resources with existing Districts. The Panel recommends that the intention and functions associated with RID concept can occur in multiple places within the City. Existing Districts should receive priority consideration for implementation of low carbon programs and policies.

The Panel envisions that the Comprehensive Plan, the Unified Development Ordinance, and the Capital Improvement Plan will all be essential in implementing policies for carbon neutrality throughout the City.

- The City is currently updating its **Comprehensive Plan** at has the opportunity to integrate SEAP goals and identify opportunities for implementation. City staff should ensure that policies that increase resilience and foster ow carbon and low energy innovation are integrated into the Comprehensive Plan. The SEAP identifies goals and objectives for the City to achieve carbon neutrality, and integrating these into the Comprehensive Plan will begin the process of linking these policies and programs spatially to land uses. Recommendation 2 speaks further about how to connect policies to land uses within the Comprehensive Plan.
- The **Unified Development Ordinance** is also is also essential for fully integrating the carbon neutral policies and programs into the City's regulatory framework. The Panel recommends including regulatory standards within the UDO that will support low carbon measures. Regulatory standards should avoid disproportionate negative impacts on vulnerable communities, and focus investment in communities that have experienced historic disinvestment or have a higher level of vulnerability.
- The **Capital Improvement Plan** will allocate funding for creating the infrastructure necessary to implement some programs and policies. The City must ensure that the CIP allocates funding for infrastructure projects that will support the success of carbon neutral programs and policies. Two examples of infrastructure projects needed to support carbon neutrality

include electric vehicle charging stations and home weatherization programs within neighborhood improvement programs.

2. Embed SEAP Principles and Strategies in the Comprehensive Plan and UDO.

The City is currently creating the Charlotte Future 2040 plan. There is significant opportunity to integrate the desired outcomes of RIDs into the comprehensive plan. The City provided guidance that any policy tool promoting resilience should be able to apply to multiple place types and scales within the City. As a growing metropolitan center with developable land, the proposed tool will need to be applicable to greenfield development, infill development, suburban development patterns, urban development patterns, transit-oriented areas, and auto-dependent areas.

The panel recommends identifying low-carbon strategies that are appropriate for different areas based on their place type characteristics. Each strategy is in service to upholding the pillars of the SEAP delivery structure. The table on page 17 illustrates how strategies implemented within a RID can be tailored by place types identified within the comprehensive plan.

		SEAP DELIVERY STRUCTURE PILLARS							
		BUILDINGS			TRANSPORTATION			GENERATION	
PLACE TYPE CHARACTERISTICS		LOW CARBON STRATEGIES							
PLACE TYPE	DEVELOPMENT PATTERN	RETROFIT EXISTING BUILDINGS FOR LOW CARBON	REQUIRE LOW-CARBON NEW CONSTRUCTION	ELIMINATE NATURAL GAS CONNECTIONS	RES. ELECTRIC VEHICLE PARKING	PUBLIC ELECTRIC VEHICLE PARKING	LAST MILE MOBILITY	ELECTRIC VEHICLE TRANSIT	LOCAL ENERGY GENERATION
Neighborhoods									
Neighborhood 1	Suburban	-	X	X	X	-	-	-	-
Neighborhood 2	Suburban/Urban	-	X	X	X	-	X	-	-
Neighborhood 3	Urban	X	-	X	X	-	X	X	X
Neighborhood Node	Urban	X	-	X	-	X	X	X	X
Centers									
Community Center	Suburban	-	X	X	-	X	-	X	-
Regional Center	Suburban	-	X	X	-	X	-	X	-
Uptown	Urban	X	-	X	-	X	X	X	-
Sectors									
Business	Suburban	X	X	X		X	-	-	X
Neighborhood Node	Urban	-	X	X	X	-	-	-	-
Neighborhood 1	Suburban	-	X	X	X	-	X	-	-
Neighborhood 2	Suburban/Urban	X	-	X	X	-	X	X	X
Neighborhood 3	Urban	X	-	X	-	X	X	X	X

3. Focus Relevant Energy Innovations and Investments to Increase Equity.

The panel recognizes the potential for carbon neutral, energy efficiency, and sustainability policies to benefit historical under-invested communities by increasing resilience and generating cost savings. Recent research entitled "Energy Cost Burdens for Low-Income and Minority Households"[1] published in the Journal of the American Planning Association indicated that "lower-income households paid more of their annual income in energy costs than higher-income households, and even within a given income band, households in minority neighborhoods faced greater burdens than those in white neighborhoods."

Resources exist to help the City define equity and identify the desired equity outcomes. The Government Alliance on Race and Equity's Racial Equity Toolkit[2] defines racial equity as follows: "racial equity is when race can no longer be used to predict life outcomes and outcomes for all groups are improved." The report is specific to racial equity but could be applied to other sources of inequality such as income or geographic location. Throughout the TAP process, the panel frequently heard the importance of ensuring equity is a key outcome of any new policies to encourage carbon neutrality. The Racial Equity Toolkit can inform the City's process for integrating equity measures into energy innovations and investments that will achieve the goals of the SEAP.

The Panel identified a strategy for supporting funding and implementation of energy investment and innovation that will allocate resources equitably across geographic areas that have different histories of public investment. A tool that other communities have used to achieve this is called Tax Increment Financing (TIF). TIF is a public financing tool that subsidizes infrastructure development in the present day based on the expected future increases in property tax from rising property values that will occur due to the existence of that infrastructure. The Panel envisions a solution where the property tax increase due to rising property values can be captured in one area and invested in adjacent historically under-invested area (e.g., the Uptown/Mud Island TIF in Memphis, TN http://cramemphis.org/). Such an approach would be appropriate as the benefits of carbon neutrality are accrued at the City level in the form of improved air quality and reduced impact on climate change, but the innovations and investments can occur in specific locations. The areas where property tax is being captured will still receive the benefits from infrastructure investments made in other areas of the City. This approach has the dual effect of achieving SEAP goals and correcting historic patterns of public disinvestment from certain neighborhoods.

In North Carolina, these funding models are called Project Development Financing, and focus on specific projects, but lack enabling legislation for a district-based financing tool. The City could pursue a change to legislation or craft an informal version of the tool that may have a less powerful impact but could be implemented within the State's current policy.

There is a wide range of innovations and investments that can produce equitable outcomes by achieving low carbon goals and providing cost savings at the household level for people experiencing energy burden. Many of these examples are strategies that require upfront costs, some of which can be reduced, deferred, or eliminated through various programs, but result in long term savings, such as home weatherization, electric vehicle use, solar panels, microgrids, transit access, and micro mobility options like e-bikes and e-scooters. Many of these approaches require infrastructure investment to be considered a logical choice for energy burdened residents. Electric vehicles require charging stations, weatherization requires materials and installation, solar panels and microgrids require materials and installation, and transit requires convenient access to routes that go places people need to be.

The City should consider the following conditions when considering where to focus innovations and investments to ensure programs are implemented equitably.

- Areas with low access to opportunity and/or high risk of displacement
- Historically disinvested areas
- Light Rail Accessibility – a station exists or is planned within a TOD area
- Areas with planned infrastructure improvements/investments
- Areas with City owned land or buildings
- Higher-ed/research located within the overlay area
- Areas with opportunity for job creation and growth particularly in green economy

4. Enable/Require Low-Carbon Strategies Through the Development Process.

The City should encourage the support of the private sector by enabling or requiring low-carbon strategies throughout the development process, specifically through the Unified Development Ordinance. These strategies should be crafted in partnership with the development community and can be integrated into the comprehensive plan and unified development ordinance.

Examples of strategies the City should consider include:

1. Requiring electric vehicle charging in all new residential and commercial development, as seen in the City of Atlanta's 2017 ordinance[3] .
2. Create zero carbon demonstration building to provide an example of how low-carbon construction strategies integrate into a real building.
3. Eliminating barriers to solar and photovoltaic cell implementation throughout the City with the use of TOD solar standards[4].
4. Parking reductions and density increases for low-carbon development in transit-oriented areas. Parking reduction strategies include:
    a. No minimum parking requirements within district
    b. Parking maximums
    c. Incentives for increased bicycle parking
5. Density bonuses or streamlined permitting for projects that:
    a. Are low carbon
    b. Establish, connect to, or expand microgrids
    c. Increase mobility access and choices by providing bike storage, showers, and e-bike or e-scooter charging.
    d. Electric vehicle infrastructure such as charging stations.
    e. Bio energy with carbon capture and storage
    f. Net metering

1 https://www.tandfonline.com/doi/full/10.1080/01944363.2019.1647446

2 https://www.racialequityalliance.org/wp-content/uploads/2015/10/GARE-Racial_Equity_Toolkit.pdf _

3 https://www.atlantaga.gov/Home/Components/News/News/10258/1338?backlist=/

4 http://ww.charmeck.org/Planning/Rezoning/2018/153-169/2018-169%20Approved%20Transit%20Oriented%20Development%20Regulations.pdf

5 https://www.home-energysolutions.com/wp-content/uploads/2015_IECC_Residential.pdf

In addition to the policies and programs noted above, the city should consider the adoption of the 2018 International Energy Conservation Code (IECC). The IECC is "a model code that regulates minimum energy conservation requirements for new buildings… and address energy conservation requirements for all aspects of energy uses in both commercial and residential construction[5]." Cities have modified and adopted versions of the IECC to suit their local needs and context. The panel recommends the City seek to adopt the 2018 International Energy Code with benchmarkings and metrics updated to conform to the City of Charlotte's context. For example, Washington State included policies that required permitted residential and nonresidential construction to achieve a 70 percent reduction in annual net energy consumption as compared to 2006, and to construct increasingly efficient homes and buildings that help achieve the broader goal of building zero fossil-fuel greenhouse gas emiision homes and buildings by 2031. Charlotte has already defined the desired metrics through the SEAP, and adopting the IECC is a powerful strategy for achieving those goals.

Additional tools and techniques to be considered can be found in ULI's **Ten Principles for Decarbonization: How Cities and the Real Estate Industry Can Partner to Fight Climate Change**

(https://urbanland.uli.org/sustainability/how-cities-and-the-real-estate-industry-can-partner-to-fight-climate-change/)

5. Continue Work in a Structured Collaborative with Private Sector, Academics, and Other Partners to Remove Barriers and Create Opportunities.

The Panel recommends the creation of a structured collaborative, such as the Boston Green Ribbon Commission (https://www.greenribboncommission.org/) that will be able to direct sustained and organized effort to implementing the strategies identified in this report. The Green Ribbon Commission provides a forum for representatives of the private sector and the City to discuss, plan and act on the opportunities, challenges, ideas, and requirements of preparing Boston to meet the imperatives of climate change. Similar to the GRC, the Charlotte collaborative should include partners from the private sector, universities, community organizations, and others to provide a broad range of perspectives. The City should recruit collaborative members based on their experience and ability with implementing carbon neutral initiatives, as well their ability to champion policy changes.

There are many strategies the City can implement within the current policy context, but some strategies will require legislative changes at the State level to enable their implementation.

- Some State regulations limit the implementation of net metering and community solar, strategies that create localized opportunities for low-carbon development. If these barriers are overcome, it creates an opportunity to implement direct energy systems across various contexts throughout the City.
- The Panel recommends using City funds to equitably distribute investment in implementing low carbon strategies in new construction or greenfield development, retrofit of University City office parks and server farms, retrofit historically disinvested areas. The priority should be on investing in historically disinvested areas.
- Determining battery storage in critical facilities is also an essential element of implementing these strategies on-site. Battery storage can elevate isolated microgrids to elements of an integrated resiliency hub network spanning the City.

The collaborative's priority should be enabling these types of low carbon energy strategies, but efforts could also include exploring bioenergy and renewable natural gas as a feedstock for fuel cells or microturbines, expanding the urban forest to reduce the heat island effect and draw down CO2, and collaborate with researchers and technology innovators to identify opportunities for carbon capture and storage.

CONCLUSION

Charlotte's initial charge to the panel was to define how Resiliency Innovation Districts can help the City achieve its low-carbon goals as outlined in the SEAP. As the conversation between the Panel and stakeholders unfolded, the panel questioned whether focusing on the RID concept was the best strategy to truly achieve the goals outlined in the SEAP. Panelists wanted initiatives and investments to be available to any community in the City and did not want the need to define a particular district to constrain the potential applications.
However, the panel recognized the power of fully integrating the SEAP goals into the forthcoming Comprehensive Plan and Unified Development Ordinance. The panel also recognized that identifying specific areas can help create critical mass of innovation and implementation. They recommend that the City depend on its existing and robust network of Smart Districts and Transit Oriented Districts to provide those areas of innovation.

The Panel recognized the necessity of including equity as a through line of RID recommendations. Input from stakeholders demonstrated the importance of ensuring equitable outcomes and to allow benefits of implementing this program to accrue in historically invested areas. Tools should be disproportionately deployed in lower-income areas because the positive impact will be marginally greater for the wider community and individual tenants and landowners.

Due to the emphasis on equity, the panel recommends that initiatives should be disproportionately deployed in areas of historic underinvestment. Many strategies require up-front expenditures (some of which can be mitigated with other programs) but result in significant cost savings over time. The City should prioritize projects that reduce or eliminate up-front costs for energy burdened households that will then receive the long-term cost savings benefits. This investment is necessary to correct the history of disinvestment experienced in communities that are home to underrepresented groups and is appropriate because benefits of becoming a low-carbon city accrue at the city level as well.

The Panel's recommendations focus on ensuring that the City can implement low-carbon strategies to achieve the goals of reducing emissions, while ensuring that equity and resiliency are embedded into outcomes. The Panel recommends that integrating the goals of the SEAP into the Comprehensive Plan and Unified Development Ordinance will have the greatest impact on implementation. Individual strategies for achieving carbon neutrality should be implemented equitably.

APPENDIX A: PANELIST BIOGRAPHIES

Craig Lewis

Principal, Stantec

Panel Chair

Craig Lewis is a Principal and co-leader of Stantec's Urban Places, a global practice that brings together experts in smart mobility, resilience, real estate feasibility, planning and urban design, mixed-use architecture, smart cities, and Brownfield redevelopment. For more than 25 years, he has been infusing a multi-disciplinary approach to building vibrant, urban places across North America that are more livable, equitable, and sustainable. His international, award-winning work for small towns, large cities, transit agencies, mixed-use developers, housing authorities, hospitals, and universities spans the range of city building to include planning, urban design, complete streets, placemaking, active transportation, urban parks and public spaces, form-based codes, smart cities, and smart mobility (autonomous, connected, electric, and shared).

