



HUMANS CAUSED
CLIMATE CHANGE
WE MUST CREATE
CLIMATE ACTION

Climate Actions

Photo: Ben Amaral
via Unsplash



The following sections lay out a broad range of more than 100 recommendations for policies, programs, and projects to reduce GHG emissions from businesses, homes, apartments, vehicles, and other aspects of the Dane County economy. When recommendations state that Dane County will take specific actions, we are referring to all the citizens and businesses in Dane County (as opposed to other instances where we specify the Dane County government).

Energy Efficiency

Energy efficiency, energy conservation, and demand-side management need to be the foundation of any comprehensive effort to reduce carbon emissions in electric and thermal energy systems. There are many reasons for this but keeping overall costs of the transition as low as possible is one of the most compelling. Wisconsin has a rich history of leadership in energy efficiency (EE) programs and achievement. EE programs not only reduce emissions but create jobs, strengthen the economy, lower utility costs, and improve comfort, productivity, and health. We needn't look any further than the state's own Focus on Energy (FOE) program to see this. FOE, the state-wide EE program for the past 18 years, has been a nation-leading program from its inception. However, FOE is limited in the resources it has and thus its ability to meet the EE needs in any one part of the state. In 2015 FOE reached two percent of the residential customers in Dane County and just one-half of one percent of the commercial customers, leaving a clear place where the Office of Energy & Climate Change can remove barriers to a proven program and delivery mechanism to expand efficiency in Dane County.

Recommendations

The Dane County Office of Energy & Climate Change will launch an energy efficiency (EE) program that will match homeowners, renters, and business owners with incentives, information, and opportunities to save energy. Leveraging the FOE program, municipal programs, and/or financial tools such as Property Assessed Clean Energy (PACE), the Dane County energy efficiency program will serve as a facilitator within communities to increase awareness of, and access to, resources that support energy efficiency.

While the program will obviously focus on energy efficiency, we will use the direct contact opportunity to give businesses, homeowners, and renters as many opportunities to reduce their carbon footprint as possible including helping them access renewable resources, water savings, and cleaner transportation options.



▲ Scott Hackel, Director of Research and Innovation at Slipstream, talks about the energy efficient heating and cooling system at Rethke Terrace, a Passive House and LEED certified affordable housing project in Madison.

The Dane County program will deliver energy efficiency services through direct marketing and will include a broad public relations effort (discussed in more detail below) designed to raise awareness of EE opportunities and make energy savings equipment and strategies available to any business or resident that expresses interest. However, the program will prioritize specific sectors for community-based outreach.

The highest priority sectors will be farms and other agribusinesses, residential customers, and small businesses. Within each of these sectors the program will prioritize underserved communities and neighborhoods. The small business EE program will begin by offering EE services to small business owners of color and to women owned businesses. Larger commercial businesses and manufacturing businesses will be critical priorities in the mid-term (as opposed to near-term) to achieving deep efficiency savings.

Within the broad categories above, residential for example, the Dane County EE program will focus on specific building types, particularly hard-to-reach or underserved buildings such as low-income multifamily housing. The multifamily

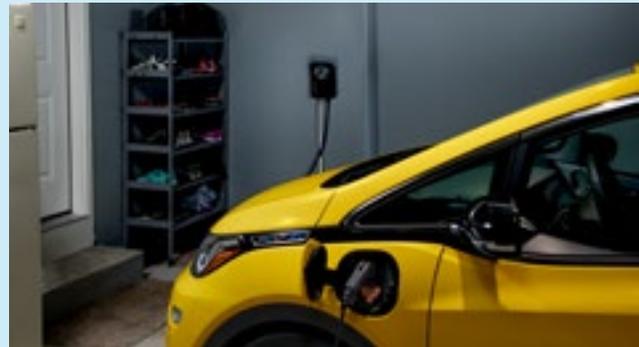
Climate Champions

Madison Gas and Electric, A Partner in Electrifying Transportation

MGE partners to electrify transportation, working with residential, and commercial and fleet customers, both public and private. The electrification of transportation is one of MGE's key strategies for achieving deep decarbonization and targeting net-zero carbon electricity by 2050.

MGE's programs include:

- **Charge@Home** for quick, convenient home charging with no upfront cost. MGE will coordinate the installation of a Level 2 charging station in exchange for a monthly fee of about \$20 (64 cents per day), plus the cost of electricity. There is no upfront charge for standard installation, and MGE takes care of charger maintenance and repairs. MGE can manage charging sessions remotely, if needed, to better manage the electric grid.
- **Public and multi-family charging.** MGE began installing public charging stations in 2009. MGE's growing network includes more than 30 public charging stations, all powered by wind energy. Since 80% of charging occurs at home, MGE partners with developers and property managers to install chargers at multi-family properties.
- **Workplace charging** to enable employees to charge at work.



▲ MGE's Charge@Home program offers homeowners the convenience of a home charging station for a monthly fee.

Partnering with customers to grow the use of EVs and awareness of their benefits advances shared energy goals for MGE and our broader community. MGE partners with:

- **The City of Madison** to electrify its buses and fleet vehicles.
- **Auto dealerships** to provide resources and education to sales staff.
- **Lyft**, the ridesharing company, to help EV drivers with Lyft share insights with riders.

MGE launched an EV website, LovEV (mge.com/LovEV), and an online feature called EV Rider (energy2030together.com/EVRider), which provide easy-to-understand information on EVs and charging. The LovEV website helps customers who are considering an EV get up-to-date and accurate information about available models, driving range, costs, emissions and charging opportunities. ☀️

sector has complex ownership and utility bill payment responsibilities, and often has a lack of capital for improvements.

The Office of Energy & Climate Change will look for multiple partners to help administer the EE program in certain market sectors. For example, in the small business sector, potential program partners could include the Citizens Utility Board, Greater Madison Chamber of Commerce, Wisconsin Women in Business Initiative, Sustain Dane Sustainable Business Network, Small Business Administration, Latino Chamber of Commerce, Madison Black Economic Empowerment Council, and others. These partners could bring many benefits to the program including helping to identify business owners and tailor offerings to serve existing small businesses as well as entrepreneurs in the pre-startup and startup phase of development. Partner organizations could contribute to networking and peer-to-peer exchange of best practices.

Buildings

Buildings consume more than 47% of all the energy used in the U.S. and about 75% of the electricity generated in the U.S. Dane County will join leading local governments across the globe by launching a major effort to tackle carbon emissions from buildings. This section is primarily focused on policies for new building construction and major renovations.

The recommendations below will improve the quality of life in Dane County by offering residents healthier, more productive, and more economical places to live, work, recreate, and learn. To encourage robust participation in this voluntary advanced-buildings program, the County will leverage:

1. Market and peer recognition for builder participants.
2. Health, productivity, and quality-of-life benefits for owners and occupants.
3. Increased economic development and stimulus.
4. Long-term return on investment.
5. Creation of a built environment with Dane County's values of health, sustainability, and resiliency.



- ▲ 749 University Row, a multi-tenant office building in Madison, is a net zero energy-ready building that achieved LEED Platinum status. The building is a testament to the viability of sustainable construction in the Madison market as it was fully leased before construction was complete.

The attraction of the advanced-buildings program will mean more families and businesses want to locate in Dane County creating more demand for efficient, sustainable, resilient buildings.

Recommendations

Building Performance Challenge

Whether a building owner or developer wants to make a strong visible commitment to climate leadership or simply seek the health, comfort, and economic benefits of reduced energy use, the voluntary Building Performance Challenge offers a way to participate. Building owners making improvements, whether new construction, remodels, or retrofits, can commit to an energy or carbon performance target appropriate to their building type:

- **Level 1:** A building that uses net zero energy or net zero carbon.
- **Level 2:** A building that uses 75% less energy than other buildings of the same type.
- **Level 3:** A building that uses 50% less energy than other buildings of the same type.
- **Level 4:** An existing building that uses 25% less energy than other buildings of the same type.

Buildings will be rated based on energy use intensity (EUI) or energy use (Btu) per area (square foot). The Building Challenge will recognize that buildings built for different uses use different amounts of energy. That's why the performance target system described above will compare buildings to other buildings of the same type.

Awards will be based on actual measured energy usage. Building owners will measure their energy use for one year before they are eligible for a Dane County Building Performance Challenge Award. When awards are given in the Building Climate Challenge, the County Executive will present the award at a press conference held at the owner's building and the Office of Energy & Climate Change will publicize that building on the Office of Energy & Climate Change website and include the building's location on the Office of Energy & Climate Change Dane County Clean Energy Champions map.

Government Leading by Example

Dane County government owns more than 90 buildings and has been investing in energy efficiency and renewable energy for its buildings for many years. The County government has invested more than \$16 million in more than 70 EE projects in our buildings and has installed solar panels on 15 of them. The Office of Energy & Climate Change will take stock of all the facilities and operations and help develop a strategic energy plan that includes all facilities, all operations, its fleets, all equipment and any other aspect of county business that results in energy use. Dane County already benchmarks the energy use in all its buildings, but the County will also join the U.S. Department of Energy's Better Building Challenge to help document and share its data. The BBC asks that building owners commit to a 20% reduction in energy use over 10 years and offers several free tools and programs to assist in meeting this goal. Dane County should shoot for 30% reduction. Lastly, Dane County will join the EPA Green Power Partnership, a voluntary program encouraging organizations to use green power to reduce carbon emissions and other harmful environmental impacts associated with fossil fuel use.

Dane County government and several of its cities are already leading by example, but by joining these voluntary efforts and learning best-in-class practices at the national level, Dane County government will be in a better position to help other counties and municipalities achieve associated goals. The Office of Energy & Climate Change will work with all the cities, villages and towns in Dane County and help them develop comprehensive energy plans and urge them to join the Department of Energy's Better Building Challenge.