Steven Baumgartner

Urban System Strategist, Baumgartner

Steven Baumgartner is an Urban Systems Strategist specializing in integrated infrastructure planning, climate action, energy strategy, and sustainability framework development and implementation. He has a rich history of creating unique solutions to assist his clients in meeting their high-performance, economic, and strategic missions across scales. He lives in Pittsburgh, PA and supports several local and national initiatives including ULI's Sustainable Development Council and Van Alen Institute's Council.

Shelby Busó

Chief Sustainability Officer, City of Atlanta

An experienced Sustainability Director, seasoned strategist and environmentalist, Shelby Busó is charged with leading the sustainability team within the Office of One Atlanta, including primary responsibility for clean energy, urban agriculture and waste diversion efforts and managing all related sustainability personnel. She previously served as the Director of Community Advancement and Market Transformation for the U.S. Green Building Council (USGBC). Working with the USGBC since July 2016, Busó collaborated with the Market Leadership Advisory Board facilitating the design and development of programs and major initiatives. Busó also developed a 200-page comprehensive sustainability plan for Midtown Atlanta which led to the first public space recycling program in the City of Atlanta as the assistant director of Transportation and Sustainability for Midtown Alliance.

PANELIST BIOGRAPHIES

Janet Shull, AICP CUD

Strategic Advisor, City of Seattle Office of Planning & Community Development

As a Strategic Advisor Janet Shull manages urban design, community planning and land use policy projects in the Office of Planning and Community Development for the City of Seattle. Janet has over twenty-five years of successful multi-disciplinary team and project management experience in both public and private sectors. She is skilled in sustainable development, community planning, affordable housing, and urban design. She currently serves as a member of the Capitol Hill EcoDistrict Steering Committee and is coordinating efforts on design guidance around light rail station area planning.

Walker Wells, AICP, LEED AP, EcoDistricts

Principal, Raimi + Associates

As a Strategic Advisor Janet Shull manages urban design, community planning and land use policy projects in the Office of Planning and Community Development for the City of Seattle. Janet has over twenty-five years of successful multi-disciplinary team and project management experience in both public and private sectors. She is skilled in sustainable development, community planning, affordable housing, and urban design. She currently serves as a member of the Capitol Hill EcoDistrict Steering Committee and is coordinating efforts on design guidance around light rail station area planning.

APPENDIX B: ULI RESEARCH & RESOURCE DOCUMENT

ULI Charlotte TAP Background Research

July, 14, 2020

SEAP STRATEGIC ENERGY ACTION PLAN CITY of CHARLOTTE

CHARLOTTE FUTURE 2040 COMPREHENSIVE PLAN

ULI

OVERVIEW

The City of Charlotte released its Strategic Energy Action Plan (SEAP) in December 2018. The plan is intended to guide Charlotte's transition to a low-carbon future by providing equitable solutions to reduce carbon emissions while enhancing the livability of the city and making it globally competitive. The upcoming technical assistance panel (TAP) will evaluate tools for assisting Charlotte's carbon-reduction goals through the built environment. To provide a background for this TAP, this paper explores options from other cities that align with Charlotte's SEAP. These options demonstrate how cities are encouraging community-scale resilience and sustainability, using the SEAP's Five Stages to Zero Carbon model to highlight the different opportunities for contributing to low-carbon development.

One opportunity for community-scale change is implementing smart growth policies, focusing especially on transit-oriented development. This paper discusses smart growth policies from other cities, which aim to influence the first two stages of shifting energy demand (by encouraging mixed uses that have different energy loads at different times) and reducing energy consumption (by reducing car use in favor of walking and biking). Although COVID-19 has sparked discussion on the pros and cons of density, balancing these near-term reactions with their long-term carbon implications is necessary. It is possible to maintain healthy environments within dense areas, and strategies for doing so—such as focusing on housing affordability—often align with the goals of equitable smart growth.

These policies could be piloted in another significant part of the SEAP, the creation of Resilient Innovation Districts (RIDs). These district-scale initiatives focus on achieving net-zero energy through innovation and workforce development, ultimately serving as pilot projects that other districts in Charlotte and beyond can replicate. RIDs contribute to the "Reduce Energy Consumption" stage by improving energy efficiency. When buildings have low-enough energy intensity, they can be more feasibly offset with on-site generation and offsets purchased, reflecting the "efficiency first, renewables second" motto that is common in the net-zero-energy community. From there, RIDs can also contribute to the latter three stages: changing the energy consumed, generating energy on site, and purchasing the remainder. At the same time, RIDs can generate co-benefits like job creation and air pollution reduction.

The final section discusses other city- or district-level initiatives that advance low-carbon development across all the stages to zero carbon. Although much of the TAP's focus is on transit-oriented development, the SEAP shows that the top source of Charlotte's carbon emissions is buildings, and transportation is second: "Buildings, both residential and commercial, comprise approximately 48% of emissions in Charlotte. Industry and Construction account for 6% of total emissions, while transportation accounts for 40%." So, the final section brings more attention to the opportunities for carbon reduction through the building sector.

Where possible, this paper discusses whether these programs and policies have been successful and have helped cities achieve their carbon reduction goals. However, tools that are successful in one city may not work in another, and many of these tools have not been fully evaluated. Understanding these options can inform the TAP process as participants consider what may be most applicable to and effective in Charlotte within the context of the SEAP.

Key Takeaways

1. The top source of Charlotte's carbon emissions is buildings, and transportation is second. Focusing on these sectors will be most impactful for carbon reduction.
2. Many of the tools available to Charlotte are most effective when implemented together, such as using smart growth to preserve density, which makes district energy systems more feasible.
3. Equity can and should be centered in carbon emissions reduction policies and programs.
4. Low-carbon development has a wide range of co-benefits, including public health, economic development, and resilience. Charlotte can intentionally maximize these co-benefits in its planning efforts.
5. Metrics are critical for measuring progress and staying accountable.

SMART GROWTH & TRANSIT-ORIENTED DEVELOPMENT

Smart growth is an approach to development that is intended to prevent sprawl while enhancing environmental and health conditions and spurring economic development. Ten principles from Smart Growth America form the basis of this approach:

1. Mix land uses.
2. Take advantage of compact design.
   Create a range of housing opportunities and choices.
4. Create walkable neighborhoods.
5. Foster distinctive, attractive communities with a strong sense of place.
6. Preserve open space, farmland, natural beauty, and critical environmental areas.
7. Direct development toward existing communities.
8. Provide a variety of transportation choices.
9. Make development decisions predictable, fair, and cost-effective.
10. Encourage community and stakeholder collaboration in development decisions.

You can find case studies illustrating each of these principles here. Notably, many of these principles relate to both the equity and sustainability goals in Charlotte's SEAP. For example, creating a range of housing opportunities ensures that people can live close to where they work rather than being locked out of nearby housing markets. This, in turn, reduces reliance on cars, which can lead to decreased carbon emissions. The full range of benefits emanating from carbon reduction, resilience, and sustainability includes the following:

- Lowering car use;
- Balancing the energy load with mixed-use buildings and product types;
- Cleaning up and reusing contaminated properties;
- Incorporating resilient features;
- Preserving density rather than allowing sprawl;
- Improving air and water quality;
- Reusing existing infrastructure and buildings to take advantage of previous investments and the energy already used to build them;
- Reducing the costs of providing public infrastructure and services through increased density;
- Generating less traffic congestion, traffic risk, and pollution;
- Reducing building operating costs as lower energy use leads to lower utility costs;
- Avoiding higher utility rates by shifting energy use away from peak demand time (there is additional potential to reduce peak energy use as people may continue to have flexible schedules emerging from the pandemic); and
- Focusing on resilience from renewable on-site generation, which makes buildings less reliant on utility grids that can be unstable.

Moreover, transit-oriented development uses smart growth principles to encourage compact development around transportation hubs. Like smart growth more generally, transit-oriented development prioritizes successes in elevating smart growth principles and transit-oriented development in its Climate Action Plan and strategic planning. The second section provides details on Leadership in Energy and Environmental Design (LEED) for Cities certification, which has developed metrics for smart growth and certifies cities that measure progress and meet standards. The final section will feature a table with additional examples of policies and incentives that cities are using to encourage smart growth in peer cities around the United States.

SMART GROWTH & TRANSIT-ORIENTED DEVELOPMENT

Twenty-Minute and Complete Neighborhoods

In 2009, the city of Portland released its Climate Action Plan. The plan featured the idea of 20-minute neighborhoods, or "vibrant neighborhoods where 90 percent of Portland residents and 80 percent of Multnomah County residents can easily walk or bicycle to meet all basic daily, non-work needs and have safe pedestrian or bicycle access to transit" by 2030. Inspired by Portland-based firm Gerding Edlen's "twenty-minute village" concept for urban redevelopment, where all residents can meet their needs within a 20-minute walk, the city's definition does not solely focus on distance but also takes into account street connectivity, sidewalks, topography, and other barriers to pedestrian access. To meet this ambitious goal, the Climate Action Plan aimed to make 20-minute neighborhoods a core component of the Portland Plan, a strategic roadmap that the city planned to adopt in 2012.

During the three years between the Climate Action Plan and the Portland Plan, the city evaluated the feasibility of 20-minute neighborhoods using the following tools:

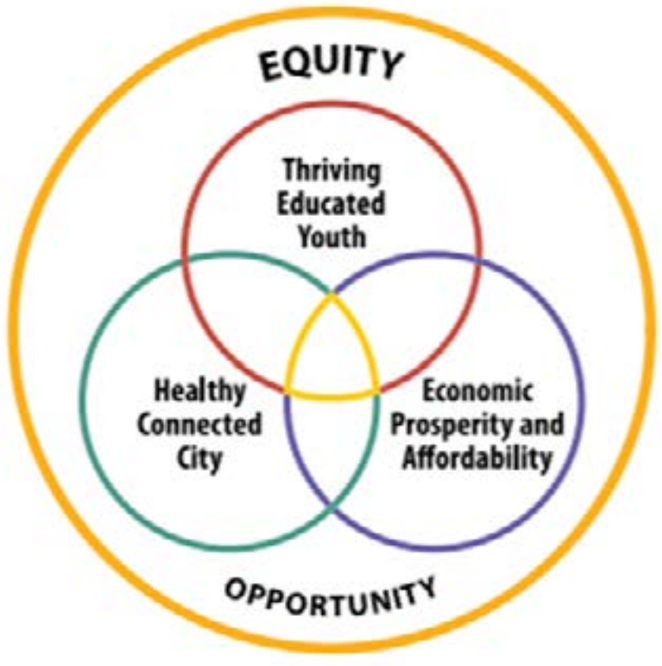
- **Market surveys:** The city assessed the economic profile of a potential 20-minute neighborhood, looking beyond basic amenities to better understand where people would go for activities like entertainment as well.
- **Mapping:** The city used mapping to understand which neighborhoods already met the criteria so that it could focus attention where it was most needed. In fact, about 11 percent of Portland already met the definition of a 20-minute neighborhood, while some neighborhoods remained far from the goal.
- **Health impact assessment:** In 2010, the Oregon Public Health Institute and the Portland Bureau of Planning and Sustainability (BPS) conducted a health impact assessment (HIA) of a neighborhood planning study led by the BPS. The aim of the study was to explore a potential 20-minute neighborhood, ultimately informing the Portland Plan and guiding the city's update of its comprehensive plan. The HIA found positive impacts of implementing the 20-minute neighborhood—especially for vulnerable groups—and no negative impacts.
- **Data-driven index:** The city also developed a Twenty-Minute Neighborhood Index to score neighborhoods on a scale from zero to 100, measuring access to amenities like healthy food, parks and green spaces, housing choices, high-quality public schools, affordable active transportation options, and businesses and services. It also considered barriers to access like sidewalk connectivity. A complete neighborhood—similar to and often overlapping with the 20-minute neighborhood concept—achieves a score of 70 or higher on the index.

In 2012, the Portland City Council adopted the Portland Plan. Based on the years of study, the Portland Plan focuses on complete neighborhoods rather than 20-minute neighborhoods: "Eighty percent of Portlanders live in a complete neighborhood with safe and convenient access to the goods and services needed in daily life" by 2035. Like 20-minute neighborhoods, complete neighborhoods are designed to lower energy use, reduce traffic congestion, improve public health, create a sense of community, and take advantage of all the other benefits of walkability. Other measures of success include the following:

- Reducing carbon emissions to 50 percent below 1990 levels by 2035;

- Achieving 70 percent mode split for transit, walking, and bicycling by 2035;
- Covering 33 percent of the city in tree canopy by 2035; and
- Increasing the safety, convenience, and overall health of citizens, which comes from having amenities such as schools, parks, and grocery stores within walking and cycling distances.

Complete neighborhoods are a part of the Portland Plan's "Healthy Connected City" strategy, which intersects with two other strategies and has an overarching focus on equity and opportunity.



The 2017 progress report on the Portland Plan showed that the percentage of Portlanders living in a complete neighborhood had slightly increased since the adoption of the plan. In 2016, about two-thirds of Portlanders lived in complete neighborhoods with good access to essential services and infrastructure, rising from 63 percent in 2010. The report attributes this increase to growing demand for housing in Portland's walkable neighborhoods. Still, inequities persist. The 2015 update to the Climate Action Plan put a spotlight on East Portland as lagging far behind the complete-neighborhood concept and advocated for enhanced access to transit as a crucial step toward equitable development.

Now, other cities like Detroit are looking to 20-minute and complete neighborhoods as a development strategy for the environment, health, social equity, and economic development. Although Portland is continuing to work toward complete neighborhoods, they remain a useful example of clearly defining smart growth goals and their co-benefits, using a variety of tools to better understand what implementation would look like, and syncing these ideas across planning processes to improve the chances of success.

LEED for Cities and Communities and Certification

Charlotte is exploring the LEED for Cities and Communities Certification, which "helps local leaders, planners, and developers create cities and communities with responsible, sustainable, and specific plans for natural systems, energy, water, waste, transportation, and many other factors that contribute to quality of life." Of the credits that existing cities are eligible to earn, the following are particularly relevant to smart growth and transit-oriented development:

Transportation performance: Promote the use of non-motorized transportation, encourage the use of public transit, and reduce pollution from the transportation sector. This is measured with a transportation performance score, based on vehicle miles traveled per capita.

Compact, mixed-use, and transit-oriented development: Encourage compact and mixed-use development, create a high level of connectivity within the city or community, and encourage walking, biking, and transit use. This goal identifies two metrics for compact and complete centers: access to transit facilities and access to diverse uses.

Access to high-quality transit: Encourage the use of diverse transportation modes to reduce the reliance on personal vehicles within the city or community. Three options exist for meeting this goal, but regardless of the option chosen, all cities or communities must disclose data on their modal split, showing the percentage of population commuting to work and other places, preferably calculated within the past year.