	Site Energy [kBtu/ft ²]net				
	Existing Buildings				Existing Average
	New Construction				
	Level 1	Level 2	Level 3	Level 4	
Warehouse (non-refrigerated)	0	15	25	30	41
Residential - Single Family	0	15	25	35	48
Religious Worship	0	15	25	40	57
Multifamily (<3 stories) 5+ units	0	20	35	50	66
Multifamily (<3 stories) 2-4 units	0	20	40	60	80
Mobile Homes	0	20	40	65	86
Retail - Service	0	25	35	50	69
School - Secondary	0	25	40	60	75
Office	0	25	45	65	85
Public Assembly	0	25	45	65	86
Public Order & Safety	0	25	45	70	93
Retail - Standalone	0	25	50	70	96
School - Primary	0	25	60	75	94
Apartments (>3 stories)	0	35	60	75	94
Retail - Mall/Strip Mall	0	35	75	100	136
Hotel	0	55	80	100	125
Food Sales	0	60	110	170	221
Health Clinic	0	70	110	140	175
Hospital	0	70	120	180	232
Restaurant - Sit Down	0	275	445	555	694
Restaurant - Fast Food	0	430	680	850	1063

▲ **Fig. 9.1** Dane Building Performance Challenge Metrics. Net site energy means onsite renewable energy can offset building energy consumption in attaining the target EUIs. Net site energy can be determined by using ASHRAE 105-2014 "Standard Methods of Determining, Expressing, and Comparing Building Energy Performance and Greenhouse Gas Emissions." Renewable utility programs in Appendix 4 can also be used to achieve net zero energy.

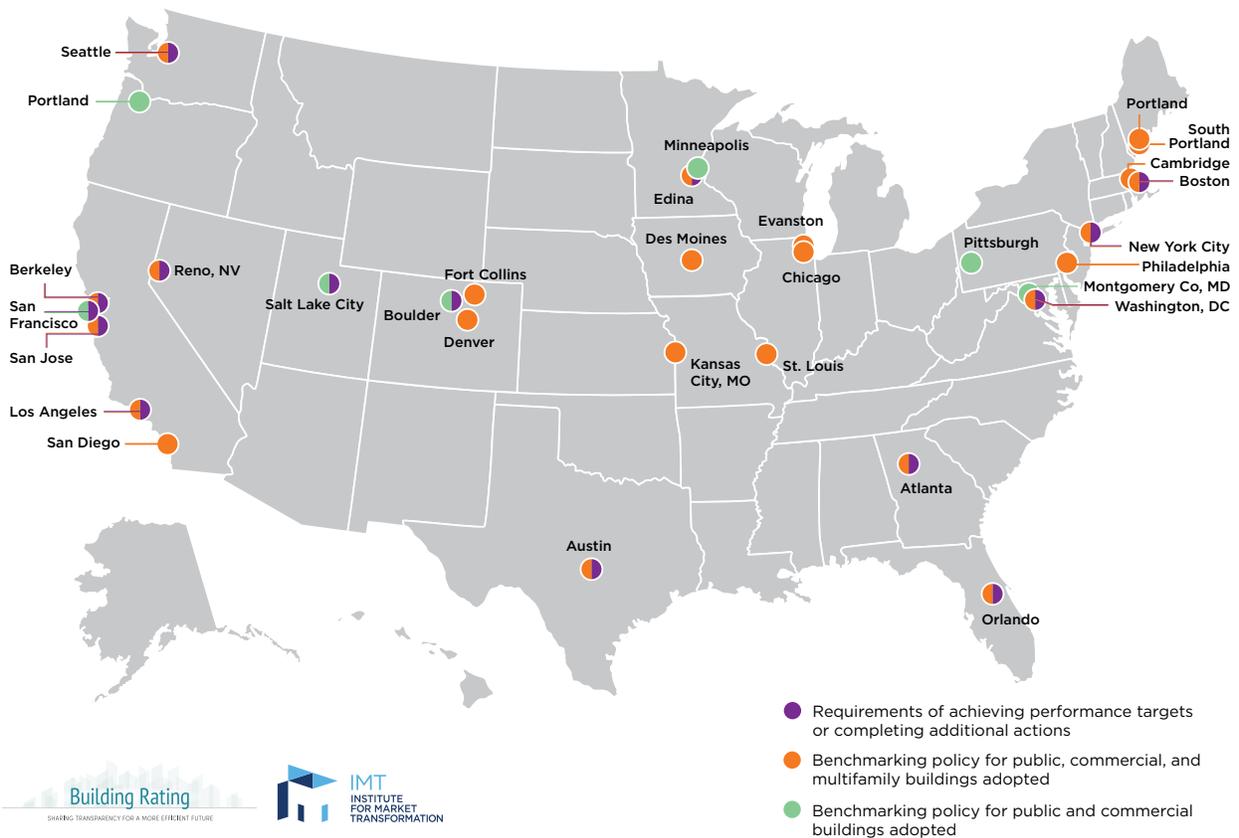
High-Energy-Use Building Assistance

The Office of Energy & Climate Change will identify buildings in Dane County that fall into high-energy-use building classes and reach out to those building owners offering technical assistance and incentives to upgrade energy systems and equipment. The Office of Energy & Climate Change will work with the building owners who choose to participate, helping them gain the economic, social, and productivity benefits of establishing, tracking, and reducing energy use through existing energy efficiency programs and grant opportunities.

Benchmarking

The Office of Energy & Climate Change will develop a voluntary benchmarking registry where building owners who choose to improve their building performance by benchmarking their building’s energy use will receive public recognition and peer support for their efforts. Participants will be able to compare their energy use (by building type) with peer buildings using local, regional, and national data sets. Building owners can then create action plans to improve their energy performance and serve as examples for others. The Office of Energy & Climate Change will establish a network for building owners who benchmark their buildings to maximize exchange of best practices related to building performance. The Office of Energy & Climate Change will work with leading building owners, local construction companies, and local building/construction consultants to establish a consensus-model benchmarking ordinance to make available to municipalities that wish to pursue a benchmarking policy.

▼ Fig. 9.2 U.S. city, county, and state policies for existing buildings: benchmarking, transparency, and beyond



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Climate Champions

Geothermal Pays Off for Edgerton Hospital

by Jim Schultz, CEO

Green was at the forefront during the planning and construction of the new Edgerton Hospital and Health Services. What really puts Edgerton Hospital on the map as a pioneer in green building is the fact that it's the first hospital in the State of Wisconsin, as well as the first critical access hospital in the United States, to be built using geothermal heating and cooling. We also included high-performance electrical, onsite construction recycling, green roofs, a healing garden, and zero volatile organic building materials.



▲ Edgerton Hospital has many clean energy technologies including a geothermal system for heating and cooling. A healing garden is shown in the foreground.

We realized hospitals are one of the major consumers of energy and must be focused on providing a cleaner and healthier environment for patients through the most efficient means. We had to really ask ourselves, "How can we reduce our carbon footprint?" We wanted to expand on incorporating high efficiency equipment, Energy Star appliances, energy efficient windows, and other technologies in an effort to provide a high performance building.

In our energy-intensive industry, using geothermal technology is just what the doctor ordered to deliver emission reductions, patient comfort, and reduced energy costs. The hospital complex features a ground-loop geothermal HVAC system that uses the relatively constant temperature of the earth to provide heating and air conditioning. The earth stores nearly 50% of all solar energy, making it a natural source of heat. Using heat pumps, this natural and renewable resource is transformed into usable energy in our hospital. In the winter, these pumps move the heat from the earth into the hospital. In the summer, they pull the heat from the hospital and discharge it into the ground.

Not only are our efforts paying off for the environment and helping to lessen the adverse health effects caused by climate change, they're also helping our pocketbook! Within five years of the hospital opening, the cost savings from reduced natural gas consumption has paid for the approximately \$850,000 geothermal system. And, the hospital saves nearly \$15,000/month in energy costs.

The use of geothermal fit well within Edgerton Hospital's 'healthy village' concept to set a new standard in healthcare with state-of-the-art technologies, sustainable building materials and systems, and exceptional patient care while promoting community health and wellness. ☀

Green Infrastructure for Climate-Resilient Cities

The world is facing an increasing population and an unprecedented urbanization, while the consequences of global warming are becoming clear with increasing events of extreme weather. Since 1950, heavy downpour events have become more common in many regions of the world, including the U.S. where the Midwest and Northeast have been most affected. Dane County experienced this firsthand in August of 2018. Similar weather patterns are being observed in the Nordic countries, where stormwater management has become paramount in designing a climate-resilient, sustainable city. While densifying cities has proved efficient in reducing carbon emissions, it often leads to a loss of green areas. This is something many of the Nordic cities are trying to address by promoting green infrastructure to combat flooding while greening the urban space. Green infrastructure is an approach to water management that reduces and treats rainwater at its source while providing many community benefits. It is a financially, socially, and environmentally beneficial solution additionally proven to improve the health of the city's citizens. Examples of green infrastructure are green roofs, permeable pavement, rain gardens, and green streets and alleys.