Smart mobility and transportation policy: Promote the efficient operation of transport systems, user facilitation, behavior change, and reduced environmental impact through smart technologies and transportation policies. Cities can adopt four policies out of a menu that includes a passenger information system (PIS), automated speed enforcement, traffic surveillance, global positioning system (GPS)/general packet radio service (GPRS) for all public transit vehicles, signal synchronization and transit signal priority, integrated ticketing system, real-time parking management, and radio frequency identification (RFID).

Quality of life performance: Track and measure metrics related to elevating the living standards of all people. This is measured using a combination of metrics on education, equitability, prosperity, and health and safety.

Distributional equity: Foster equitable economic prosperity and expand access to community services to all. Options for measurement are equitable per-capita income, equitable workforce mobility or graduation rate equity, equitable employment, or access and proximity. "Access and proximity" means demonstrating that community facilities—such as parks, libraries, recreation centers, and schools—and healthful retail food outlets are as accessible to low-income residents as they are to the broader community.

Housing and transportation affordability: Provide an adequate and diverse supply of location-efficient and affordable housing options for all. The metrics look at housing supply, healthy housing standards, density around public transit, and spending on housing and transit.

Civic and community engagement: Promote a cohesive and socially connected community and facilitate its participation in local decision-making. Metrics reflect public engagement, appointments to local boards and

commissions, neighborhood cohesion, whether residents feel they can have an impact on their community, and levels of volunteering.

If Charlotte instead applies as a "new city," the available credits are similar but focused more on developing sustainable strategies than on measuring performance. In addition, LEED for Cities and Communities includes credits related to energy efficiency, innovation, water management, waste management, and many other goals that are discussed in the following district-scale initiative section of this research report. Certification would allow the city to benchmark itself against peer cities that have already been certified, including Austin, Texas, and Denver, Colorado. Peer learning can accelerate progress toward recertification at a higher level.

Smart Growth Policies and Programs

The following table highlights additional smart growth policies from peer cities. Although they have not been evaluated for impact, they provide options for the TAP to consider within the context of Charlotte. All policies are pulled from a full list on the American Council for an Energy-Efficient Economy (ACEEE) Location Efficiency database, which was updated in March 2020.

Additional resources on parking policy developed by the Urban Land Institute for the American Cities Climate Challenge include a Matrix of Innovative Parking Policies, Innovative Parking Policy Addendum, and Potential Benefits of Implementing Off-Street Parking Policy Updates. Other resources include a TOD Standard from the Institute for Transportation and Development Policy and a report on parking and equitable TOD from the SPARCC project.

Category	City	Policies
Location-efficient zoning code	Atlanta	Atlanta has mandatory neighborhood form-based codes in addition to citywide floating zones that have been in place since 1999. The city also has transit-oriented development–specific codes for the Doraville and Edgewood neighborhoods. While some districts have street connectivity requirements, the code does not currently have any broadly applying TOD requirements.
	Columbus	The Columbus municipal planning code includes citywide commercial zoning overlays to encourage pedestrian- and transit-friendly development in existing corridors while traditional neighborhood development zoning encourages a mix of residential types

SMART GROWTH & TRANSIT-ORIENTED DEVELOPMENT

Category	City	Policies
		and commercial properties.
	Dallas	Dallas' Chapter 51A Article XIII uses mixed-use districts on the neighborhood scale to implement transit-oriented communities and mixed-use development in area plans.
Parking policies	Austin	The city has removed minimum parking requirements for certain zoning districts (e.g., the central business district).
	Denver	Denver requires 1.25 parking spaces or fewer per unit in suburban neighborhoods, with a complete removal of minimum requirements in some areas. Downtown developments must provide 0.75 space per unit, with a complete removal of minimum requirements in some areas. The city has recently started implementing parking maximums in several locations.
	Indianapolis	The city has reduced parking requirements by 30 percent in areas located within a quarter mile (0.4 km) of public transit.
Location efficiency incentives and disclosures	Atlanta	As an incentive to promote location-efficient real estate development, the city of Atlanta offers several incentives to developers working in certain areas of the city. These incentives include the Buckhead Density Bonus, the Buckhead/Lenox SPI Intent (see section 16-18L.018 for Transportation Demand Management Plan requirements), a density bonus for districts zoned as mixed-use residential commercial areas, and the Affordability

Category	City	Policies
		Density Bonus.
	Austin	As an incentive to promote location-efficient real estate development, Austin's Safe, Mixed-Income, Accessible, Reasonably Priced, Transit-Oriented (SMART) housing program provides fee waivers, expedited review, and support to projects that provide certain levels of affordable housing and are transit-accessible.
	Columbus	As an incentive to promote location-efficient real estate development, the zoning code includes the use of tax incentives in the downtown zoning district to attract high-density development to the downtown area.
	Fort Worth	The city has community-wide mixed-use zoning and urban residential zoning categories that offer height and density bonuses. The city has dedicated project facilitators for mixed-use and and urban residential development that expedite land development and permitting.
	Louisville	The city has a "mixed residential development incentive" that allows multifamily dwellings in a single-family zoning district with a density bonus.

Equitable smart growth and transit-oriented development policies and programs can also encourage the construction of affordable housing and local job creation. One of the most successful examples is in Los Angeles, where the Transit Oriented Communities (TOC) Incentive Program the construction of affordable housing near bus and train stations. Voters passed Measure JJJ in 2016, which amended the Los Angeles where the Transit Oriented Communities (TOC) Incentive Program the construction of affordable housing near bus and train stations. Voters passed Measure JJJ in 2016, which amended the Los Angeles Municipal Code to create the TOC program and required Los Angeles City Planning to create TOC guidelines for all housing developments within a half-mile (0.8 km) radius of a major transit stop.

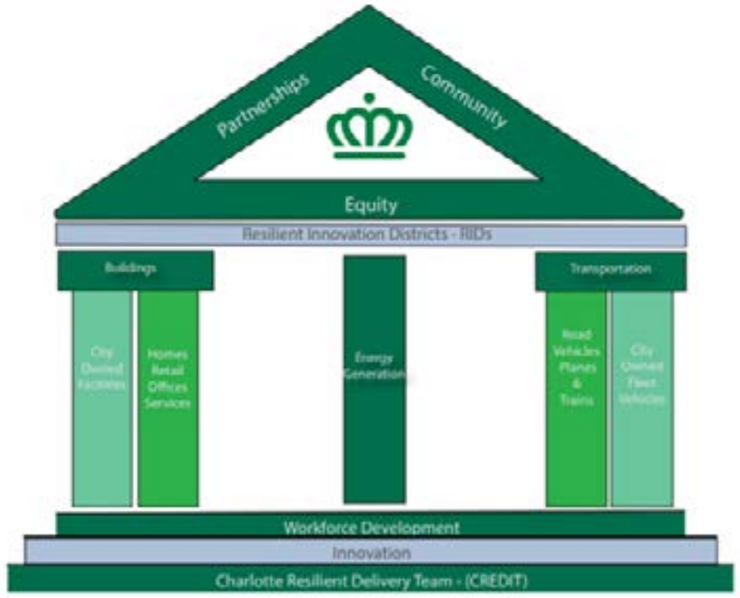
Additional resources include the following:

- Promoting Opportunity through Equitable Transit-Oriented Development (eTOD): Barriers to Success and Best Practices for Implementation (Enterprise Community Partners)
- Equitable Transit Oriented Development: Examining the progress and continued challenges of developing affordable housing in opportunity and transit-rich neighborhoods (Poverty and Race Research Action Council)
- Advancing Equitable Transit-Oriented Development through Community Partnerships and Public Sector Leadership (PolicyLink)
- Building Capacity: Helping Communities Create Vibrant, Healthy and Economically Prosperous Neighborhoods (Center for Neighborhood Technology)
    - Chapter 16: Connecting Jobs and Workforce Development to Transit (Reconnecting America)
- Making the Connection: Transit-Oriented Development and Jobs (Federal Reserve Bank of San Francisco)
- Preserving Affordable Housing Near Transit (Reconnecting America).

DISTRICT-SCALE INNOVATION

As defined in the Strategic Energy Action Plan, a Resilient Innovation District is a site or neighborhood that pilots policies, programs, and projects supporting the goals of the SEAP, and particularly the goal to achieve 100 percent renewable energy by 2050. By first piloting these ideas, the city has a chance to collect data—enabling it to measure success and tweak the implementation as needed—and to work around barriers like regulatory bodies by generating proof of concept before scaling up. The RIDs take a holistic view of resilience, contributing to the city's environmental sustainability (greenhouse gas emission reductions, energy efficiency, climate change preparedness goals), economic mobility (workforce development, job creation), health and livability (public safety, affordable housing), and capacity for innovation (renewable energy technology, smart-city platforms). The RIDs will take place in partnership with the 2040 Comprehensive Plan and Unified Development Ordinance to improve overall city planning.

A RID could advance SEAP goals by accelerating equitable progress toward renewable energy and energy efficiency. The SEAP is made up of action areas, one of which is developing RIDs to test ideas for a low-carbon and resilient future quickly and efficiently. However, to align with the holistic definition of resilience, the RIDs intersect with and contribute to a variety of other action areas. This is also because many of the SEAP projects will be implemented through RIDs, as shown in a figure from the SEAP below, to advance innovation in buildings, energy generation, and transportation. Notably, workforce development and innovation are at the foundation of all these initiatives.



Although there is potential to use RIDs across all of the SEAP's action areas, the following represent some of the clearest opportunities:

Action Area Seven: Achieve net zero carbon non-municipal buildings by 2050.

- **Retrofit existing residential buildings.** This can be demonstrated through RIDs, similar to existing district-level residential energy initiatives in Charlotte like the North End Smart District (NESD) Smart Homes program. This program has brought together residents, the city, the Renewable Energy Transition Initiative, and Duke Energy to help residents lower their utility bills through weatherization, education, and technology. Similar programs in RIDs could leverage the success of the Smart Homes program and move retrofitting forward to reach the goal of 1,000 homes per month in 2030, increasing to about 5,000 per month by 2045.
- **Retrofit existing nonresidential buildings.** RIDs could help identify business models for overcoming challenges with ownership, lease length, construction quality, and associated standards of energy efficiency.
- **Innovate new construction buildings.** New mixed-use developments in RIDs could incorporate low-carbon buildings from the start, test incentives for low-carbon development, and experiment with innovative approaches like sharing waste heat between buildings and using heat dumps, such as swimming pools.

Action Area Nine: Develop and implement strategies for deploying low-carbon infrastructure generation.

- **Develop educational tools.** The uptake of low-carbon technology and processes in residential settings may vary by income group and awareness level. RIDs can help clarify demographic differences in uptake, test educational tools to increase awareness, and identify business models that increase uptake across groups. For commercial buildings, uptake may also vary by ownership size. Smaller building owners often are not aware of opportunities and advancements in the green building space, educational tools that showcase the technology, or the business case for implementing them. To remedy this, programs like the Atlanta Better Buildings Challenge, LA Better Buildings Challenge, and DC High-Performance Buildings Hub provide support for owners.
- **Demonstrate new and integrated approaches to meeting energy demand.** After testing both new technologies and proven but less well-known approaches in RIDs, they will be better poised to spread throughout Charlotte and the United States. These strategies include combining technologies (e.g., solar thermal, geothermal, and bioenergy combined head and power [CHP] system), district heating and cooling systems, and biogas. These strategies also include grid-interactive systems like batteries that can support utility demand response efforts. This can be done through partnership with the utility, which can fund pilot programs to test new technologies and efforts to balance the energy demand curve.

Action Area Ten: Create a pipeline for workforce development and entrepreneurship.

- Because the RIDs will need skilled workers to support work that currently does not exist—such as the retrofitting projects discussed above—building a pipeline will be critical. Notably, the U.S. Department of Energy has a workforce development initiative that the city can use.

The city could also work with Duke Energy, Charlotte's utility provider, across these action areas. RIDs depend on innovative partnerships, and working with a utility can help RIDs to pilot new programs, develop new efficiency incentives, test new demand response programs, and green the grid faster with more utility-scale renewables.

RIDs could also be integrated into the Charlotte Future 2040 Framework, which has a related set of goals:

Smart Growth Principles

- **10-minute neighborhoods.** All households will have access to essential amenities and services within a safe and comfortable 10-minute walk, bike, or transit trip.
- **Transit- and trail-oriented development for the majority of households.** Smart growth enables communities to reduce their dependence on cars, thereby lowering energy demand. It also creates a diversity of building types within the district, all of which use energy at different times of the day and help reduce energy load fluctuations.

Water and Air Quality, Biodiversity, and Native Habitats and Ecosystems

- **Increased integration of resilient energy systems and sustainable building techniques.** This applies to both new construction and retrofits of existing structures.
- **Healthy and active communities.** This section promotes the increased use of clean energy, the reduction of energy use per capita, and decreased carbon per capita.

Other examples of district-scale innovation include EcoDistricts, zero-energy districts, energy innovation districts, advanced energy communities, net-zero-energy communities, and innovation districts. Where possible, these examples will discuss the initiatives' implementation and their lessons for Charlotte's UDO planning process. The section on innovation districts will also highlight the role of transportation in district-scale innovation.

These types of initiatives can also work toward environmental justice. In Minneapolis, the Environmental Justice Working Group for the Climate

DISTRICT-SALE INNOVATION

Action Plan recommended a Green Zones Initiative, which supports neighborhoods experiencing the cumulative effects of environmental pollution, such as poor air quality and soil contamination. The initiative focuses on the environment, health, and economic development, recognizing that social, political, and economic vulnerabilities have compounded these communities' environmental challenges. The Green Zones Initiative is one example of how place-based programs can center equity, and Resilient Innovation Districts can learn from both the energy-focused initiatives below and equity-focused initiatives like these.

EcoDistricts

By building collaboration, equity, and innovation into the certification process and underlying protocol, EcoDistricts not only help neighborhoods reach a holistic standard of community development but also guide districts through transformative change while developing the scalable tools necessary to tackle multiple challenges at once.

- **Approach:** Scalable, innovative, neighborhood-scale change for urban regeneration and community development.
- **Priorities:** Place, prosperity, health and well-being, connectivity, living infrastructure, and resource regeneration.
- **Cross-cutting imperatives:** Equity, resilience, and climate protection.
- **Framework:**
  - Formation—building leadership, collaborative structures, and decision-making processes.
  - Roadmap—performance targets, feasible strategies, and a schedule for implementation.
  - Performance—implementation, reporting, and harnessing results to further improve.

The EcoDistricts Registry supports the reporting process by collecting performance data and measuring impact. Although one organization leads this approach—from any sector—collaboration remains a key part of the model.

EcoDistrict certification costs $9,500. After making a commitment to the three imperatives, the EcoDistrict follows the "formation" and "roadmap" stages of the protocol to get certified. Post-certification, the "performance" stage ensures that progress continues. A third party verifies each step.

The table below highlights EcoDistricts—and especially eco-innovation districts, which combine EcoDistricts with innovation districts (described later in this report)—in peer cities and discusses their implementation and impact so far.

Category	Project Details	Context	Stakeholders	Impact
The Talbot-Norfolk Triangle Eco-Innovation District (TNT EID) https://ecodistricts.org/district-profile/tnt-eco-innovation-district/	Project type: Neighborhood redevelopment. Site size: 46 acres (18.6 ha); 13 city blocks. Implementation stage: The EID has been implemented and has collected lessons learned: • Its goals and objectives are clear to all parties and success can be quantitatively and qualitatively measured • Efforts remain understaffed and underfunded with gains made too slowly, particularly compared with private-sector development efforts. Nonetheless, the pace of housing creation has accelerated and small commercial gains can be seen throughout the TNT EID. • Coordination with the city of Boston continues to change with incoming and outgoing political leadership. Grant funding is inconsistent and slow. • While community engagement is critical to the CSNDC's formation and implementatio implimplementation process, residents are busy and have limited capacity for volunteer engagement.	Residents: 1,500 buildings; 525 residential units Demographics: African American: 78% Latino: 20% Caribbean and Haitian: 8% Adults: 74% Children and youth: 26% Economy: 50% unemploy-ment rate among males of color. 66% of residents live at or below the poverty line.	Codman Square Neighborhood Development Corporation; Talbot Norfolk Triangle Neighbors United; city of Boston; LISC Boston; Enterprise Community Partners; Barr Foundation.	• There is an expanding portfolio of affordable housing through existing building renovations and LEED-certifiable new construction • Developed incentives and programs for first-time homebuyers and rent support for low-income families. • Developed financial literacy and homeowner-ship initiatives to educate residents and prevent displacement. • Home energy retrofits have improved the energy efficiency of over one-third (or more than 500) of the district's homes and apartments. • Green bus shelters, rain barrels, solar panels, and other sustainable infrastructure are actively being implemented. The combined green infrastructure and energy investments could reduce greenhouse gasses in the TNT EID by 11 percent while saving neighborhood stakeholders $267,900 on energy costs. • EID selected as one of only two Boston neighborhoods to pilot a Slow Streets

DISTRICT-SALE INNOVATION

Category	Project Details	Context	Stakeholders	Impact
	They will next try to leverage the EID as a peer learning opportunity and work with the city on district-scale strategic engagement, anti-displacement policies, and equitable engagement strategies.			initiative. Projects that have been implemented across the TNT EID as a result of the Slow Streets program include wayfinding, green zones, and traffic-calming measures. • Planning is underway to convert the district's aging Auto Mall into a mixed-use hub of innovation and housing, complete with career training centers and community spaces. The hub also will include business and retail space to attract startup ventures and entrepreneurs. • Received a grant to expand the CSNDC's smoke-free housing policy and promote health and mobility in the EID. • An initiative is underway in the district to promote biking as an alternative and healthy form of transportation. • The EID is now home to an urban agriculture co-op that sells its produce at a local farmers market; provides job training, placement, and referrals to previously incarcerated men of color; and provides an

Category	Project Details	Context	Stakeholders	Impact
				urban gleaning program.
Pittsburgh's Eco-Innovation District https://pittsburghpa.gov/dcp/eid	Project type: Neighborhood revitalization. Site size: 200 acres (81 ha). Implementation stage: The Eco-Innovation District Plan was adopted by the City Planning Commission in 2017. Since then, the community has organized the Uptown Task Force, which provides district governance and collaboration. There are four subcommittees of the Uptown Task Force that focus on implementing the four chapters of the plan. The task force meets every month and the subcommittees adopt annual work plans that focus their activities on priority projects.	Residents: Over 1,000 residents and at least 20 institutions in Uptown. Land use: 37 percent of the land in Uptown is underused. Area context: Uptown and West Oakland are located between the second- and third-largest employ-ment centers in Pennsly-vania: downtown Pittsburgh with 153,224 jobs and Oakland with 79,896 jobs.	City of Pittsburgh; Urban Redevelopment Authority; Sustainable Pittsburgh; Envision Downtown, Uptown Partners; Oakland Planning and Development Corporation; Port Authority of Allegheny County; and more.	• Early projects include rezoning the Uptown area to incentivize development consistent with community goals, a community-driven proposal for a 1.8-acre (0.7 ha) publicly owned development site, and a number of park and stormwater management projects.
Austin, Texas, Seaholm	Project type: Brownfield redevelopment.	Residents: 2,500	City of Austin Office of	• Created a logo and graphic epitomizing the spirit of

DISTRICT-SALE INNOVATION

Category	Project Details	Context	Stakeholders	Impact
Ecodistrict https://austintexas.gov/page/seaholm-district; https://ecodistricts.org/district-profile/seaholm-ecodistrict/	Site size: 85 acres (34.4 ha), 22 city blocks. Implementation stage: The EID is being implemented and is collecting lessons learned: • As a brownfield redevelopment that includes eight city-owned blocks, the Seaholm Ecodistrict is an ideal scale to test innovative sustainable solutions. • With leadership from several city departments, implementation has not been a barrier. However, the Seaholm Ecodistrict already was in an advanced stage of planning when stakeholders initially engaged with EcoDistricts. Because of this, project implementation has rapidly, but it has been more difficult to integrate the EcoDistricts Protocol into projects already under development. • Funding continues to be an issue in completing all the projects outlined in the	anticipated. Infrastructure: 2,500 housing units; 200,000 square-foot (18,600 sqm) LEED® Platinum Central Library; 44 acres (17.8 ha) open space. Resource restoration: - 3.67 MW building-generated solar power. - 35.1 million kWh solar thermal potential. - 8.98 million gallons - 36.6 million gallons per year potential stormwater capture and reuse.	Sustainability; Economic Development Department and Public Works Department; Austin Energy; Southwest Strategies Group Inc.; Trammell Crow, Watershed Protection Department; Austin Public Library.	the iconic Seaholm power plant to provide a shared identity for residents and visitors and can be used for wayfinding materials. • The City of Austin Art in Public Places program completed eight public art installations in the Seaholm Ecodistrict in fall 2016, including LED installations, child-engaging sculptures, traffic-calming art bollards, murals, and digital placemaking. • The 2nd Street extension will be designed as a "festival street" extending from the Seaholm Plaza to Shoal Creek, incorporating sidewalk improvements, pedestrian crossings, paving patterns, street furniture, native landscaping, removable traffic-calming bollards, and an urban tree canopy. Planting areas will provide stormwater treatment to minimize urban runoff. • Partnered with Farm to Work to serve all employees at the new Central Library. • Features multiple micro-solar installations

Category	Project Details	Context		Impact
	team has hired a consultant to research financing options. • Since the district currently has no residents, city leaders must envision how to incorporate equity into their outcomes through the development of a process for creating and monitoring a community benefits agreement, affordable housing development, accessibility, health and wellness, and other key issues. • The Seaholm Ecodistrict sits in an ideal geographic location for its resource regeneration initiatives and has strong potential for connectivity. • They will next move through the EcoDistrict certification process and create anti-displacement and equity engagement policies for the city.			tablet, and computer charging stations powered by 100 percent solar energy. • The new Central Library includes a 350,000-gallon (1.3 million liters) rainwater harvesting system with a cistern developed through the adaptive use of an abandoned underground concrete pump room in the adjacent electric substation. This rainwater harvesting system will enhance water quality and protect riparian habitat from pollutants of the adjacent Shoal Creek and nearby Lady Bird Lake.
Seattle, Washington, Capitol Hill EcoDistrict:	Project type: Mixed-use. Site size: 525 acres (212 ha).	Residents: 15,000 households, including	Capitol Hill Housing; Seattle Office of Planning and Community	• Incorporated community priorities into the development agreement for the Capitol Hill light rail

DISTRICT-SALE INNOVATION

Category	Project Details	Context	Stakeholders	Impact
https://ecodistricts.org/registered-districts/capitol-hill-ecodistrict-seattle/	Implementation stage: Continuing implementation.	nearly 1,300 low-income households.	Development; Seattle 2030 District; Capitol Hill Chamber of Congress; and more.	station. • Launched a shared parking pilot that the city of Seattle wants to replicate across its neighborhoods. • Provided low-income residents with reduced-cost transit passes. • Installed a first-of-its kind community solar array atop an affordable housing property. • Piloted a pedestrian street closure series and improved pedestrian safety both on streets and within Cal Anderson Park. • Worked with small businesses to promote resource conservation and reduce waste. • In 2015, the EcoDistrict was recognized by a city of Seattle resolution as a formal partner in advancing health and resilience priorities on Capitol Hill. • Fostered a diverse and civically engaged community through the launch of the Capitol Hill Renter Initiative. The Capitol Hill Renter Summit, held in September, convened

Category	Project Details	Context	Stakeholders	Impact
				renters from across the EcoDistrict to exchange ideas, organize behind a collective political voice, and build a set of policy recommendations. Outreach intentionally focused on recruiting lower-income renters, members of the LGBTQ community, people of color, and other people typically underrepresented by the civic engagement process as part of a multiyear effort to empower Seattle's "silent majority" to assume greater ownership of the city's evolution and growth.

Zero-Energy Districts

Zero-energy districts work toward designing districts that maximize energy efficiency, especially in new construction, so that renewable energy generated on site can meet the district's remaining energy needs. The U.S. Department of Energy runs a three-year Zero Energy Districts Accelerator (ZEDA) to help district-level partners meet their zero-energy commitments. The district partner projects can also overlap with EcoDistricts, advanced energy communities, and other aligned programs.

- **Approach:** District-scale innovation and planning
- **Priorities:** Zero energy.
- **Process:**
  - Bring together developers, planners, national experts, utilities, and stakeholders to develop detailed energy master plans.
  - Assess building and district life cycles.
  - Create a governance and business case model and development pathway toward zero energy.

ZEDA is expecting to share the resulting strategies to help other cities and districts with their zero-energy efforts. The Accelerator chose to work on a district scale to enable experimentation with new technologies and business models, take advantage of economies of scale, and use the diversity of energy load shapes to overcome the limitations of individual building types and renewable energy's peak capacity while creating opportunities for waste heat recovery and energy sharing. The following district partner projects are taken from a Better Buildings (U.S. Department of Energy initiative) white paper, and the descriptions and energy opportunities are quoted.

DISTRICT-SALE INNOVATION

Location	Project Details	Description	Energy Opportunities
Denver, Colorado	National Western Center Size: 250 acres (101 ha). Building/space types: Event centers, arenas, office, education. Building area: 2.8 million square feet (260,000 sq m).	The National Western Center (NWC) is located on the historic grounds of the Denver Union Stock Yard Company, which currently hosts the annual National Western Stock Show convention. The redevelopment project will transform the area, doubling its footprint, with the goal of creating a sustainable, multipurpose campus that attracts visitors year-round. The project is aiming for a zero energy campus to include energy-efficient buildings and the development of on-site renewable resources by five years after full build-out. The project is a partnership between the City and County of Denver, Western Stock Show Association, and Colorado State University and is seeking innovative approaches to developing a technically and financially feasible campus-wide energy system to meet both thermal and electrical loads. The NWC strives to be an international model for an educational, research-and-development community to meet the needs of the 21st century.	• Potential for district-scale heat recovery from 72-in. diameter sewer pipes running above ground on-site • Potential for advanced building controls that adapt to variable use of event and conference spaces This report is available at no cost from the National Renewable Energy Laboratory (NREL) as www.nrel.gov/publications • Large rooftops available for solar Pv • Engage with the private sector to form a public-private partnership to design/build/finance/operate the energy systems infrastructure for the campus.
Denver, Colorado	Sun Valley EcoDistrict Size: ~100 acres (40 ha). Building/space types: Multifamily	The Sun Valley neighborhood is Denver's lowest income area and home to less than 1,500 people. The majority are residents of the Denver Housing Authority's 333-unit, distressed public housing site located in the heart of the	• Planning to build high performance public and low-income housing that can achieve zero energy. • Through a request for qualifications (RFQ), SVED is

Location	Project Details	Description	Energy Opportunities
	housing, office, retail, events centers. Building area: 1.6 million square feet (148,600 sq m).	neighborhood. As a nonprofit master developer, the Sun Valley EcoDistrict (SVED) Trust will oversee the design and construction of district infrastructure and roadways during the next 10 years and deliver district-based energy to achieve zero energy within the "SVED Core." SVED is committed to delivering projects with a social return and an economic benefit to community members and the city as a whole.	seeking district utility partners that will help finance, build, and maintain district energy systems.
St. Paul, Minnesota	Ford Twin Cites Assembly Plant Redevelopment Size: 135 acres (54.6 ha). Building/space types: Small, medium, and large multifamily. residential; office; retail; civic. Building area: 2,400 to 4,000 residential units, based on the current plans.	Located on the former site of a Ford Motor Company factory, the Ford Twin Cities Assembly Plant Redevelopment Site aims to become a mixed-use zero energy district during a 15- to 20-year period. The City of St. Paul has developed a master plan for the space, and Ford Motor Company is currently seeking a master developer to purchase the land for redevelopment. As Ford's former Twin Cities Assembly Plant is redeveloped in the coming years, the vision for the site is a connected, livable, mixed-use neighborhood that looks to the future with clean technologies and high-quality design for energy, buildings, and infrastructure. The City of St. Paul received thousands of ideas and suggestions during the past 10 years, and these shaped the backbone of the proposed	• Saint Paul has one of nation's largest district thermal systems, and they are exploring potential for a next-generation system within the district. • Potential for aquifer thermal energy storage.

DISTRICT-SALE INNOVATION

Location	Project Details	Description	Energy Opportunities
		redevelopment framework for the St. Paul Ford site. Energy goals for the project include resilience, innovation, zero energy, energy efficiency, and cost-effectiveness. The foundation of a sustainable Ford site redevelopment is a site-wide, integrated energy system that incorporates renewable energy sources and design efficiencies. The site will be redeveloped from scratch, starting with the installation of new utilities, streets, sewers, and water. This provides an unprecedented opportunity to design and install a comprehensive and integrated energy system using the best, cutting-edge technologies and systems appropriate to site conditions. Development of buildings on the site will follow the start of infrastructure and proceed in phases across the site, with total site build-out expected to take 12–20 years.	
Buffalo, New York	Western New York Manufacturing Zero Energy District Size: 148 acres (60 ha). Building/space types: Office, light manufacturing. Building area: 80,000 square feet (7,400 sq m) for first building;	The Erie County Industrial Development Agency has recently acquired approximately 148 acres of the 994-acre Bethlehem Steel Redevelopment Area, the largest brownfield in the Buffalo, New York, Niagara region. The first planned project in the district is designed to be a large, zero energy, light industrial building to serve as a "lighthouse project" to attract more zero energy development. The project will advance sustainable building	• Pursuing zero energy for light manufacturing building, with zero energy leases for tenants • Lighthouse project to be a model for zero energy approaches • Potential for on-site wind because of proximity to Lake Erie.