Copenhagen, Denmark, is acknowledged as one of the leading cities in rainwater management, among other things working with New York City on becoming



- ▲ Tåsinge Plads is Copenhagen's very first climate-adapted urban space. "A green oasis in the climate resilient neighborhood." The rain parasols in the square collect rainwater and tanks beneath the metallic raindrop sculptures store rainwater from the parasols and surrounding roofs. *Photo: Copenhagen Municipal Government, Department of Climate Adaptation.*



- ▲ Augustenborg, Sweden, has the world's first botanical roof garden. Over 9,000 square meters of living roofs support a wide variety of inspirational gardens including one that features endangered plants and animals. *Photo: Scandinavian Green Roof Institute*

more climate resilient. In response to several historic storm surge events, the city designed a “cloudburst management plan” in 2012. The plan relies mostly on a green and blue system approach where stormwater is dealt with at street level through a network of parks, cloudburst boulevards, and retention zones rather than gray infrastructure where water is redirected into the city’s existing sewer and drainage system. This was the most financially beneficial solution for Copenhagen, expected to cost the city approximately \$1.3 billion.

Here are some examples of innovative green solutions to stormwater management that might be applicable to Dane County communities:

Tåsinge Plads is Copenhagen’s first climate adapted urban space. The square is meant to manage stormwater while functioning as an oasis for residents of the neighborhood. During heavy rains, the flowerbeds will fill with water and wait to drain until the storm runoff subsides. The upside-down umbrellas collect rainwater that later can be used to nourish the square’s plants. The landscaping directs the water to large underground storage tanks. This water is filtered and purified so it can later be used for water play; above the tanks are bouncy floor panels for children to jump on. The energy from their feet pumps water through the pipes below, with the water appearing at the surface running towards a rain garden. Tåsinge Plads can keep up to 7000 m² of water from running into the sewers.



- ▲ Rabalderparken in Roskilde, Denmark, is a large park with drainage canals and reservoirs that collect rainwater from adjacent areas of the city. Designed to be a skate park and BMX bike park in dry weather, the park also has fitness equipment, trampolines, running paths, and other recreational activities. *Photo: SNE Architects*

Green roofs are an efficient means of collecting rainwater in an urban setting. They are becoming increasingly common internationally and many Nordic cities are introducing legislation to ensure their popularity. In Copenhagen green roofs are required by law on all roof slopes of less than 30 degrees. Studies show that green roofs reduce annual runoff by 40-90%, create a habitat for animals and plants, reduce urban temperatures, and increase the functionality of buildings.

The Augustenborg botanical garden is 9,500 square meters (over 100,000 square feet) of greens planted on top of industrial and office buildings. This construction has functioned as a solution to minimize flooding while providing a better local climate.

Rabalderparken is a 450-meter-long drainage canal with the purpose of delaying rainwater. The canal directs rainwater into three bowl-like basins that in totality can hold 23,800 cubic meters, or more than six million gallons of water, which is more than nine Olympic swimming pools.

The destination of the water is a small lake, normally one meter deep, with potential for expanding. The area functions daily as a skate park and popular recreational area. At the largest basin, there is a surface allowing the area

to be used for concerts or similar events. Along the canal are other play and seating areas, making the park attractive to non-skaters as well. The park is only designed to handle extreme rainfall events and is therefore expected to fill approximately once every 10 years.

The Office of Energy & Climate Change will look to neighboring municipalities and others across the country that have been making major investments in green infrastructure for many years and document best practices and the most relatable case studies in a white paper. We will then use that white paper to conduct outreach and solicit input from Dane County businesses that develop and construct green infrastructure and others that might consider investing in green infrastructure on their property. The next step will be to integrate green infrastructure into existing Office of Energy & Climate Change programs or create a new program specifically to encourage, incentivize, and support investments in green infrastructure.

Transportation & Land Use

The transportation sector is responsible for approximately 30% of all the carbon emissions released in Dane County. Nationally, the transportation sector surpassed the electricity sector as the largest carbon emitter in 2016, primarily due to decreasing carbon intensity in the electric sector as coal generation was replaced by natural gas, wind, and solar generation. Dane County has consistently been the largest population growth engine in the state of Wisconsin and shows no sign of slowing down. Therefore, a dual strategy of planning land use and transportation systems to reduce driving, while transitioning our transportation sector away from petroleum-based fuels to electric vehicles and renewable compressed gas is essential.



▲ Dane County has allocated \$305,000 in its 2020 budget to install 15 electric vehicle charging stations at a variety of locations.

Transportation systems impact equity in Dane County communities in a variety of ways. Air pollution from fossil-fueled vehicles disproportionately impacts communities of color as well as low-income communities. A lack of transportation options creates a barrier to healthy and affordable goods and services, and economic opportunities. Creating access to clean, affordable, reliable transportation is critical to addressing inequity in Dane County.

According to the Union of Concerned Scientists, diesel-powered vehicles and equipment account for more than two-thirds of all particulate matter air pollution from transportation sources in the U.S. Equitable and just transportation in Dane County requires and means a lot of things including getting diesel trucks off Dane County roads, affordable access to electric cars, zero-emission accessible transit, zero-emission commercial goods and services transport, and access to safe and beautiful bike trails and other active transportation opportunities.

“The transportation sector is responsible for providing accessibility to basic human needs. Therefore, transportation planning must ensure affordable transportation that provides for community members’ mobility and access to daily activities and services, including jobs, education, health care, affordable housing, and social networks.”

-Equitable & Just National Climate Platform

Recommendations

Electrifying Transportation

Electrifying the transportation sector is a key strategy for achieving deep decarbonization. As of 2017, 0.1% of all vehicles registered in Dane were EVs. EVs made up just .67% of light-duty vehicle sales in Wisconsin in 2017. As of August 2018, the three states with the highest EV market shares were California, Oregon, and Washington, with 9.96, 4.12, and 3.54% respectively.

Even though more than half of the electric generation in Wisconsin today is from coal (55%), the average EV purchased in Wisconsin today emits approximately 40% less carbon dioxide emissions than the average gasoline-fueled car. The Union of Concerned Scientists maintains a simple tool on their website at evtool.ucsusa.org that allows you to compare carbon dioxide emissions from a

Climate Champions

Zerology, Aiming for Zero Emissions

Zerology is a start-up company that envisions Dane County with fewer cars and greater clean transportation possibilities. Founder and CEO, Shree Kalluri, sees a future where it's affordable for anyone in Dane County to use a shared electric vehicle for day trips or to run errands. Zerology's mission is to reduce the need for individual vehicle ownership by providing unparalleled transportation options with zero emissions.

The Zerology suite of products and technology contributes to a smart and shared mobility ecosystem for Dane County.

- Ridesharing creates affordable and convenient options for Dane County residents to use EVs. Zerology recently converted the entire Green Cab of Madison fleet to all-new Tesla Model 3, zero-emission vehicles. In the future, Shree envisions an expanded network of zero-emissions rideshare vehicles as Zerology explores partnerships with other taxi companies in Madison.
- Zerology is piloting a new car sharing program, ZeroCar, in early 2020. Using Zerology's mobile application, members can register, reserve a car, unlock, and go. Zero-emissions vehicles will be available at four area apartment buildings during the pilot. As this network expands to residential and commercial locations throughout Dane County, more people will be able to use zero emissions vehicles.
- Zerology is planning to introduce micro-transit community and corporate shuttle options which will provide more flexibility for eco-friendly travel. These electric shuttles will expand current commuter options with zero-emissions vehicles that will enable easy access to workplaces in city centers or surrounding areas, helping to grow Dane County's workforce and contribute to economic development.
- Beyond moving people, soon Zerology will offer EVs to overhaul how commercial goods and services are delivered in Dane County. Switching from diesel fuel to EVs to deliver packages will reduce air and noise pollution and improve air quality in the area. Fewer diesel emissions will contribute to better health outcomes, including fewer asthma attacks.



▲ Zerology founder and CEO Shree Kalluri is transforming the cab industry in Dane County. He purchased two companies, Green Cab and Badger Cab, and converted both fleets to electric vehicles.
Photo: Zerology

With fewer cars, cleaner vehicles, and better transportation systems, the future is more sustainable. Kalluri visualizes a future with more parks and fewer parking lots as part of a Dane County transportation sector that saves money, saves time, and helps save the planet. ☀

wide variety of EVs on the market today with an average gasoline-fueled vehicle in your location.

To get on a path to deep decarbonization, Dane County as a whole needs to accelerate EV sales very quickly, while making an equally expedient shift to renewable electric generation. The Climate Council is recommending a wide variety of programs and policies to promote and encourage electric vehicles.

Specific Actions

Municipal Transportation Electrification

1. Dane County government will work with towns, cities, and villages to replace existing gasoline vehicles with electric vehicles in their fleets as quickly as possible.
2. Dane County government will explore bulk purchasing opportunities that would bring down the cost of both EVs and EV charging infrastructure.
3. The Office of Energy & Climate Change will work with the public and private sector to prioritize electrification of shared-use vehicles: buses, bikes, taxi cabs, carpool vans, and community cars.

Improve and Expand EV Charging Infrastructure

1. Dane County government will identify strategic charging locations and install DC fast charging stations and Level 2 (slower) charging stations in all County-owned priority locations within four years.
2. The Office of Energy & Climate Change will work with utilities to create incentives to increase charging infrastructure at single-family and multifamily housing developments.
3. Dane County government will establish policies that support EV-ready affordable housing.
4. The Office of Energy & Climate Change will work with utilities and other EV stakeholders to develop EV charging hubs with multiple charging stations on key roadways in the County.

5. The Office of Energy & Climate Change will research and develop EV-ready construction requirements and incentives for multifamily dwellings and commercial buildings.

EV Education and Outreach

1. The Office of Energy & Climate Change will work with stakeholders to create a program to educate municipalities, businesses, residents, and developers on the benefits, cost savings, and incentive opportunities provided by EVs.
2. Office of Energy & Climate Change will work with Madison to build on Madison's goal of a 100% renewable and net-zero carbon bus fleet by 2030, and work with other municipalities to adopt similar goals. The Office of Energy & Climate Change will help all cities develop the infrastructure for compressed (renewable) gas vehicles.
3. The Office of Energy & Climate Change will work with utilities and other stakeholders to create a program to educate car dealership sales staff on EVs.
4. The Office of Energy & Climate Change will organize and hold EV "ride & drive" events at existing community events or at local businesses.
5. The Office of Energy & Climate Change will work with electric utilities to incorporate Dane County CAP programs and incentives in utility newsletters, bill inserts, web content, and other outlets.
6. The Office of Energy & Climate Change will partner with EV stakeholders to develop and create an EV education center where consumers can go to learn about and test drive multiple models of EVs with no sales pressure.
7. The Office of Energy & Climate Change will help incorporate EV education into school curriculums and automobile technology training programs.

Renewable Natural Gas Fueled Vehicles

Dane County recently completed construction of a \$29 million biogas processing facility to clean up the landfill gas to produce nearly pure methane and inject it into an interstate pipeline. Once in the pipeline, the gas will be sold to

compressed natural gas (CNG) fueling stations to produce 3 million gallons of clean renewable vehicle fuel annually.

Dane County has a compressed natural gas fueling facility at the County Highway garage just east of the landfill. The county has already converted more than 80 vehicles to run on compressed gas including many heavy-duty vehicles such as snowplows and dump trucks. The County Executive has stated that he wants to see all the County's fleet converted to either compressed biogas or electric vehicles.

The County recently secured a \$450,000 grant to expand the capacity of the existing CNG vehicle fueling station at the Rodefild Landfill and to extend renewable CNG or renewable natural gas (RNG) fuel lines to the station. This grant will help fund a \$900,000 bio-methane fueling station expansion. This will allow the County to continue to grow its RNG fleet. With the increased capacity, the County will also be able to sell RNG vehicle fuel to other governments and

- ▼ Dane County has converted more than 80 vehicles to renewable natural gas. Many of them are heavy duty trucks like this dump truck, that used to run on diesel fuel.



businesses with heavy-duty truck fleets. The site is in an ideal location for a fueling station, with quick access to U.S. Highway 12&18 and Interstates 90 and 94.

With the RNG processing infrastructure in place, the savings for Dane County will grow with an increasing number of customers purchasing RNG from Dane County, even as the price for the RNG goes down (as it is spread over a larger customer base). Some of the savings from the sale of RNG can be put into increased fueling capacity to serve more public and private sector fleets. There are 11,975 heavy-duty vehicles registered in Dane County. The CAP is recommending that Dane County adopt a goal of converting 60% of those vehicles that currently burn diesel fuel to RNG by 2026. It may not make sense to convert 100% of the fleet, even if that were possible, because at some point in time EVs will achieve greater GHG reductions. For the foreseeable future, however, RNG vehicles result in a greater GHG reduction.

Reducing Emissions through Reduced Driving

Transitioning to electric vehicles that run on clean energy will take time and cannot fully achieve the necessary emissions reductions. Reducing total vehicle miles traveled (VMT) will be equally important for staying on course toward deep decarbonization. That means the County should take an active role in encouraging land use patterns and travel options that let people meet all their daily needs while making fewer and shorter trips by single occupancy vehicles. In addition, reducing VMT has very significant public health benefits.

Active transportation, such as walking and biking, is an important part of reducing VMT. It's easy to find all kinds of rankings of the best cities in the U.S. for biking, and Madison is often among the top five or 10. Dane County has long been ahead in developing beautiful and safe bike trails and will work with Madison and all of the other cities, villages, and towns to make Dane County a recognized national leader.

Specific Actions

Land Conservation

The preservation of green space, natural areas, and farmland is an important aspect of sound land use and quality of life in Dane County. It will also help to limit greenhouse gas emissions. The Climate Council felt it was important to

recognize that Dane County has been a leader in land conservation for many years. Dane County currently has 12,608 acres in parks and open space (natural and wildlife areas) and another 2,775 acres in conservation easements. It is critical to continue to fund, implement, and expand upon the current (2018-2023) Dane County Parks and Open Space Plan. In particular, this CAP supports the Plan's goal to "preserve large tracts of nature and agricultural rural landscapes at urban fringe areas that will provide regional resource protection and recreation benefits."

This CAP also recommends that the next Dane County Parks and Open Space Plan include this CAP among its "Related Planning Efforts" and coordinate with the Dane County Office of Energy & Climate Change.

Urban Villages

Many cities in the U.S., including Seattle and Denver, and other cities across the globe have pursued the concept of "urban villages" as a way to shape development and land use to be more sustainable, equitable, productive, safe, and healthy. An urban village is an urban development characterized by medium to high-density housing, mixed-use zoning, effective public transit, walkability, bicycle friendliness, and exceptional public spaces that bring communities together. Urban villages include a full range of residential options, employment opportunities, and essential services, such as grocery and hardware stores, banks and restaurants, all within a half-mile wide "circle" or area, making travel on foot or by bicycle very practical and convenient.

This recommendation envisions Dane County, in collaboration with the Capitol Area Regional Planning Commission, creating a set of guidelines and templates that cities, villages, and towns can use to modify their codes and ordinances to promote urban village developments, encouraging development that reduces the number of single-occupancy vehicle trips, increases public transit use, and increases active transportation such as walking, biking, skating, or skiing. Sixty percent of new urban growth should occur as compact development by 2030 and 90% by 2050.

Active Transportation

Dane County government will continue its commitment to bicycle and pedestrian infrastructure by increasing its active transportation budget to achieve the build-out of a comprehensive bike and pedestrian network that enables



- ▲ In June of 2019, Madison became the first city in the U.S. to have a 100% electric bike share program. The fleet of BCycle electric bikes is manufactured by Trek Bikes based in Waterloo, Wisconsin.

non-motorized transportation within and between its communities. This includes its extensive network of shared-use paths, but it could also focus on improved safety and comfort for walking and biking along major County roads. This can be achieved partly through policies and programs like Complete Streets and Safe Routes to Schools, but it also requires an emphasis on bicycles and pedestrians in all road design decisions, including design standards.

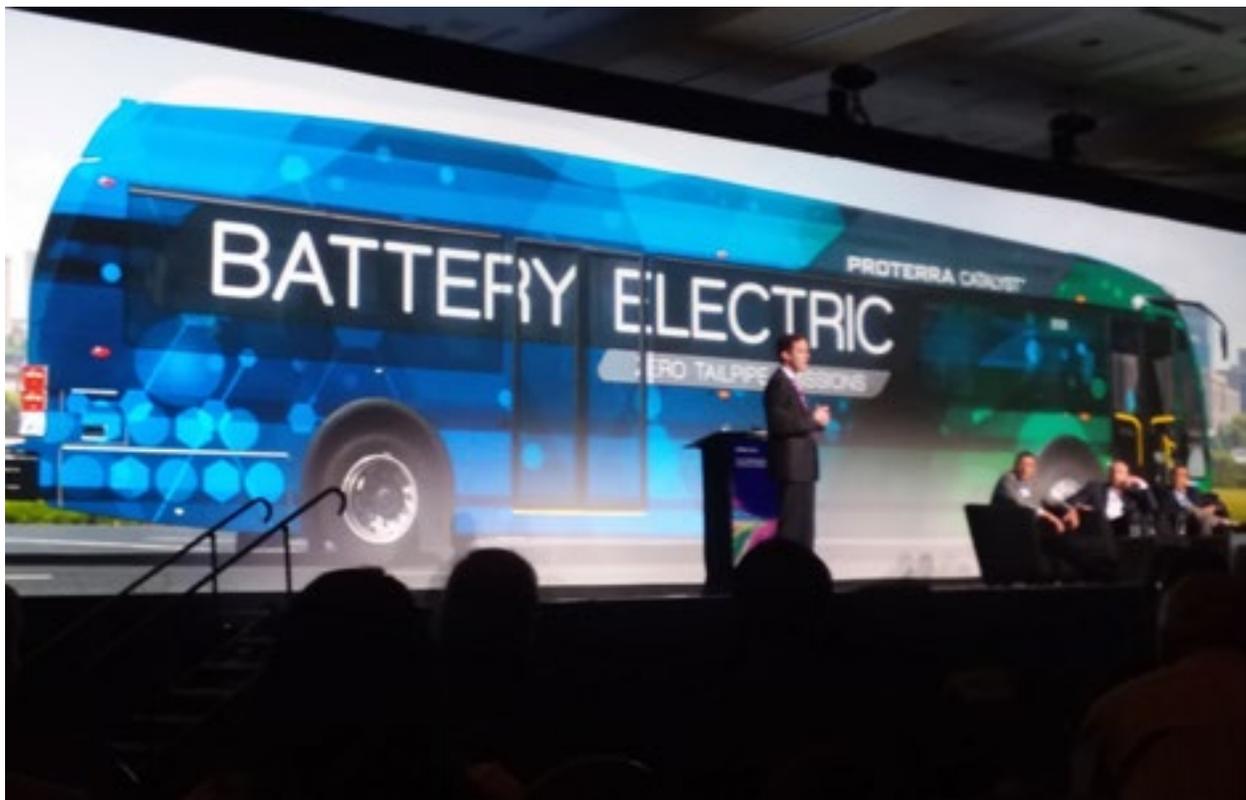
Regional Transit

A strong regional transit system provides an important foundation for reduced car travel by letting people travel reliably between towns, activity centers, and urban villages, where they can then travel by foot, bike, or other feeder services. The County can take several steps in supporting the development of this system, particularly in terms of funding. Regional transit authorities (RTAs), which let communities fund transit through mechanisms like sales taxes, have not been

allowed in Wisconsin since 2001 but the County could help facilitate a discussion among all local units of government to achieve the goals of an RTA through other structures and other sources of funding. Even without an RTA, the County, along with individual municipalities within the County, can prioritize using revenues raised through taxes and fees toward expanded transit service, improved transit facilities, and operating costs.