Location	Project Details	Description	Energy Opportunities
		design and construction and will ultimately tell the story of resiliency, urban and industrial regeneration, and innovation. The building will feature more than 80,000 feet of mixed-use manufacturing and commercial office space and will be powered by solar, geothermal, and wind energy to produce as much energy as it consumes on an annual basis. As the first certified zero energy manufacturing facility of its size in New York State, the project will result in a state-of-the-art, dynamic facility to showcase new advances in renewable energy construction. The facility will serve as a valuable hub for construction education and performance testing, energy management, and workforce training for the remaining district build-out and the greater region.	

Energy Innovation Zones

In the United Kingdom, energy innovation zones (EIZs) exist in four areas across the West Midlands, a region facing energy poverty, grid constraint, and energy-intensive manufacturing, but also encompassing universities, innovation agencies, and a large regional economy. EIZs support local innovators to advance clean energy technologies in a region that has the capacity to implement them.

- **Approach:** Scale up local technologies to a regional scale.
- **Priorities:** Clean energy, innovation, and job creation.
- **Process:**
  - Act as a bridge between small-scale technologies in the West Midlands and the national market.
  - Turn new technologies into commercial propositions by demonstrating them on a regional scale.

EIZs, like RIDs, also help to overcome regulatory barriers, test business models and support related goals such as reducing emissions and creating jobs. The descriptions are quoted from each individual EIZ website, linked in the first column.

DISTRICT-SALE INNOVATION

Location (all in the West Midlands)	Project Details	Description
Black Country https://www.energycapital.org.uk/eizs-across-the-west-midlands/black-country-eiz/	Size: 297 acres (120 ha). Sites: Dudley, Wolverhampton, Darlaston and i54 – Wolverhampton North	As the seat of the industrial revolution in the late 18th century, the Black Country can claim to be the world's first 'energy innovation zone' (EIZ), and this heritage perhaps explains the enthusiastic local support for the proposed EIZ. But of the four potential EIZs, the Black Country is the least developed, and so provides the greatest opportunity to demonstrate a complete model of how an EIZ can be defined, developed and implemented. There is a strong desire in the area to lead the energy transition by securing investment in modern, clean energy systems which deliver power at globally competitive costs and thus support delivery of the national industrial strategy. The EIZ is intended to provide a focus for this, specifically within the geography of the existing Enterprise Zones. The focus of these zones is to promote and attract advanced manufacturing in the Black Country – by offering competitive advantage to manufacturers who locate there – especially targeting aerospace, automotive and high added value engineering. There are already major manufacturing companies located on the i54 site, including JLR, Moog, Eurofins and ISP. This enterprise zone is known as one of the most successful in the country, and total investment of more than £1.5 billion is expected across the Black Country over next 15 years. A key competitiveness issue for the Black Country is the cost of energy, and to drive
		their processes are keen to secure reliable and high-quality energy supplies with predictable and highly competitive pricing.
Tyseley and Birmingham https://www.energycapital.org.uk/eizs-across-the-west-midlands/tyseley-eiz/	Size: 16 acres (6.5 ha) (Tyseley Energy Park). Sites: HS2 Curzon Street station, Smithfield, Snow Hill, Typhoo Wharf, Arena Central, Tyseley Energy Park.	Birmingham city centre will undergo massive redevelopment over the next 15 years…The area also suffers serious air pollution and the City Council is developing plans for a Clean Air Zone to start by 2020. This will require the construction of a substantial clean energy transport refueling infrastructure including hydrogen and electric vehicle charging at scale. There is little space available for vehicle recharging in the city centre. Part of the solution may be to use the industrial land available at Tyseley Energy Park, 5km east of the city centre, to produce clean energy for the city centre and local communities, and power a new clean transport refueling infrastructure. The Tyseley environmental enterprise district will be a clean technology hub for the city of Birmingham. With a long history of industry in this area, the remaining businesses seek new and innovative energy supplies in order to help the remaining firms stay competitive. It is against that backdrop of transforming industrial competitiveness that the vision has been conceived. Tyseley is already the site of the city's energy-from-waste (EfW) plant, which burns 350,000 tonnes of waste per year to generate 25MWe. The 16 acre industrial site next door is being developed as Tyseley Energy Park by its owners, Webster and Horsfall, and partners including the University of Birmingham, the City Council and the Local Enterprise Partnership.

DISTRICT-SALE INNOVATION

Location (all in the West Midlands)	Project Details	Description
		Tyseley Energy Park already hosts a 10MWe biomass generating plant and private wire electricity supply, and is also the depot for a growing fleet of rent-by-the-hour electric taxis – most of the city's taxi drivers live nearby. A clean energy refueling station is being built to provide electric vehicle charging, hydrogen and CNG for the city's bus fleet, and for the refuse vehicles that supply the EfW plant. Future plans include recycling waste heat from the EfW plant through a heat pipe to the Birmingham District Energy Scheme in the city centre, which is owned and operated by ENGIE. This route would run through areas of dense housing including many energy poor households. There may also be synergies with new transport initiatives such as the proposed tram route to the airport, and refueling and recharging infrastructure for the city.
UK Central Hub https://www.energycapital.org.uk/eizs-across-the-west-midlands/uk-central-hub-eiz/	Sites: Birmingham Airport, the National Exhibition Centre, Jaguar Land Rover, Birmingham International Station, and Birmingham Business Park; High Speed 2 rail station and Arden Cross development after 2026.	The UK Central Hub is an economic area which includes the significant infrastructure of Birmingham Airport, the National Exhibition Centre, Jaguar Land Rover, Birmingham International Station and Birmingham Business Park. From 2026 it will also include the High Speed 2 rail station and the enormous mixed use Arden Cross development. Each of the stakeholders has ambitious growth plans that will dramatically increase the level of employment and housing in the Hub area, and support the wider West Midlands economy. In order to support this opportunity Solihull Council formed the Urban Growth Company (UGC) to concentrate public sector investment on removing infrastructure constraints. As an EIZ, the wider significance of UK Central Hub is that it epitomizes the energy challenges of a modern multi-modal transport hub. The Hub is only one of UK Central's four development zones. The others are North Solihull, Solihull Town Centre, and Blythe Valley Park. Each has its own energy challenges and priorities. North Solihull, for example, must regenerate large amounts of 1950s/60s housing stock in Chelmsley Wood, where there are high levels of fuel poverty. Solihull Town Centre has recently completed a feasibility study that identified a low-carbon heat network opportunity that would be both technically and economically viable. Blythe Valley has the potential to develop a hydrogen hub. Each could therefore form its own EIZ, but there may also be a case for creating a single overarching EIZ to cover all four UK Central development zones.
Coventry and Warwickshire https://www.energycapital.org.uk/eizs-across-the-west-midlands/coventry-south-eiz/	Size: Whitley, Bagington, and area around Coventry Airport.	Coventry and Warwickshire is an example of a potential Energy Innovation Zone (EIZ) which could be used as an effective mechanism to ensure innovation and carbon reduction are effectively built into development plans, and these are properly scrutinized and integrated into local infrastructure. Coventry and Warwickshire covers Whitley, Bagington and wide area around Coventry airport, incorporating land in both Coventry and Warwickshire. This area is well served by transport networks, and significant growth is planned through developments such the £250 million Coventry and

Location (all in the West Midlands)	Project Details	Description
		Warwickshire Gateway scheme, and the £500 million development of Whitley South – a 60 acre engineering technology hub next to Jaguar Land Rover's global headquarters. There is little spare capacity in the local electricity network, yet demand is forecast to rise significantly over the next decade. Coventry Central and Coventry South are reaching the limits their circuits can supply, requiring major reinforcement works to raise capacity. Other areas of planned expansion in Coventry and Warwickshire are Gaydon and Ansty. Jaguar Land Rover and Aston Martin have plants at Gaydon, which suffers grid constraints that would limit the growth plans of these and other companies. Ansty has shown considerable growth in recent years and has potential for large development in the future. Both sites need to ensure adequate power supply to enable future development. Like UK Central Hub, these areas of economic growth and grid constraints need to develop timely and cost effective clean energy solutions, which an EIZ could facilitate.

Advanced Energy Communities

Advanced energy communities (AECs)—often defined by a neighborhood—prioritize energy efficiency, progressively achieve net-zero energy and near-zero greenhouse gas emissions, and use renewable energy to meet their needs. Many AECs are in California, where the California Energy Commission (CEC) leads the "Electric Program Investment Charge (EPIC) Challenge: Accelerating the Deployment of Advanced Energy Communities."

- **Approach:** Accelerate getting to zero energy on a neighborhood scale.
- **Priorities:** Energy transition, job creation, public health, and social equity.
- **Process:**
  - CEC solicits projects that accelerate the deployment of AECs over 18 months, when project teams conduct research on barriers and opportunities, design master plans, and develop tools for pilot communities within the first phase.
  - In the second phase, teams receive funding to implement specific projects in their pilot communities.

Each AEC is unique and leverages the strengths of its local partners, but microgrids, energy storage, zero net energy building programs, and electric vehicle initiatives are all common components. The following AECs are also participating in the Zero Energy Districts Accelerator, and so these summaries, like the ZED summaries above, are taken from a Better Buildings (U.S. Department of Energy initiative) white paper.

Location	Project Details	Description	Energy Opportunities
Huntington Beach, California	Huntington Beach Advanced Energy Community Size: 660 acres (267 ha). Building/space types: Multifamily, community center, industrial, education, commercial. Building area: To be determined.	Oak View, located in Huntington Beach, California, was identified by the California Energy Commission as a good candidate for an Advanced Energy Community (AEC) demonstration project. The goal of the Oak View AEC is to improve grid reliability and resiliency by achieving zero energy with on-site renewables and storage. Oak View is low income and includes mostly multifamily residential rental properties. Additionally, it maintains a commercial school zone and an industrial area with an open-air municipal solid waste treatment facility. Phase One of the project involves producing a scalable feasibility study; community outreach; economic analysis, including sustaining business models; and identifying the potential for workforce development. The goal of the project is to develop tools that will help plan and design an integrated set of energy infrastructure technologies and advanced energy technologies in a Huntington Beach community. The research will integrate new energy innovations with the existing community electric grids, infrastructure, and buildings to maximize the cost-effective use of renewable energy sources, reduce	• Pursuing dramatic energy upgrades for a disadvantaged community. • Aiming to address grid reliability concerns with battery storage and fuel cell integration.

Location	Project Details	Description	Energy Opportunities
Fresno Business District, California	Energize Fresno Size: 1 square mile (2.6 sq km). Building/space types: Retail, community center, industrial, education, commercial, residential. Building area: To be determined.	emissions in the community, reduce life-cycle cost of energy consumption for ratepayers, and improve grid reliability and resiliency. Energize Fresno is an Advanced Energy Community project in the business district of Fresno, California. The master community design aims to respond to the city's challenges of economic hardship and rising electricity demand while leveraging the city's considerable momentum in reducing overall energy consumption and expanding its renewable energy infrastructure each year. It is intended to provide a community-focused roadmap to mobilize the development of high-performance buildings, improve the security of Fresno's energy systems, and support reduced energy cost burdens for some of the most vulnerable populations in the state. Through an 18-month master planning process, the project leaders identified an "Energy Opportunity Zone" that would comprise a portfolio of commercial and residential projects across a range of building types and residential neighborhoods, including 13 development sites, two activity centers, two program enhancements, and two electric vehicle charging proposals.	• Identifying existing new construction and retrofit projects that can be enhanced through additional lighting, HVAC, battery energy management systems, solar, and battery improvements. • Planning to implement a virtual microgrid across all projects to harness district-wide demand management and electric energy storage.

Net-Zero Energy Communities

The National Renewable Energy Laboratory defines a net-zero energy (NZE) community as "one that has greatly reduced energy needs through efficiency gains such that the balance of energy for vehicles, thermal, and electrical energy within the community is met by renewable energy." This may also be called a zero net energy community.

- **Approach:** Accelerate getting to net-zero energy on a neighborhood scale.
- **Priorities:** Net-zero energy.
- **Process:**
  - Unlike EcoDistricts, energy innovation zones, or California's Advanced Energy Communities, a net-zero energy community is not associated with a certifying organization or specific program.

The community approach shifts the typical net-zero energy focus from the footprints of individual buildings, which may not be able to reach net-zero energy, to a system in which renewable energy generation can enable the neighborhood to meet these goals as a whole. The table below features five different NZE communities. The NZE communities developed by the U.S. Army and University of California–Davis are further described in a white paper from the Alliance to Save Energy, and NZE communities in Cambridge, Fort Collins, and Palo Alto are detailed in an ACEEE report.