Verona and Sun Prairie, in coordination with Madison Metro Transit, have developed an express commuter bus service from a surrounding community to the Capitol Square. This is a critical step in linking Dane County communities with transit. Dane County can play an important role in helping other cities connect to Madison and each other with new transit routes or other transportation systems. The County can provide informational materials and talking points regarding the county-wide benefits of regional transit. It will be important to communicate that transit benefits everyone whether they use it frequently or not. For instance, it provides an option to driving in certain circumstances and potentially alleviates traffic for drivers by providing an alternative for many commuters.

- ▼ Electric buses were a topic at a national electrification conference hosted by the Electric Power Research Institute. Madison has begun to convert their bus fleet with a goal of 100% electric buses.



Project Scoring

The Office of Energy & Climate Change will work with partners in County government to establish transportation funding formulas that specifically address deep decarbonization and limit future transportation emissions. Common funding formulas that prioritize congestion relief over multimodal investments, for instance, can often lead to additional vehicle miles traveled through induced demand. This is the phenomenon where, as highways are improved, development spreads outward along rural highways and people drive longer distances. The County can continue making spot improvements to address highway bottlenecks while re-adjusting formulas to prioritize projects that are more likely to reduce overall vehicle travel demand.

Agencies like the San Francisco Bay Area Metropolitan Transportation Commission and the Virginia Department of Transportation have implemented data-driven project scoring approaches based on policy goals like reduced per capita emissions and improved access to destinations. These project scoring approaches can help direct limited transportation funds toward projects that offer the greatest benefit per dollar, including smaller multimodal projects, and move the County toward meeting its long-term emissions reductions goals.

Pricing and Incentives

Pricing mechanisms and other incentives can be put in place to shift the costs of driving and parking from hidden subsidies to more direct payment on a per-mile or per-use basis. This is critical in helping people to make more informed decisions about their day-to-day travel choices.

The County can leverage revenue streams such as vehicle registration fees and fuel taxes to reflect the full costs of road construction and maintenance, but it could also explore more direct pricing methods like tolls or mileage-based fees such as Oregon's voluntary OReGO program. Revenues from these programs should be directed toward improving transportation options, offering travel incentives, offsetting driving costs for low-income families, and benefitting underserved communities.

The County can also promote and guide the implementation of local travel demand management programs or transportation management associations and changes to local zoning codes. These programs and policies should provide incentives for non-single occupancy vehicles travel and reduce or eliminate hidden subsidies for driving and parking, including free parking for employees

at major institutions, free parking for visitors in central business districts, and minimum parking requirements in zoning codes.

The County can also encourage and implement a change in how traffic impact assessments are conducted for new developments, so that environmental impacts are measured in terms of added VMT instead of highway level of service, to promote infill development and multimodal transportation improvements. It can learn from any number of communities in California that are currently making this change in accordance with a new state law (SB 743).

Triple-benefit Transportation Systems

If fewer vehicles on our roads (reducing VMT) is an important strategy for reducing GHG emissions in Dane County, and expediting the transition to electric vehicles is an important strategy, and creating just and equitable access to affordable, clean transportation is an important strategy, then it only stands to reason that transportation systems that accomplish all three strategies should be a very high priority. We can foster creative collaboratives among diverse partners to develop such programs. Ridesharing in electric vehicles is one way. Carsharing with electric vehicles is another. Electric, zero-emission transit is another. We recommend that the Office of Energy & Climate Change work with private sector partners to establish programs that:

1. Create affordable ride sharing programs using electric vehicles that are convenient for all Dane County residents to access, including urban and rural low-income residents.
2. Create affordable electric carsharing programs at, and exclusively for, affordable housing residents.
3. Expand transit options with electric buses in vulnerable communities including electric buses to transport blue-color workers to manufacturing jobs in outlying communities.
4. Create a system for transporting commercial goods and services with electric commercial vehicles.



- ▲ This Milwaukee Public Library building has a green roof with solar panels, known as "biosolar." The green roof mitigates flooding and the plants make the air around the solar panels cooler which increases the amount of electricity the solar panels produce.

Renewable Energy Production

If Dane County hopes to do its part in addressing climate change by achieving deep reductions in carbon emissions, it must move away from dirty fossil fuel (specifically coal and natural gas) electric generation and transition to clean, renewable generation sources as quickly as possible. While Dane County's wind resource is not as robust as some of those to our west in Iowa and Minnesota, Dane County is blessed with an abundance of wind, solar, and biogas resources; and these renewable resources are very cost-effective. Many home and business owners are lowering their utility bills substantially by installing solar panels on their roofs or other property. The Office of Energy & Climate Change will facilitate a county-wide effort to pursue these seven action items:

1. Accelerate solar development – Establish and achieve a mid-term, 2030, goal of meeting one-third of county-wide electric demand/use, approximately 1,200 MW of capacity, with solar power.

2. Accelerate wind development – Establish and achieve a mid-term, 2030 goal of meeting one half of county-wide electric demand/use, approximately 700 MW of capacity, with wind power.
3. Launch a comprehensive solar education program – Establish partnerships with all County stakeholders to develop and deploy an expansive public education and awareness campaign to highlight the many benefits and affordability of solar power.
4. Municipalities leading by example – Continue to work with Dane County municipalities to develop comprehensive energy plans and develop, adopt, and achieve renewable energy goals.
5. Accelerate energy storage development – Pursue public-private partnerships and make the investments necessary to bring energy storage online in Dane County through multiple ownership and finance models with the dual goals of expanding levels of renewable resources and building resiliency for critical infrastructure and vulnerable citizens.
6. Grid modification – Work with other stakeholders to support utility efforts to modernize the electric distribution grid in Dane County.
7. Establish a geothermal work group to help accelerate investment in geothermal heat pumps for large building owners/developers, particular institutional buildings such as schools, hospitals, municipal buildings, and others.

Recommendations

Accelerate Solar Development

The Dane County Office of Energy & Climate Change should facilitate and lead efforts by all pertinent Dane County departments to collaborate with community leaders, solar developers, utilities, advocates, and Dane County home and business owners, to accelerate solar developments in the County. The County should prioritize solar projects with equity/justice benefits and conduct all the efforts in this section in a way that ensures all residents have equal opportunities to realize the benefits of solar power.

Climate Champions

Charles Hua: Organizing for Renewable Energy

In 2017, a coalition of students and staff at Madison West High School launched a campaign to install solar panels on the school's roof. This group, West Green Club, created an adopt-a-panel program in which individuals and organizations could adopt and name a solar panel with a \$500 donation. Within a year, West Green Club raised over \$140,000 under the leadership of Charles Hua, a Madison West High School graduate and Harvard College student. West Green Club received funding from countless Madison residents, foundations, businesses, and neighborhood associations. As one of the largest youth-led sustainability efforts in Wisconsin, this clean energy initiative, titled Project Solis, will provide students with hands-on learning opportunities in a growing clean energy job market, generate savings in electricity costs that will save taxpayers money, and reduce the school's carbon footprint. Project Solis received local and state-wide attention and was recognized by many organizations, including Wisconsin State Journal, Sierra Club, and Dane County.



- ▲ In 2017, Madison West High School students launched Project Solis, an “adopt-a-solar panel” program that raised \$150,000 to fund a solar array at the school. Leading the effort were members of the West Green Club, all seniors at the time, (from left to right) Charles Hua, Grace Upham, Kari Weiss, and Nyah Banik.

Since leading Project Solis, Hua, along with other students, parents, and community members, helped found and organize 100% Renew Madison, a group that advocated for the Madison Metropolitan School District to adopt a 100% renewable energy resolution in alignment with the City of Madison's sustainability goals. Months of grassroots advocacy and organizing culminated in 2,500 petition signatures collected and dozens of press hits and on April 29, 2019, Madison became the largest school district in the nation to make a commitment to using 100% renewable energy. Hua hopes to spread this momentum throughout Dane County and has already communicated with several city and school district leaders about his vision of a coordinated county-wide clean energy effort.

West Green Club and 100% Renew Madison hope their efforts will serve as a pilot program for schools looking to pursue renewable energy. The success of these initiatives, and the community support they have both demonstrated and generated, continues to motivate these groups to spearhead sustainability initiatives and promote awareness of pressing environmental challenges facing Dane County. ☀



▲ Many solar farms have rows of panels relatively close to the ground to minimize the use of steel, but in this installation the panels are significantly higher and more widely spaced. Even when panels are closer together there's sufficient sunlight to support prairie grasses and other plantings under a solar farm.

The County will promote both large (utility) scale and small-scale solar projects by:

1. Maximizing development of County building roof tops and appropriate County lands.
2. Exploring co-owned, or co-offtake, solar projects with other municipalities, non-profit organizations, and businesses.
3. Exploring a County role for administrating and/or promoting a County-wide residential group buy program or County rebate/subsidy programs.
4. Prioritizing resources and leveraging existing programs to maximize solar development on affordable housing.
5. Partnering with utilities and solar developers to support and reward solar project landowner participants in instances where participation results in

water quality, farmland preservation, ecosystem, and carbon sequestration benefits.

6. Partnering with utilities and municipalities to develop medium-sized utility-owned solar projects (e.g., the Dane County Airport).
7. Partnering with utilities and municipalities to establish community solar arrays in every city and village in Dane County.
8. Playing a pivotal leadership role in leveraging existing solar financing tools (e.g., commercial PACE) and creating new ones.
9. The purchase of renewable energy credits from strategic solar projects (e.g. project where solar is coupled with a second renewable resource or energy storage).