Location	Project Details	Description
Army Net Zero Initiative Pilot	Sites: Nine U.S. Army bases.	• Each base will produce as much energy as it consumes over a one-year time frame. • The NZE community follows the physical boundary of each base (it will not use renewable energy produced off site), excluding the energy associated with employees and visitors or the delivery of goods and services to the bases. • Energy audit teams work with each location to identify opportunities for energy efficiency, including no-cost/low-cost facility operations and scheduling changes and larger capital improvements such as boiler or chiller replacements. Renewable-energy assessments determine whether there are opportunities for solar, wind, geothermal, wave, ocean thermal, and tidal energy systems. The U.S. Department of Energy's Federal Energy Management Program reviews the results of these assessments and helps the Army to develop specific Net-Zero Roadmaps for each site.
UC Davis West Village	Site: College campus. Size: 200 acres (81 ha) for 3,000 students, faculty, and staff; 662 apartments; 343 single-family homes; 42,500 square feet (3,900 sq m) of commercial space,	• Partnership between UC Davis and West Village Community Partners. • With all energy efficiency measures (solar-reflective roofing; radiant barrier roof sheathing; high-efficiency light fixtures, air-conditioning systems and appliances; thick 2" x 6" exterior walls for added insulation; and architectural elements

DISTRICT-SALE INNOVATION

Location	Project Details	Description
	a recreation center, and study facilities.	such as generous roof overhangs and window sunshades), projected demand will come to about 11 million kilowatt hours, a 50 percent reduction. On-site renewable energy and conservation incentives will help meet the remaining energy needs on an annual basis. • The cost for Phase One is around $280 million, of which UC Davis invested about $17 million to bring utilities and infrastructure to the site. The university will recoup this investment through a surcharge placed on residents' utility bills. UC Davis also received nearly $7.5 million in federal and state grants to study NZE systems. Energy grants were awarded to explore waste-to-renewable-energy alternatives, to study innovative technologies and innovative business models related to solar photovoltaic systems, and to assist in the design and engineering of renewable energy systems.
Cambridge, Massachusetts	Site: Citywide, focusing on the building sector.	• The city has been designated as a Green Community under the Massachusetts Green Communities program and has adopted a net-zero emissions goal. Close to 80 percent of the greenhouse gas emissions in Cambridge stem from buildings operations, so the city of Cambridge chose to focus its net-zero strategies on existing buildings and new construction. • Over 25 years, the goal is that, on an annual basis, all greenhouse gas emissions produced through building operations are offset by carbon-free energy production. Achieving the net-zero objective relies on a combination of energy efficiency improvements, renewable energy production, and, where necessary, purchase of carbon offsets or, potentially, credits (that meet specific criteria).
Fort Collins, Colorado	Size: 2.5-square-mile (6.5 sq km) downtown, mixed-use district.	• In 2012, the city of Fort Collins, Colorado State University, Colorado Clean Energy Cluster, and other key partners created the Fort Zero Energy District (FortZED) with the aim of turning it into a zero net energy (ZNE) pilot project. The area is estimated to include 45 MW of peak electricity demand, and roughly 10 15 percent of Fort Collins's distribution system. • Initial efforts in FortZED have centered on four projects: • The Renewable and Distributed System Integration (RDSI) project, which focuses on distributed resources to reduce peak electricity demand. This project is funded by a $6.3 million grant from the U.S. Department of Energy and $5 million in local community support, and it has so far tested several technologies, including a microgrid demonstration; • The New Energy Communities Grant aims to reduce energy demand in city buildings and install renewable energy technologies; • The Community Energy Challenge is a grassroots outreach effort to reduce home energy use; and • The Green Restaurant Initiative encourages local restaurants to conserve energy. • Through the RDSI project alone, FortZED has so far demonstrated a potential 20 to 30 percent reduction in peak electric demand.
Palo Alto, California	Site: Downtown Palo Alto Net Zero Energy (dpaNZE) Initiative.	• In 2014, the city, in collaboration with the Clean Coalition, launched the dpaNZE, which targeted 100 existing commercial buildings in downtown Palo Alto for net-zero energy by the end of 2017 and serves as an example of retrofitting for the rest of Palo Alto. • The focus of dpaNZE is on 1) promoting fuel switching to electrify natural gas applications, and 2) accelerating the transition to electric vehicles. Electrification will enable renewable energy to power a larger share of building energy through renewable energy generation.

Innovation Districts and Transit

Innovation districts are defined as "geographic areas where leading-edge anchor institutions and companies cluster and connect with startups, business incubators, and accelerators. They are also physically compact, transit-accessible, and technically wired and offer mixed-use housing, office, and retail." By combining smart growth principles and transit-oriented development with a focus on innovation, these districts seek to transform neighborhoods. The Brookings Institution recommends the following 12 principles for the development of innovation districts:

1. The clustering of innovative sectors and research strengths is the backbone of innovation districts.
2. For innovation districts, convergence—the melding of disparate sectors and disciplines—is king.
3. Districts are supercharged by a diversity of institutions, companies, and startups.
4. Connectivity and proximity are the underpinnings of strong district ecosystems.
5. Innovation districts need a range of strategies—large and small moves, long-term and immediate.
6. Programming is of paramount importance.
7. Social interactions between workers—essential to collaboration, learning, and inspiration—occur in concentrated "hot spots."
8. Make innovation visible and public.
9. Embed the values of diversity and inclusion in all visions, goals, and strategies.
10. Get ahead of affordability issues.
11. Innovative finance is fundamental to catalyzing growth.
12. Long-term success demands a collaborative approach to governance.

Given the similarities between innovation districts and eco-innovation districts, described above, this section focuses on transit as it relates to innovation districts. Transportation innovation is a key part of Charlotte's SEAP—necessary to connect investments in anchor institutions, mixed-use developments, and the rest of the city while contributing to lower carbon emissions through electrification and reduced car use. The approaches in current innovation districts range from experimenting with mobility and "smart city" innovations, to improving access to and within districts, and to developing districts around existing transit.

- **Mobility Innovation: Washington, D.C.'s Southwest Business Improvement District** – The Southwest BID is considering a mobility innovation district, which would focus on the transition to future mobility by providing a platform for experimenting with and testing new technologies. It would "explore how cities will adapt to these changes over time as the pace of change for policy, infrastructure and urban design, behavior change, and technology vary significantly."
- **Focus on Transit-Oriented Development: Minneapolis's Innovation Districts** —The first innovation district in the Twin Cities is Towerside, a 370-acre (150 ha) urban redevelopment. It includes the mixed-use development Green Fourth Street, which incorporates parking reservoirs and a district-wide parking framework to encourage active transportation. It also takes advantage of an 11-mile (18 km) light rail completed in 2014, encompassing half of the development along this new line.
- **Improving Access to the ID: Boston's Innovation District Transit Plan** – This plan includes transportation upgrades, improved infrastructure for cyclists and pedestrians, increased access to the innovation district through enhanced public transit services, and greater connectivity to better link the innovation district with the rest of the city.
- **Improving Access within the ID: Tampa Innovation District Transit Circulator** —Tampa is planning a series of innovations around transit that build off one another, including an innovation district app with a travel planner, an expanded district circulator, a connected walk and bike district, and a downtown express.
- **Data and Transit Innovation: Sidewalk Labs' Replica** – Sidewalk Labs has invested in Replica, a data-driven urban planning tool that facilitates modeling and decision-making around transportation. Although Sidewalk Labs is no longer going forward with its transformation of the Toronto Waterfront, technologies like these can contribute to similar redevelopments.

OTHER INITIATIVES FOR LOW-CARBON DEVELOPMENT

Strategies for low-carbon development go beyond smart growth principles and district-scale innovation, but they often complement these main themes. Some of the most fundamental and impactful strategies for carbon reduction can be piloted in RIDs or incorporated into transit-oriented developments. Five of the most essential strategies are:

- Improving building energy efficiency;
- Renewable energy sourcing;
- Converting the population's vehicle fleet to electric, charged via renewable energy;
- Working with the local utility to help supply green electric power, help supply electric vehicle charging stations throughout the city, and offer incentives for building efficiency; and,
- Investing in an energy-demand shifting strategy to flatten the "duck curve" of a traditional power plant and renewables loads. This includes buildings shifting their loads to avoid peak use at peak capacity, the addition of battery storage to the grid, and creative solutions like electric vehicles providing power back to the grid during times of peak use, which aligns with the "Grid-Interactive Efficient Building" concept.

Moreover, the U.S. Department of Energy will be putting out a funding opportunity announcement (FOA) in the next few months about connected communities, defined as "a group of grid-interactive efficient buildings with diverse, flexible end-use equipment that collectively work to maximize building and grid efficiency without compromising occupant needs and comfort. Connected communities leverage smart technology, distributed energy resources, flexible loads, and grid integration to cost-effectively reduce energy use and peak demand while improving the occupant experience." Charlotte can encourage stakeholders to apply for this, and connected communities could be piloted in a RID.

After discussing examples of overarching processes and metrics that cities have used to accelerate low-carbon development, the following sections will look at each stage of getting to zero carbon: shifting energy demand, reducing energy consumption, changing the energy consumed, generating energy on site, and purchasing the remainder. The report will conclude with policies and incentives that cities can

use to encourage compliance.

Processes

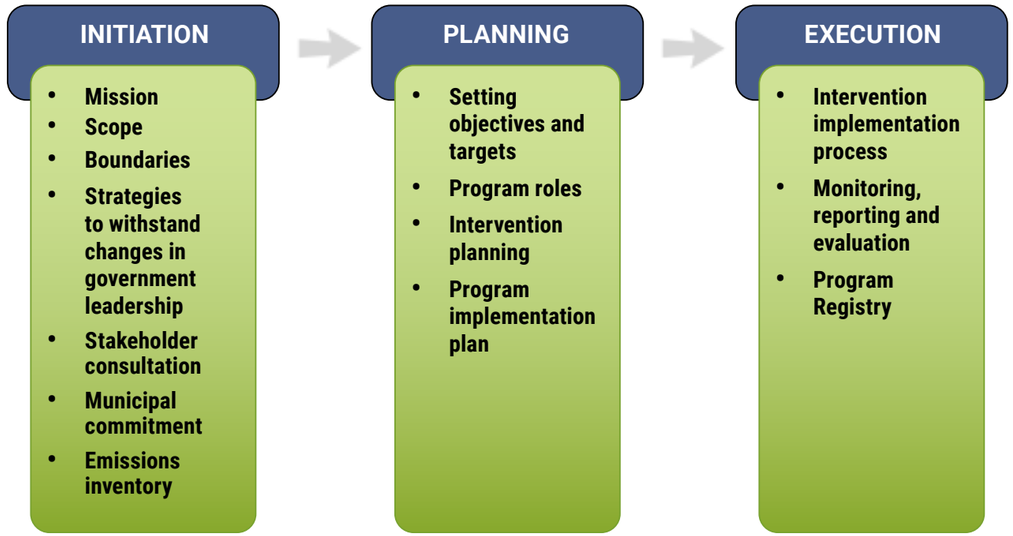
Clear processes and metrics for getting to zero carbon are the foundation of a city's carbon reduction initiatives. These processes should prioritize equity throughout, as detailed in a comprehensive guidebook from the Greenlining Institute.

The following table illustrates common types of metrics that cities are using to guide their carbon reduction processes.

Source	Metric	Notes
City of Portland	The goal for city bureaus is to achieve a 52 percent reduction in carbon emissions by 2030 compared with fiscal year 2006–2007 emissions.	Includes a baseline, timeline, and specific percentage for carbon emission reduction.
City of Minneapolis	Committed to reducing greenhouse gas emissions, Minneapolis has adopted targets to reduce community-wide emissions by 15 percent by 2015, 30 percent by 2025, and 80 percent by 2050 using 2006 as a baseline.	Includes benchmarking for multiple years to stay accountable and on track.
City of Atlanta	The Clean Energy Resolution states that Atlanta's transition plan must include "interim milestones, budget estimates, equity metrics (such as, but not limited to, energy burden), estimated financial impacts, financing mechanisms, and the percentage of clean energy that shall be locally and distributively generated."	Many cities plan for more expansive metrics to align with their other priorities. Embedding the preferred metrics into resolutions and planning processes can facilitate their use, especially if they are not already measured and need to be developed.
City of Denver	Double renewable production from city facilities from 2012 level by 2020 by using direct installations and power purchase agreements.	This focuses on energy itself rather than the resulting emissions. Additional metrics for renewable energy can be found here: http://www.usmayors.org/wp-content/uploads/2018/01/Renewable-Energy-in-Cities-Overview.pdf.

OTHER INITIATIVES FOR LOW-CARBON DEVELOPMENT

The protocol from the Low Carbon City Development Program (LCCDP) Guidebook recommends a general set of steps for cities to adapt to their context and planning processes:



This protocol is largely reflected in the example of Chicago, which uses specific targets:

Step	Chicago Example
Leadership	***Mayor*** Richard Daley shows early climate leadership, launching tree planting campaigns in 1989, 1991 Landscape Ordinance requiring green elements in city development projects, 1992 Bike Plan, 1995 Greencorps green jobs program Leadership Team established with the Chicago Climate Task Force, including Research Advisory, Finance and Communications committees
Inventory	Chicago's emissions ***inventory*** highlighted that electricity use in the buildings sector (43.5%), space and water heating in the ***buildings*** sector (27.8%), and on-road ***transportation*** (20.2%) are the dominant emission sources Energy and GHG emissions are tracked annually
Targets	Chicago used detailed analysis and three main criteria to set targets that are 1. Sufficient to avoid an adversely altered climate, as agreed by scientists 2. Advantageous for Chicago by improving the quality of life and boosting the economy and 3. Feasible given current technologies and resources Two overachieving targets: 25% reduction of GHG emissions from 1990 to 2020 and 80% reduction of GHG emissions from 1990 to 2050

Strategies	Chicago chose strategies in five main areas, plus active engagement of the community: 1. Energy-efficient buildings 2. Clean and renewable energy sources 3. Improved transportation options 4. Reduced waste and industrial pollution 5. Adaptation
Implement	*Partnerships* formed for each policy measure, for example, Energy Action Network of City of Chicago, Cook County economic development association, utilities and energy service providers, and 21 community organizations. *Government leadership:* Public Building Commission energy efficiency improvements (fan systems and induction pumps) and water-energy savings (low flow aerators, showers, and urinals) Chicago Area Alternative Fuels Deployment Project (electric and biodiesel) Chicago Parks District incorporating 25% renewable power
Monitor and evaluate	Evaluation of the Climate Action Plan found progress in the first 2 years: 456 measures developed by 16 City Departments and related agencies 13,341 housing units retrofitted to be more energy efficient 393 commercial and industrial buildings retrofitted to be more energy efficient 20 million more Chicago Transit Authority rides annually 35 million gallons of water conserved per day 1.8 million square feet of additional green roofs installed or under construction

Source: Created by the authors using data from Chicago Climate Action Plan (City of Chicago, 2008): Chicago 2010 Regional Greenhouse Gas Emissions Inventory (ICF International, 2010); and Chicago Climate Action Plan — Progress Report 2008-2009 (City of Chicago, 2010).

First Stage to Zero Carbon: Shift Energy Demand

According to the World Resources Institute, some utilities incentivize consumers to shift their electricity use to times when renewables generate more power. These incentives include lower prices (more common) and payments (less common). There is even a program in Arizona that pays consumers to use more electricity when renewable energy generators produce an excess. The generators return the revenue from these periods—when they would otherwise have to curtail production or turn off their facilities—to consumers by lowering energy bills. The activities that qualify for this program must be nonessential, such as a town fountain that runs only during periods of negative pricing.

Programs like these, which encourage customers to shift energy demand, are common and will become more important as renewables continue to enter the utility grid mix, making it more difficult for utilities to balance their load curve while avoiding the use of "peaker plants" (which often run on coal or natural gas) to meet the increased demand. As part of these programs, utilities can:

- Charge more with time-of-use pricing to encourage customers to use less when power is more expensive.
- Pay predetermined customers to shave their energy load during peak times through a demand response program. Operationally, customers can take actions like turning off some elevator bays, turning off lights in common areas, and widening their temperature deadbands/setpoints to ease HVAC use.

Buildings can also be charged a "demand" cost on their utility bill based on their peak use (kW). This is in addition to their dollar/kWh "usage" cost on the utility bill. In response, buildings can:

- Participate in the utility's demand response programs;
- Watch for peak pricing and reduce the building's load during those times; and
- Use batteries to drastically shift the load profile of the building with technologies like ice storage, generators, or batteries.