The Office of Energy & Climate Change will commission an assessment/study of strategic solar deployment throughout the County to determine where solar, and solar with storage, can provide significant benefits to bolstering the transmission and distribution systems, increasing resiliency and energy security/independence, become part of micro grid, power other key CAP technologies such as EV charging infrastructure, contribute to a Dane County clean energy district” (see Cross-sector Solutions), or provide other strategic equity, resiliency, economic, or social benefits.

A shortage of skilled workers is viewed by many in the Wisconsin solar industry as the single biggest barrier to accelerating the expansion of solar locally. Dane County will actively partner with other units of government, non-profit organizations, and higher education institutions to develop workforce training programs for the solar industry.

Accelerate Wind Development

Wind power has arrived. Electric generation from wind is cost competitive with fossil fuels and has been for some time. Besides achieving major carbon emission reductions, wind power creates lots of jobs, generates revenue for rural towns and farmers, and preserves farmland.

Wind power goal: meet 50% (approximately 700 MW of capacity) of Dane County’s electric energy use with wind power by 2030.

Achieving this goal will result in:

- More than \$1 billion in investments.
- More than 460 high-paying jobs.
- More than \$2 million annually in payments to farmers.
- More than \$2.5 million annually in payments to local governments.
- Preservation of farmland

The Office of Energy & Climate Change will work with utilities, municipalities, and wind developers to develop new community wind and utility-scale wind projects in and near Dane County to reach this goal.

Launch Comprehensive Solar Education Effort

Dane County, in partnership with solar developers, utilities, solar consultants, clean energy advocates, other Dane County municipalities, Wisconsin Energy Institute, UW Extension, and other organizations and associations with existing educational programs that relate to energy, will develop, test, and launch a solar education and outreach effort to key audiences. The campaign will have the objective of increasing business and individual (homeowner and renter) investment in cost-effective solar photovoltaic systems including:

- Customer sited roof-top and ground-mounted solar arrays.
- Community solar gardens.
- Renewable contracts (e.g. MGE renewable energy rider).
- Utility-scale solar.

The solar education and awareness campaign will target specific audiences, address the biggest barriers (such as up-front costs), describe the many solar benefits, and employ more than a dozen specific communication strategies including:

- Strong and steady social media messaging.
- Outreach materials describing leading finance tools (including PACE).
- A speakers' bureau of trusted messengers.
- Direct targeting of market segments with tailored and tested messages.
- Presentation of high-profile solar success stories and case studies.

Municipalities Leading by Example

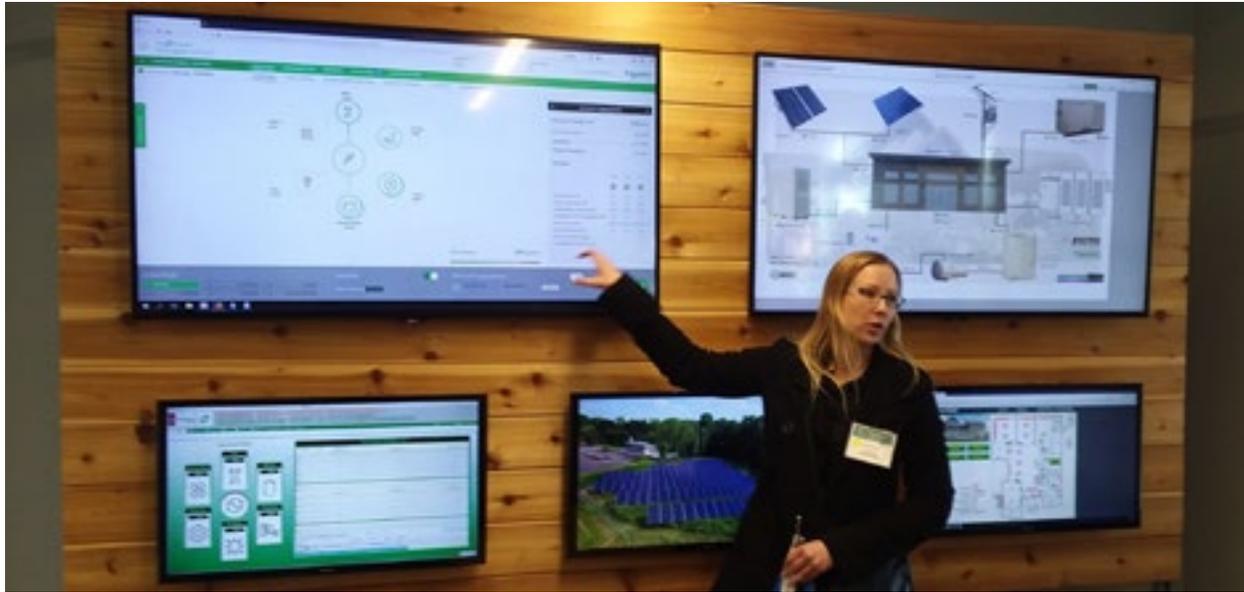
The 61 cities, villages, and towns within Dane County are key players in the effort to reach deep decarbonization. Eleven of those municipalities, and those who live and work in them, make up 91% of the electricity use in the County.

Specific Actions

1. The Office of Energy & Climate Change will work with the municipalities to establish programs and procedures for benchmarking, tracking, and evaluating energy use in their government facilities and operations, as well as the GHG emissions.
2. The Office of Energy & Climate Change will work with municipalities to adopt clean energy goals and develop comprehensive clean energy plans to meet those goals.
3. The Office of Energy & Climate Change will continue to facilitate a municipal clean energy work group and will support their efforts to implement comprehensive clean energy plans. The Office of Energy & Climate Change will support municipalities by helping to identify clean energy project grant opportunities and write successful grant proposals; work with utilities and other stakeholders to identify and pursue clean energy project opportunities; ensure equitable access to clean energy for low and moderate income neighborhoods; identify and coordinate opportunities for group buys of renewable energy, energy efficiency products, energy storage, and other clean energy strategies and technologies. The Office of Energy & Climate Change will also help municipalities establish clean energy districts (see the Cross-sector Solutions Section).

Energy Storage

Electric energy storage will have to play a major role if we hope to generate all, or even close to 100%, of our electricity from renewable, zero-carbon resources. Energy storage also holds promise to greatly increase resiliency within our communities by keeping power flowing to critical facilities and vulnerable facilities when transmission or distribution grids are down. While there are a variety of technically feasible energy storage technologies available, batteries are the most cost-effective technology with diverse applications. In Wisconsin, electric energy



- ▲ The Gordon Bubolz Nature Preserve teamed up with Faith Technologies and Schneider Electric who together developed and installed multiple clean energy components to create one of Wisconsin's first microgrids. Here Caramy Biederman, a Faith Technologies electrical engineer, leads a tour in the microgrid control room where various components including solar panels, battery storage, a fuel cell, and a microturbine are monitored. You can see the output and usage of each component on this real-time dashboard: bubolzpreserve.org/bubolz-microgrid-data-dashboard

storage is not cost-effective today in most instances if we are only looking at the storage function to supply electricity. However, prices for storage are coming down very steadily, and storage has many potential value streams. As policies are adopted that reward these value streams, storage will become cost effective. Such values include:

- Provision of capacity.
- Energy arbitrage.
- Peak load shaving.
- Demand reduction.
- Voltage control.
- Frequency regulation.
- Spinning reserve.
- Renewable resource firming.
- Power quality.
- Transmission upgrade deferral.
- Distribution upgrade deferral.
- Increased reliability.
- Increased resilience.

The Climate Council urges the Office of Energy & Climate Change to pursue energy storage projects to realize some of these benefits and gain experience with energy storage. To that end, the Council has identified five different potential energy storage project structures:

1. Utility-scale, utility-owned storage on the distribution system.
2. Co-owned (by utility and business or government customer) utility-scale storage sited on customer premises. Operations could also be shared responsibility.
3. Storage for a microgrids for critical Dane County infrastructure.
4. Behind-the-meter storage for commercial or industrial businesses.
5. Behind-the-meter residential storage.

Specific Actions

1. Dane County will partner with utilities and businesses and invest in storage projects that will provide valuable experience. The County should prioritize projects where clean energy storage is coupled with renewable generation and increases equity and resilience.
2. The Office of Energy & Climate Change will engage with the Midcontinent Independent System Operator to support the development of strong rules under Federal Energy Regulatory Commission order 841 for development of strong energy storage markets that maximize opportunities for Dane County utilities and their customers to take advantage of energy storage.
3. The Office of Energy & Climate Change will conduct, or contract for, a comprehensive energy storage potential study focused on storage coupled with new or existing renewable generation. The study should look at costs and benefits, including emission reductions, equity, resiliency, and grid support. The study should identify potential sites that maximize these storage benefits. Feasibility studies on specific projects at specific project sites should be considered depending on the results of the potential study.

4. The Office of Energy & Climate Change will add storage to the list of potential projects and technologies to consider for group purchasing with other municipalities.
5. The Office of Energy & Climate Change will lead a collaborative effort to develop an energy storage action plan, potentially like the one written by the Iowa Energy Office in May 2019.

Grid Modernization

Our existing transmission and distribution grids were developed to accommodate a power system model of relatively few large central generation stations (power plants) and not a lot of thought to the demand side of the supply and demand equation. To achieve deep decarbonization, our grid will need to get much smarter and by this we mean it must accommodate a larger number of more dispersed clean energy generation sources. It will also need to increase use of digital communication, controls technology, and advanced metering to optimize grid operations and resources, increase security, integrate smart appliances and consumer devices, and incorporate demand response, demand-side resources, and energy efficiency resources, among other things.