For example, the Texas ISO ERCOT's homepage shows the anticipated supply and demand for the day. If it looks like demand will outpace supply at a certain point in the day, that will trigger the utilities' demand response programs to get participating buildings to shed their energy load at that time.

Another popular strategy is to charge electric vehicles while there is a greater supply of clean energy. Of course, even when these load-shifting, demand-response, and reverse-demand strategies are successful, energy storage continues to be a critical part of managing mismatches in supply and demand.

Second Stage to Zero Carbon: Reduce Energy Consumption

Energy efficiency is an impactful way to reduce energy consumption. The American Council for an Energy-Efficient Economy (ACEEE) ranks 75 large U.S. cities, including Charlotte, on their energy efficiency policies and programs:

- Local government operations
  - Local government goals
  - Procurement and construction policies
  - Asset management
- Community-wide initiatives
  - Community-wide goals
  - Equity-driven approaches to clean energy planning
  - Local clean distributed energy systems
  - Urban heat island mitigation
- Buildings policies
  - Building energy code stringency
  - Building energy code compliance
  - Benchmarking and transparency
  - Incentives and financing
  - Required energy actions
  - Workforce development
- Energy and water utilities
  - Utility efficiency saving
  - Targeted energy efficiency programs
  - Energy data provision
  - Renewable energy incentives and efforts
  - Efficiency efforts in water services
- Transportation policies
  - Sustainable transportation strategies
  - Location efficiency
  - Mode shift
  - Public transit
  - Efficient vehicles policies
  - Freight
  - Efficient transportation for low-income communities.

Notably, many of these categories align with not only Charlotte's energy goals but also their focus on equity. Charlotte achieves 16 points out of 100 on its Clean Energy Scorecard, ranking 68 out of 75. Using this scorecard to identify where the city could improve on energy efficiency is one way to further strategically plan for reducing energy consumption.

The City Energy Project and American Cities Climate Challenge support cities in developing

and implementing climate mitigation policies, such as energy benchmarking ordinances, building audit or tune-up requirements, building energy performance standards, and net-zero building codes. All these policies strive to increase the energy efficiency of the built environment. Additional details on this range of policies can be found in this Urban Land article.

The New Climate Economy produced a working paper on the economic case for investing in low-carbon strategies, many of which overlap with the metrics used in the ACEEE scorecard. They found that "[l]ow-carbon investments in the buildings, transport, and waste sectors can more than pay for themselves over their lifetime and generate direct economic savings for cities currently valued at US$16.6 trillion, and with supporting policies could be as high as US$21.8 trillion. As new measures, such as smart grids, and innovations by the private sector are refined and deployed at scale, the scope for economic and carbon savings could be even higher" due to economic, social, and environmental benefits, such as improved levels of equality, health, education, employment, innovation, productivity, mobility and environmental quality, new revenue streams, and the reduced need for government expenditure.

Buildings	
New building heating efficiency	New buildings are constructed at passive heating levels: <30 kWh/m^2 from 2020-2030 and 15kWh/m^2 from 2031-2050.[12]
Heating retrofits	Old buildings are upgraded at a rate of 1.4-3% of the building stock per year, such that all existing buildings are upgraded by 2040. The retrofit reduces building energy intensity by 30-40% compared with the baseline scenario and includes heat pumps in mid-latitude countries.[13]
Appliances and lighting	Efficient lighting and appliances are aggressively deployed, based on the IEA's 2DS scenario.[14]
Solar PV	Building-mounted solar PV is ambitiously installed, based on the assumption that half of the solar PV in IEA's 2DS scenario[15] is distributed PV deployed in cities, in proportion to the regional urban population.
Transport	
Urban planning and reduced passenger travel demand	Land use planning reduces motorized passenger travel activity (pkm per capita) by as much as 7% in OECD countries and 25% in developing countries.
Passenger mode shift and transit efficiency	Expansion of public transport leads to 20% lower pkm mode share of light-duty vehicles (LDVs) and higher mode share for rail and bus transport.[16]
Passenger car efficiency and electrification	A combination of more efficient and electric private vehicles results in >45% improvement in private vehicle efficiency globally. The energy intensity impact of electrification is based on the 2DS scenario variant

OTHER INITIATIVES FOR LOW-CARBON DEVELOPMENT

	Electrifying Transport[17] and ***Energy Technology Perspectives***.[18]
Freight logistics improvements	Freight transport logistics improvements lead to a 5% reduction in tkm per capita by 2030 and 12% by 2035.[19]
Freight vehicle efficiency and electrification	Global freight energy efficiency improves by 1% by 2030, and by 26% by 2050. In addition, 27% of global freight is electrified by 2050.[20]
Freight logistics improvements	Freight transport logistics improvements lead to a 5% reduction in tkm per capita by 2030 and 12% by 2035.[19]
Freight vehicle efficiency and electrification	Global freight energy efficiency improves by 1% by 2030, and by 26% by 2050. In addition, 27% of global freight is electrified by 2050.[20]
Waste	
Recycling	Recycling rates rise to collect 80% of recoverable materials by 2050 in all regions by 2050.
Landfill has capture	The fraction of methane captured rises by 5.5% annually in non-OECD countries and by 2.5% in OECD countries. All regions experience 2% annual growth in methane capture facilities that also generate grid electricity.

Source: Erickson and Tempest, 2014.

Third Stage to Zero Carbon: Change the Energy Consumed

Electrification is embedded throughout the SEAP and will become an increasingly useful tool as electricity continues to become cleaner. This can include encouraging the switch to electric appliances in a significant fraction of buildings, incentivizing electric vehicles, using electric fleets for transit, and converting whole building systems to electric. Electrification is becoming especially important as cities set policies that do not allow natural gas hookups in new construction. Berkeley, California, was the first city to do this, and now dozens of localities on the West Coast have adopted the same policy. Because there is no clean-energy substitute for natural gas—making this policy a critical strategy to reduce carbon emissions—electrification would be an important proactive step. Smart grids can help integrate renewables into the electricity supply to accelerate the benefits of electrification.

Moreover, one district-scale solution that could align with Resilient Innovation Districts is district energy. Because district energy works best when there is a relatively dense group of participating buildings, it would also encourage smart growth.

District energy systems heat and cool a network of buildings in one geographic area from a central plant, thereby requiring less fuel, reducing the need to import fuel, and improving efficiency by making separate systems in each building unnecessary. They are often connected to combined heat and power (CHP) plants, which also generate electric power and are generally more efficient than a conventional power plant. They can also rely on "waste" heat from industrial processes, coal- or gas-fired boilers, and renewable energy such as geothermal, hydrothermal, solar thermal, biogas, municipal solid waste, or other types of biomass. Examples of successful district energy projects include the following:

- **St. Paul, Minnesota** – District Energy St. Paul operates the largest hot water district heating system in North America.
- **Tampa, Florida** – A new development will include district cooling for the entire Water Street 53-acre (21 ha) site.
- **Austin, Texas** – The city has two district cooling plants and is developing a third, which is being implemented. There also are plans for future cooling.

Other cities have also successfully implemented geothermal systems or community solar:

- **Boise, Idaho** – The city has one of the largest geothermal systems in the world and provides incentives for developers to connect to the grid.
- Numerous **U.S. housing community developments** also take advantage of geothermal technology, as demonstrated here and here.
- **Minnesota** – Community solar in Minnesota has been steadily growing.

Fourth Stage to Zero Carbon: Generate Energy on Site

Charlotte has expressed interest in expanding its solar panels on city-owned rooftops—one way of generating energy on site. The Institute for Local Self-Reliance studied municipal solar in several cities with the following results:

- **Lancaster, California** – The city now produces more solar energy on a daily basis than it consumes.
- **New Bedford, Massachusetts** – City energy bills are being cut, and the city is deploying more solar per capita on city property than any other city in the U.S.
- **Denver, Colorado** – The city is using innovative financing techniques to ramp up city-owned solar, especially to take advantage of solar opportunities at the city-owned airport.
- **Kansas City, Missouri –** Despite facing restrictive state policy and modest sunshine, the city has put solar on 59 city buildings.
- **Raleigh, North Carolina –** This city is using innovative financing arrangements to increase its municipal solar, even though grid power has continued to be inexpensive and state policy support is limited.

Although these cities faced barriers specific to them, they have demonstrated that strong leadership and innovative financing techniques can enable cities to overcome low state-level support and restrictive policies. C40 Cities recommends the following tactics to improve the chances of success:

- Set a highly visible, citywide target for clean energy to gather momentum.
- Create an inventory of city-owned site and their solar potential.
- Develop a stakeholder engagement plan and release a request for proposals to solar vendors.
- Monitor system performance and promote benefits with the public through clear communication.

Municipal solar alone is not enough the reach zero carbon. The Sierra Club provides a detailed overview of how to make changes within the broader energy landscape, beyond city-owned rooftops, in *Pathways to 100: An Energy Supply Transformation Primer for U.S. Cities*. This resource also discusses procurement, the topic of the next section.

Nonmunicipal commercial and residential buildings stand to benefit from generating energy on site as well. The cost of solar power is now cheaper than other options, so the business case for a lower energy bill can motivate buildings to install panels. Furthermore, on-site energy generation offers resilience benefits, since it reduces dependence on grids that can be unreliable. Some utilities even allow net-metering, in which buildings can sell back the extra renewable power generated to the grid. One example of a city encouraging this is the Northern Virginia program Solarize Alexandria in which the city helps aggregate residents' and businesses' solar purchases to ensure bulk pricing and high-quality vendors. Finally, the increased popularity of distributed energy resources (DERs) represents an important advancement in driving carbon emissions reductions.

Fifth Stage to Zero Carbon: Procure the Rest

If there is a shortfall of renewable energy produced on site, then cities turn to procurement. Charlotte is a part of the American Cities Climate Challenge's renewables accelerator, which has extensive guidance on procurement, including options by state. All their tools and resources are free to use and publicly accessible.

More and more utilities are offering programs for customers to buy green power, including Duke Energy. However, if there is no space to install solar on site and the utility does not offer green power purchasing options, a company or municipality may consider a power purchase agreement (PPA). Better Buildings defines a PPA as follows:

> "A Power Purchase Agreement (PPA) is an arrangement in which a third-party developer installs, owns, and operates an energy system on a customer's property. The customer then purchases the system's electric output for a predetermined period. A PPA allows the customer to receive stable and often low-cost electricity with no upfront cost, while also enabling the owner of the system to take advantage of tax credits and receive income from the sale of electricity. Though most commonly used for renewable energy systems, PPAs can also be applied to other energy technologies such as combined heat and power (CHP)."

One example of a successful PPA is an agreement in Saugus, Massachusetts, between Regency Centers (an owner, operator, and developer of grocery-anchored shopping centers), which installed the rooftop solar, and Trader Joe's, which purchased the resulting clean energy at a discount. Similarly, the District of Columbia Department of General Services (DGS) is implementing its portfolio of solar projects using PPAs.

Policies and Incentives

This final section replicates a table from ULI's publication *Decarbonizing the Built Environment: 10 Principles for Climate Mitigation Policies*. As Charlotte works across sectors to reach zero carbon using a mix of the strategies available within each of the five stages, policy development and compliance will be key. The following table describes examples of financial and nonfinancial incentives and penalties to drive compliance.

Example incentives and penalties to drive climate policy compliance

INCENTIVES

NONFINANCIAL

Increased density/additional floor area ratio
Example
Seattle: Living Building and 2030 Challenge pilots allow departures from the Seattle land use code through design review and offer additional height and floor area incentives for projects attempting to meet the Living Building Challenge.

Increased height
Example
New Orleans: Allows buildings to exceed floor area and height base standards for attaining LEED Gold or other public investments.

Expedited permit review
Example
Chicago: The Green Permit Program provides an expedited permit process for environmentally conscious design elements, including green roofs.

Parking reduction
Example
Shoreline, Washington: Deep Green Incentive Program reduces minimum parking requirement by tier (from 5 to 50 percent), among other benefits.

Rezone incentive
Example
Vancouver, British Columbia: All rezoning must meet a low or near zero emissions building standard, such as the International Living Building Institute's Net-Zero-Energy Building Certification.

C-PACE financing program
Example
Columbus, Ohio: Local owners receive upfront funds for energy/climate resilience improvement projects and pay back loan through long-term tax assessment (20 to 30 years).

Recognition program
Example
Denver: Certifiably Green Denver recognizes certified businesses through free advertising, including Internet listings and newspaper advertisements, magazines, radio, and water bill inserts. Businesses also receive a framed certificate and a window decal.

Photo with the mayor
Example
Salt Lake City: The Elevate Buildings Awards is attended by the mayor and recognizes high-performing buildings.

FINANCIAL

Reduced or waived fees
Example
South Portland, Maine: Properties in compliance with the benchmarking policy are excused from paying the first $5,000 per project of any building, electrical, plumbing, demolition, site plan, or other city application or redevelopment on the covered property.

Tax abatement
Example
Cincinnati: Provides a rebate as a percent of tax assessed value. The International Living Future Institute (ILFI) suggested range: 0.1 percent to 100 percent over 10-15 years depending on certification level and building type.

Cash rebate, including rebate for green building certification costs or equipment replacement
Example
Sacramento: The city offers rebates for replacing a gas furnace or water heater with a heat pump or heat pump water heater.

Low-interest project financing
Example
Memphis: Low-interest loans are available through collaboration with Pathway Lending, which provides 100 percent financing for projects up to $5 million. Rates are set at 2 percent for five years or 5 percent for 10 years.

Green Bank loan program
Example
Montgomery County, Maryland: Green Bank provides low-interest loans for energy efficiency projects through partner lenders and acts as hub for lenders and contractors, simplifying the process for loan applicants.

Reduced permitting fees
Example
Gainesville, Florida: Voluntary green building ordinance benefits include fast-tracked building permits, a 25 percent reduction in permit fees, marketing support, and an annual green building award.

Rebate of fees
Example
Miami Beach: Developers are required to pay into a Sustainability Fund, with a rebate given according to LEED certification tier.

Utility incentives
Example
Chicago: After benchmarking to understand energy use, the city recommends reaching out to the local utilities, ComEd and Peoples Gas, for free energy assessments.

Grants
Example
Chicago: The Small Business Improvement Fund supports commercial and industrial properties located in a tax increment finance district conducting repairs and remodels, including energy efficiency projects. Up to 75 percent of project costs

projects. Up to 75 percent of project costs are covered up to $100,000 for commercial and $150,000 for industrial buildings.

Technical design/implementation assistance
Example
Austin: Austin Energy's voluntary green building program and rating system provides personalized consulting services on design and construction from beginning to end of the process to ensure the highest possible rating. Program is open to commercial, multifamily, and single-family buildings.

Free audits
Example
Boston: Mass Save, a consortium of multiple utilities, provides a number of incentives and rebates for efficiency upgrades based on free assessment for residential property owners of any size, with cash rebates differentiated by upgrade type. Multifamily buildings in which 50 percent or more of tenants are at 60 percent or below of the area median income receive free assessments and upgrades.

PENALTIES

FINANCIAL

Fine added to taxes
Fine by total building square footage
Example
Fort Collins, Colorado: Failure to comply with the benchmarking ordinance can result in fines of $0.0025 per square foot, up to $1,000 per day of noncompliance.

Fine as a percent of construction costs
Example
Miami Beach: Developers that do not meet new construction standards (LEED certification) receive no refund of the Sustainability Fund fee, equal to 5 percent of construction costs.

Fine for each day of noncompliance
Example
Philadelphia: Failure to comply with the Benchmarking Ordinance results in a $300 fine for the first month they are late, and subsequent $100 fines for each day they are late afterwards.

Fine based on emissions over the limit
Example
New York: Buildings that exceed the emissions limits set by the Climate Mobilization Act will be fined $268 per metric ton over the limit.

Lose ability to lease space to new or existing tenants
Example
United Kingdom: If Energy Performance Certificate-subject properties cannot meet a minimum energy efficiency rating, owners lose the right to rent or sell the property until improvements are made to reach the minimum acceptable rating.

OTHER INITIATIVES FOR LOW-CARBON DEVELOPMENT

NONFINANCIAL

Connect compliance to receiving other building permits, including the city withholding the certificate of occupancy until a building is in compliance
Example
Baltimore: The Green Construction Code mandates that all permits for commercial and certain multifamily buildings are required to complete a Green Building Statement of Compliance to determine code applicability and to identify a green building compliance path. Acceptable pathways include LEED Silver, NGBS, and ASHRAE 189.1a. certification level and building type.

Public display of performance level at building entrance
Example
Chicago: Chicago Energy Rating system assigns large commercial properties covered by benchmarking ordinance (more than 50,000 square feet) a rating from one to four stars depending on Energy Star points. Placard with star rating is required to be posted in a prominent location and shared at time of sale or lease.

Shame-list of noncomplying buildings' contact information provided to local vendors
Example
Orlando: Buildings that do not provide benchmarking data by the deadline are identified as noncompliant in an annual report on a public benchmarking map.

APPENDIX C: ADDING ADAPTATION INTO CHARLOTTE'S CLIMATE WORK

Additional context on climate adaptation and city policy from the ULI Urban Resilience program (https://www.uli.org/resilience)

Introduction

Tackling climate change requires a dual approach: we must reduce the severity of the problem by cutting greenhouse gas emissions, and we must prepare for the climate impacts we are already facing, like increased risks from flooding, extreme heat, or wildfires.

As you are likely aware, the first approach is often known as climate change mitigation, and usually falls under the umbrella concept of sustainability. The second approach is known as climate change adaptation, a term which is frequently used interchangeably with the word resilience. Resilience, as the Charlotte Sustainable Energy Action Plan (SEAP) broadly defines, is a city's ability to "deal with shocks and stresses," climate-related or otherwise.

The SEAP frames resilience for Charlotte primarily in terms of carbon emissions and socioeconomic growth, aiming for a "low-carbon future" driven by innovation in energy efficiency and business models. This framing, while strong from a mitigation perspective, leaves a gap for explicitly addressing adaptation to physical climate risks like increased flooding or heat.

This briefing defines resilience as climate adaptation to physical risks, and focuses on how adaptation can complement mitigation and sustainability – specifically, how Charlotte can use this ULI Technical Assistance Panel as a strategic moment to integrate adaptation planning, alongside the SEAP, into its Comprehensive Plan update and Unified Development Ordinance.

This would build on Charlotte's prior and ongoing adaptation and resilience work, such as that represented by the Urban Forestry Master Plan, Floodplain Regulations, and Stormwater Regulations, or the findings of the *Making Charlotte a Climate-Ready and Just City* report by the Center for American Progress. As that report noted, building climate resilience into city policy is also a key moment to address current and historical equity issues within the city, and make sure the needs and participation of vulnerable populations – mainly, low-income communities of color – are prioritized in this process. This would build on Charlotte's prior and ongoing adaptation and resilience work, such as that represented by the Urban Forestry Master Plan, Floodplain Regulations, and Stormwater Regulations, or the findings of the *Making Charlotte a Climate-Ready and Just City* report by the Center for American Progress. As that report noted, building climate resilience into city policy is also a key moment to address current and historical equity issues within the city, and make sure the needs and participation of vulnerable populations – mainly, low-income communities of color – are prioritized in this process.

Two Sides of the Coin

It's important to note that there is often overlap between adaptation and mitigation.

For example, high-performance, energy efficient buildings frequently feature enhanced insulation, efficient lighting, appliances, and mechanical equipment, and onsite energy generation (like solar panels) to reduce energy use and associated carbon emissions. According to the SEAP, buildings emit 48% of Charlotte's greenhouse gases, and therefore they are essential to address from a mitigation perspective. However, greater insulation also helps keep hot air out during heatwaves, and solar panels double as shade devices to reduce heat absorbed by the roof, keeping indoor temperatures comfortable as an adaptation to extreme heat.

Buildings that need less energy, and generate most or all of it themselves, reduce reliance on the local grid system and they are also more able to ride out power outages during storms or heatwaves – another form of adaptation.

Lastly, protecting or enhancing a community's green infrastructure – the living ecosystems that cities are part of and benefit from, like parks and open spaces, urban tree canopy, or water bodies and wetlands – can contribute modestly to reducing emissions through natural carbon sequestration by plants and soil. However, green infrastructure also cools off its surroundings and helps absorb stormwater, simultaneously reducing heat and flood risks.

While some adaptation actions work against mitigation by increasing emissions (such as using air conditioning in hot weather or diesel backup generators during outages), many do not. Adaptation and mitigation can and should work in concert to meet a city's climate goals.

Cities With Adaptation-Mitigation Synergy

Some cities have begun addressing climate adaptation within their mitigation and sustainability plans (often known as Climate or Community Action Plans), comprehensive plans, and even zoning codes. Below are several examples of a combined approach Charlotte could draw from, along with a sample incentive policy that can finance adaptation and mitigation simultaneously. Adaptation planning also requires local consensus on the potential range of climate impacts to a region in the medium and long-term, such as anticipated localized impacts of future flooding or extreme heat.

Climate Action Plans and Comprehensive Plans

1. **Minneapolis 2040**. Minneapolis 2040 differs somewhat from Green Cincinnati and Orlando's Community Action Plan in that it is a sustainability and resilience-focused comprehensive plan, rather than a standalone sustainability plan. Minneapolis 2040 integrates resilience/adaptation into the city's master planning efforts on land use, housing, economy, transportation, urban design, and effective governance. In comparison to climate action plans, which are usually managed by a sustainability department, a comprehensive plan is a whole-of-government affair, broadening the potential for impact. Comprehensive plan policies will be binding, rather than aspirational, when the City updates its zoning code to reflect the Comprehensive plan as required by state law. Minneapolis 2040 combines adaptation and mitigation into a single climate resilience goal (one of 14 goals in the plan), with 21 associated policies and a dual 2040 objective of becoming resilient to the effects of climate change and being on track to achieving an 80% reduction in greenhouse gas emissions by 2050. Sample mitigation policies include accelerating energy efficiency and resilience retrofits for buildings, shifting fuel sources for heating and cooling in buildings from fossil fuels to electricity and increasing use and generation of carbon-free energy. Adaptation policies include increasing stormwater management requirements for private development, adopting an urban heat management plan, and developing guidance for climate-sensitive design for private buildings, parking lots, and open spaces.

Minneapolis 2040 also contains policies around Innovation Districts to explore district-scale infrastructure and systems, mirroring Charlotte's Resilient Innovation Districts. These Districts will facilitate investment in infrastructure and systems at a larger scale and will require above-standard approaches to mitigation and adaptation through energy efficiency and production, stormwater management, and public realm elements like green space.

Select peer cities with resilience initiatives in their comprehensive plans include:

- Dallas, TX
- Denver, CO
- Indianapolis, IN
- Long Beach, CA
- Memphis, TN
- Portland, OR
- San Diego, CA

2. **Green Cincinnati Plan.** The city's long-term climate plan, passed in 2018, presents 80 strategies to advance sustainability, resilience, and equity, with a central goal of reducing carbon emissions 80% by 2050. The plan breaks down the 80 strategies by sector, such as Built Environments, Energy, Transportation, or Resilience. Mitigation measures, like making all city facilities and operations carbon neutral by 2035, tripling renewable energy generation by residents and businesses, or increasing the passenger miles traveled on public transit 25% by 2035, are seamlessly integrated with adaptation measures, like conducting urban heat island and neighborhood vulnerability assessments, adding renewable backup power systems for emergency facilities and shelter areas, increasing the stormwater management capacity of green infrastructure, and restructuring stormwater fees to encourage onsite stormwater retention.
3. **Green Works Orlando:** 2018 Community Action Plan. As part of the Green Works Orlando Initiative, the city's broad sustainability program implemented by the Office of Sustainability & Resilience, the 2018 Community Action Plan aims to make Orlando "one of the most sustainable cities in the U.S. by 2040." The plan's mitigation goals are to reduce greenhouse gas emissions 90% from 2007 levels by 2040, reduce energy consumption citywide by 25%, and source 100% of citywide electricity from renewables by 2050. However, climate resiliency is one of several overarching themes within the plan (alongside social equity, smart technology, and innovation), aiming to ensure that "All communities, businesses and residents in Orlando are prepared for and are resilient to the potential impacts of a changing climate." Adaptation/resilience strategies include increasing citywide tree canopy to 40% by 2040 to mitigate heat and stormwater impacts, amending the Land Development Code to strengthen protections for trees, wetlands, and natural areas, and ensuring 95% of residential addresses are located within half a mile of a park or open space to help spread green infrastructure throughout the city. Additional strategies could have been included in this plan to develop it further, but it nevertheless offers a glimpse of a city more at the beginning stages of integrating adaptation and mitigation goals.

Zoning Codes

As alluded to above, climate adaptation goals that are enshrined within legally binding regulations like zoning or other land use ordinances have a greater impact on advancing resilience goals. Below are several cities which have incorporated adaptation and resilience measures into zoning.

1. **Norfolk, VA's 2018 Zoning Ordinance.** Norfolk is amongst the most cities in the U.S. most vulnerable to sea level rise and subsidence; however, the city has taken a proactive approach to addressing this issue through zoning, as well as on-going initiatives managed through its Office of Resilience and major projects such as the city's participation in the National Disaster Resilience Competition (NDRC). Norfolk has implemented extensive coastal adaptation measures in its updated zoning and is widely considered to be the leader in the U.S. for proactively using site vulnerability to climate impacts as a key factor for determining future land use approach and density. Among more common requirements for elevating buildings in flood-prone areas and encouraging development in safer upland areas is a zoning innovation known as a Resilience Quotient, which requires all new development and significant building expansions/renovations to incorporate some combination of features from each of three categories: flood and storm risk reduction, green infrastructure and stormwater management, and energy resilience and efficiency. LEED-gold buildings are exempt, illustrating another mitigation/adaptation synergy. See the Georgetown Climate Center's summary for more detail.
2. **Phoenix, AZ's Zoning Code.** Phoenix has a number of heat resiliency features in its zoning. Buildings over 5,000 square feet must provide shade for 75% of their sidewalk frontage and 50% of their public and private open space, and landscaped areas must have at least 30% tree canopy coverage. Any paved surfaces should use permeable pavers, porous concrete, or similar materials to allow heat to escape through water evaporation from the soil below.
3. **Seattle, WA Green Factor.** Seattle has a landscaping policy in its zoning, known as the Green Factor. Comparable to Norfolk's Resilience Quotient, this system requires private development to include a certain amount of green infrastructure to meet a threshold on a point system, with the goals of improving stormwater management and flood control and reducing the intensity of hotter weather. Washington, D.C. has a similar policy known as the Green Area Ratio.

PACE Financing: An Incentive for Funding Adaptation & Mitigation

Many federal, state, local, and utility-based incentives exist for financing mitigation and energy efficiency projects in buildings. (For a longer list of incentives, see ULI Greenprint's *Decarbonizing the Built Environment: 10 Principles for Climate Mitigation Policies*). However, many of these incentives stop at energy efficiency, without considering how to finance resilience projects

An important exception to this is PACE financing, or Property-Assessed Clean Energy. In PACE programs, a private lender provides 100% of upfront funding for energy efficiency, renewable energy, or resilience features in retrofits or new construction; the loan is paid back through an assessment tied to the property, typically over 10-20 years. Payments are usually lower than the savings created through the efficiency measures, meaning projects can be cash flow positive immediately. PACE can be used for nearly any property type. Nearby states with active programs include Virginia, Kentucky, Georgia (in development), and Florida. Columbus, OH is an example of a peer city with an active program. North Carolina has passed PACE-enabling legislation but has no active programs in place. Charlotte could be the first city in the state to utilize this program.

See the US Dept. of Energy's resources on PACE financing for resilience projects for more detail..

Missed Opportunities for Building Adaptation into Mitigation Policy

As mentioned above, cities often do not include adaptation within their mitigation policies. Some exceptions exist, such as those listed here; inversely, some cities incorporated mitigation into their official resilience strategies (specifically, those developed through their participation in the Rockefeller Foundation's well-known 100 Resilient Cities Initiative), such as Berkeley, California's or New York City's.

However, climate mitigation plans often leave resilience to the resilience plan and related policy. A high-profile example of this separated approach can also be found in New York City, which passed landmark mitigation legislation in 2019 known as the Climate Mobilization Act. The Act's central policy is Local Law 97, which requires commercial and residential buildings over a certain size to cut their greenhouse gas emissions 40% by 2030 or face steep fines, a first-of-its-kind legislation that is among the most stringent in the U.S.

While the Local Law 97 will quickly drive New York City's progress on mitigation, and some elements may contribute to resiliency (such as requirements for solar panels or green roofs), a watershed policy like this will spur huge growth in the energy efficiency retrofit market – yet, it did not require retrofits for storms or coastal flooding, creating a missed opportunity to scale resilience work across the city's vulnerable large commercial and multifamily buildings.

By avoiding this type of siloed approach and ensuring that adaptation finds its way into its Comprehensive Plan and Unified Development Ordinance update, Charlotte can seize a great possibility for national leadership on climate change.

ULI Charlotte
1300 Baxter Street, Suite 360
Charlotte, NC 28204

704 940 7388
charlotte@uli.org
charlotte.uli.org