Our utilities recognize this need to modernize the grid and are taking a variety of steps to do so. However, in Wisconsin, government lags in supporting them in that effort. The Clean Energy Technology Center in North Carolina tracks and reports on grid modernization efforts in all 50 states. The “50 States of Grid Modernization” reports showed that Wisconsin was one of only 13 states that took no actions toward grid modernization in 2017, and one of 14 states that took two or fewer actions in 2018, compared to Michigan and Minnesota that took 10 or more actions in 2018. “Actions” included deployment, policy adoption, investments, studies and investigations, and planning. The GRIDWISE Alliance is a national coalition of power sector stakeholders that includes electric utilities, industry suppliers and service providers that also tracks and ranks grid modernization activities. Their 2018 Annual Grid Modernization Index ranks Wisconsin 39th among the 50 states in grid modernization leadership. Illinois ranks second, Minnesota 10th and Michigan 11th.

While state resources, investments and policies are obviously extremely important to massive infrastructure-transition undertakings such as electric grid modernization, this CAP urges the Office of Energy & Climate Change to work with other government entities, other power sector businesses, and nonprofit groups to take a leadership role in doing all it can to support utility efforts to

modernize the distribution grid within Dane County to transition to a more efficient and effective power sector. This becomes increasingly important as we pursue electrifying the other sectors of the economy such as transportation. There is much less that Dane County can do to improve the transmission grid, for obvious reasons, but most importantly it can support the strategic and environmentally sound buildout of the transmission grid to accommodate more clean renewable generation.

Geothermal Heat Pumps

The Deep Decarbonization Pathways Project tells us, and our modeling confirms, that electrifying heating and cooling to phase out the use of fossil fuels, is a critical strategy to meet our GHG emission reductions goals. Geothermal heat pumps, or ground-source heat pumps, transfer heat to and from the ground. An electric pump pushes a refrigerant liquid from a building through a series of looped tubes in the ground and back to the building. The soil more than 10 feet or so underground remains a constant temperature, around 50 °F at this latitude, and so the refrigerant cools down when it passes through the loops in the summer and warms up beneath the ground in the winter. The same type of technology that is used in air conditioners in homes and cars – a vapor-compression refrigeration cycle – brings the temperature from the ground temperature to where you want it on cold winter days and hot summer days. The same technology is used in air-source heat pumps. You can heat directly with electricity (such as an electric space heater), but an air-source heat pump is more efficient, and less costly. A ground-source, or geothermal heat pump, is even more efficient, because the earth (via the sun) is doing much of the work.

Geothermal heat pumps require a certain amount of land and they are more costly to install because of the amount of earth moving involved. However, geothermal heat pumps are cost effective today for larger businesses and large institutional buildings such as schools, hospitals, and large municipal buildings. EPIC in Verona, for example, has one of the largest geothermal heat pump systems in the U.S. This CAP is recommending that the Office of Energy & Climate Change establish a Geothermal Work Group to come up with a County-wide program to help large building owners finance and install geothermal heat pumps at a much faster rate than is currently happening. That same work group should also come up with recommendations that the County government and the Office of Energy & Climate Change can take to establish pilot programs for air-source heat pumps.



▲ Dane County is a dairy industry leader and a University of Wisconsin dairy research group has identified practices to significantly reduce greenhouse gas emissions from dairy farms. *Photo: Copyright David Nevala for Organic Valley*

Agriculture & Forestry

Agriculture

Dane County covers approximately 1,238 square miles or 791,978 acres of land. Agriculture, forests, pastures, and other undeveloped lands account for about 82% of the land area. Dane County is one of the top agricultural producing counties in the state.

Dane County's abundant and highly productive agriculture and forest lands hold critical opportunities for climate mitigation, particularly through carbon sequestration. At the same time, Dane County's agricultural lands are considerable sources of greenhouse gas emissions, particularly methane and nitrous oxide. Methane, as a greenhouse gas, is 25 times more potent than carbon dioxide, even though it stays in the atmosphere a fraction as long, and nitrous oxide is nearly 300 times more potent than carbon dioxide. The

Climate Champions

Yahara Pride Farms

Established in 2012, Yahara Pride Farms is a farmer-led 501c (3) non-profit organization that strives to preserve agricultural heritage while simultaneously encouraging farmers to engage in proactive environmental stewardship within the Yahara Watershed. Participating farms employ practices that result in the preservation and enhancement of soil and water resources for today, and for generations to come. In 2018, farmers in the program reduced the risk of phosphorus delivery to Madison lakes and the Yahara River by 22,000 lbs.



▲ Planes are used to plant cover crops that help keep soil in place all year. Coupled with the right management techniques, cover crops can also aid in carbon sequestration.

Research has shown that three conservation practices endorsed by Yahara Pride Farms help to reduce greenhouse gases.

- Composting directly increases soil carbon storage by creating stable carbon and reduces methane and nitrous oxide emissions, which are greenhouse gases that contribute to climate change. Compost releases nutrients to the soil over a span of seasons. When farmers consistently spread compost on their fields, they reduce the need for the application of commercial fertilizers. Farmers are not only saving on fertilizer costs, but they are also avoiding the greenhouse gases related to the production of that fertilizer. Compost is very nutrient dense and as a result, requires fewer trips across the field than traditional manure/nutrient application reducing fossil fuel use. When farmers apply liquid manure or other fertilizers before they are composted, many times the fields will require more tillage which releases greenhouse gases from the soil.
- Cover crops work to hold nutrients within the plant root zone of the soil, reducing costs and the carbon footprint associated with application of additional nutrients. In many cases, cover crops also result in reduced tillage. Cover crops work to condition the soil for next year's seed bed, reducing the amount of tillage required.
- Strip till, no-till and reduced till decrease the amount of carbon released into the atmosphere by minimizing soil disturbance and the resulting oxidation of soil carbon.

To learn more about Yahara Pride Farms, these practices, and other conservation practices promoted by the group go to yaharapridefarms.org. ☀

substantial and highly productive agricultural lands in Dane County are both a greenhouse gas source and sink. The Climate Council views this fact as a major opportunity – an opportunity to research, learn, document, and demonstrate how to keep Dane County an agriculture industry leader in the state, while at the same time making these productive lands less of a greenhouse gas source and more of a sink.

An important concept to understand before we dive into recommendations is the concept of regenerative agriculture. Regenerative agriculture is a system of farming practices that is sustainable because it regenerates (enriches) topsoil, increases biodiversity, improves water cycles, and generally increases ecosystem services. At the same time, it increases crop yields. These farming systems also increase the capture of carbon in the soil while making crops more resilient to pests, drought, flooding, and other adverse climate impacts. Terra Genesis International (terra-genesis.com) is an excellent place to learn more about regenerative agriculture. Regenerative agriculture reduces nitrogen and carbon emissions from the soil while increasing the amount of carbon that crops sequester in the soil.

A bonus is that these farming systems also increase what is often referred to as “ecosystem services.” Ecosystem services are the benefits that people receive from various ecosystems and include basic things like clean water, clean air, and food products, as well as nutrient cycling, soil formation, wildlife habitat, regulation of flooding, drought, and even cultural benefits such as recreation, and spiritual and religious benefits.

Regenerative agriculture practices include:

- No-till cropping.
- Composting.
- Perennial cropping.
- Agroforestry.
- Silvopasture.

Recommendations

1. Dane County will hire staff members with greater expertise in regenerative agriculture systems and dedicate staff to regenerative agriculture projects and practices including composting, perennial cropping, silvopasture, tree intercropping, multi-strata agroforestry, alley cropping, biochar, and others.

2. The Office of Energy & Climate Change will join the 4 per 1000 Initiative, which is an international initiative consisting of governments, foundations, research organizations, private companies, and farm and forestry organizations who are committed to improving soil carbon management, combating poverty and food insecurity, and mitigating climate change. The Office of Energy & Climate Change will establish a commitment under the 4 per 1000 Initiative on behalf of Dane County government, review the states-and-local-authorities list of action item commitments, and take action on all that make strategic sense in the context of this CAP.
3. Dane County government will aggressively market the County Continuous Cover Program to expand perennial native plantings and promote sustainable agriculture practices including continuous cover, prairie strips, and riparian buffers.
4. Dane County government will establish a schedule to convert county-owned farmland, currently leased for row cropping, to regenerative agriculture systems including multi-strata agroforestry, alley cropping, silvopasture, and others. Initially, the emphasis should be on innovation, research, and demonstration. The county will complement this effort with workshops and demonstration projects to encourage these practices on private lands.
5. The Office of Energy & Climate Change will work with the Agriculture and Forestry Work Group to commission a feasibility study to explore the potential costs, benefits, barriers, and opportunities associated with a biomass “upcycling” facility that would process more marginal biomass streams and convert these into value-added biomass products. The upcycling facility could include a regional manure composting operation, a mixed substrate composting operation, and a processing operation for biomass harvested from nutrient catch strips and agricultural land prairie strips.
6. The Climate Council encourages the Dane County Land and Water Resources Department to continue to pursue and accelerate the build-out of anaerobic digesters in the Yahara watershed, but also support, incent, and catalyze the development of anaerobic digesters in the other watersheds as well. The Council urges the County to adopt and pursue the goal of processing half of all the Dane County dairy cow manure in digesters by the year 2030.
7. The Office of Energy & Climate Change will work with other Dane County departments to develop a protocol for calculating GHG emissions from agriculture practices in the County including carbon dioxide, methane, and nitrous oxide. The County should develop a baseline for these emissions as

soon as possible and then track the emissions going forward and estimate the emission reductions resulting from all the initiatives above. The Office of Energy & Climate Change should prepare a report on the agricultural GHG emissions and share this report with all agricultural stakeholders in the County. The report should also analyze and estimate the avoided GHG emissions from digesters, composting and other agricultural practices in place today.

Forestry

Recommendations

The Office of Energy & Climate Change will work with the Dane County Land and Water Resources Department, Dane County Parks, the Dane County Tree Board, and others to implement the following five broad forestry strategies:

- Keep forests as forests.
- Create new forests through reforestation and afforestation.
- Manage existing forests.
- Protect, maintain, and increase urban forests.
- Increase the use of forest products.

Specific Actions

Keep forests as forests

1. The Office of Energy & Climate Change will work with the Ag/Forestry/Food Work Group and the Dane County Tree Board, to conduct an assessment of the existing forest cover in Dane County using the U.S. Forest Service i-Tree Landscape, the National Land Cover Database, and the National Agriculture Imagery Program to establish a tree canopy baseline for the County. The Office of Energy & Climate Change will use i-Tree, the Forest Inventory and Analysis program, or a similar tool, to track the carbon storage and ecosystem services of trees in Dane County and include this data in the CAP evaluation reports.
2. Dane County will encourage land use planning that maintains existing forest canopy (e.g. conservation subdivisions).

3. The Office of Energy & Climate Change will work with the Land and Water Resources Department to identify key parcels of forest land for acquisition to maximize continuous forest ecosystems.

Afforestation

1. Dane County will support and take full advantage of existing federal and state programs that promote afforestation with seed or planted stock.
2. Dane County will create county-level incentives for private sector investment in afforestation. We will track and measure the additions to the forest canopy on a three-year schedule.
3. The Office of Energy & Climate Change will support County applications to the U.S. Department of Agriculture Natural Resource Conservation Service, and other sources, for funds to establish a new grant program for municipalities to plant and inventory urban forests.
4. The Office of Energy & Climate Change will work with community organizations to prioritize and support tree planting programs.

- ▼ Remnant oak savannas are well adapted to Dane County, featuring the white, red and bur oak species. These oak-dominated forests, which are common in Dane County, represent an excellent opportunity for landowners to sequester carbon, mitigating both the effects of climate change and adapting to new climate conditions. *Photo: Wisconsin Department of Natural Resources*



Manage existing forests

1. The Office of Energy & Climate Change will work with the Land and Water Resources Department to encourage the integration of carbon sequestration management practices into public forest lands. The Office of Energy & Climate Change will also investigate working with other government agencies including Department of Natural Resources and private groups and foundations to hold a conference on managing forests for maximum carbon sequestration.
2. The Office of Energy & Climate Change will work with the Land and Water Resources Department to encourage private landowners to participate in state and/or federal forest management programs.

Protect and expand urban forests

1. The Office of Energy & Climate Change will use existing urban forestry inventories to create an urban forest baseline and to quantify the contribution the urban forests made to the total Dane County tree canopy. We will also estimate the current level of carbon sequestration from urban forests in Dane County.
2. The Office of Energy & Climate Change will work with cities and villages in Dane County to increase public investments in restoring, maintaining, and expanding urban forests, particularly to address insect and disease impacts.

Increase the use of forest products

1. The Office of Energy & Climate Change will integrate information on carbon sequestration in wood used in building construction into the advanced building guidelines discussed earlier in this action plan.
2. The Office of Energy & Climate Change will launch an education and awareness campaign on the carbon that can be sequestered in wood products.
3. The Office of Energy & Climate Change will conduct, or commission, an analysis on cradle-to-grave use of various materials from a GHG standpoint.



- ▲ Local citizens display their pledges to protect ground water and our environment. Madison Metropolitan Sewerage District is leading this pledge campaign.

Water Energy Nexus

No other single feature helps to define Dane County quite like water. The Yahara chain of lakes is iconic and brings incredible value to the County's economy. Lake Mendota is one of the most studied lakes in the world and the City of Madison is one of only two U.S. cities that is built on an isthmus.

Managing water is critical to both mitigating and adapting to climate change. Much of the GHG emissions related to water are related to the energy it takes to move water. Moving water around the County, from deep underground to your kitchen sink faucet, or from a toilet to the wastewater sewerage plant, uses a tremendous amount of energy. There are 28 water utilities in Dane County that use about 32 million kWh of electricity a year.

Dane County Government will need to continue to collaborate with all of the sewage districts and water supply utilities across the county to maximize water efficiency and energy efficiency, and encourage the use of renewable energy to reduce GHG emissions associated with moving water through Dane County.

Recommendations

1. The Office of Energy & Climate Change will support efforts of the Madison Water Utility to develop and implement a residential water efficiency and rainwater capture incentive program. By replacing older fixtures and appliances with EPA Watersense-labeled products, and by capturing rainwater for non-drinking water uses, the water utility will aim for a goal of reducing residential water use by 20% by 2030.
2. The Office of Energy & Climate Change will work with the Water Work Group to develop best energy efficiency practices and identify the most efficient appliances and equipment for major Dane County commercial sectors and building types. The Office of Energy & Climate Change will, in turn, also work with the Water Work Group to integrate these water efficiency practices and equipment into the Dane County energy efficiency program (see Energy Efficiency).
3. The Office of Energy & Climate Change will work with the Water Work Group and the Madison Water Utility to identify and analyze water efficiency and rainwater capture policies and promote those policies with Dane County municipalities.
4. The Madison Metropolitan Sewerage District will complete an energy master plan and implement key improvements to significantly reduce its energy demand and dependency. Energy reduction and generation projects could include water treatment process efficiencies such as demand-based nutrient removal, improving onsite co-generation, developing a co-digestion program, and constructing renewable energy facilities for treatment plant energy demand needs.
5. The Office of Energy & Climate Change will work with the Water Work Group to analyze the Net Blue model ordinance for water-neutral community growth. Net Blue is a collaborative initiative of the Alliance for Water Efficiency, the Environmental Law Institute, and River Network to support sustainable community growth. The Office of Energy & Climate Change and the Water Work Group will develop a plan for the most impactful application of that ordinance, or another comprehensive water efficiency ordinance, and the Office of Energy & Climate Change will work with Dane County municipalities to adopt the ordinance.



- ▲ Madison Metropolitan Sewerage District's Pollution Prevention Specialist, Emily Jones, demonstrates how easy it is to use MedDrop bins to properly dispose of unused pharmaceuticals. See safercommunity.net/meddrop/locations for MedDrop locations.

Waste Materials & the Circular Economy

Waste Collection & Disposal

Waste collection and disposal activities contribute significantly to GHG emissions and associated climate impacts. The Environmental Protection Agency states that municipal solid waste landfills are the third-largest source of human-related methane emissions in the U.S., accounting for approximately 14.1% of these emissions in 2017. But what was once a potential liability can become an important community asset. This can be accomplished by transitioning from traditional waste disposal programs to responsible resource management systems in a circular economy.

On average, every person in Wisconsin generates over 1,700 pounds of waste each year. Every year, 250,000 tons of garbage are landfilled in the Dane County-owned-and-operated Rodefild Landfill. All that garbage is not waste, it is simply wasted resources.



- ▲ Bikes brought to the Dane County landfill to be discarded are fixed and free for the taking. The County gives many to local non-profit organizations that fix them and get them to children that would not otherwise have a bike. The tires are recycled into products or infrastructure, such as playground surfaces.

Recommendations

The Office of Energy & Climate Change will work with the Dane County Department of Waste & Renewables to implement the following waste strategies:

1. Creation of a comprehensive sustainable materials management policy. The policy should include:
 - Adoption of goals for waste diversion through reuse, repurposing, and recycling, including a prioritization list for new programs to divert additional waste materials from the landfill in ways that are economically and environmentally sustainable. Food waste should be one of the next waste materials on the landfill diversion prioritization list.
 - Procurement rules for products manufactured and brought to market based on GHG lifecycle analysis.
 - Environmental standards for waste collection vehicles, with an emphasis on RNG and EV vehicles.

- Programs and policies to encourage development of local businesses that use waste resources as their product feedstock. This should include the consideration of a sustainable materials business park, similar to the Phoenix Resource Innovation Campus (bit.ly/PhReInCa) or the Kent County Sustainable Business Park (reimaginetrash.org/sbp).
 - Education and engagement programs.
2. Creation of a departmental, long-range, solid waste plan. The plan should account for future waste types and volumes, as well as current and future community needs for waste diversion and disposal facilities and programs. This plan should also consider the best use of the land controlled by the Department of Waste & Renewables, both during operations and after final landfill closure. Emphasis should be placed on using portions of the land for solar and biogas renewable energy systems, conservancy, light recreational use, reforestation, and prairie restoration.
 3. Adoption of steps to actively reduce the GHG emissions associated with waste disposal and management activities.
 - Install landfill gas collection wells sooner and optimize landfill gas collection systems to minimize amount of fugitive emissions. This will help reduce GHG emissions, increase RNG renewable fuel production, increase revenue, and reduce landfill odors.
 - Continue to pursue carbon capture from the remaining emissions at the RNG plant.
 - Implement fuel efficiency programs and convert landfill equipment to RNG as technology becomes available. Encourage the conversion of our landfill customer garbage truck fleets to renewable fuel vehicles.
 - Install solar PV projects to meet the high energy demands associated with managing large volumes of waste and biogas.
 4. Work with the Emergency Management Department to update the County's Disaster Debris Management Plan.

Food Waste

According to Paul Hawken's *Drawdown: The Most Comprehensive Plan Ever Proposed to Reverse Global Warming*, reducing food waste is the third most important action that we can take to reduce GHG emissions globally. Roughly a third of all the food prepared is not eaten, this translates into 4.4 gigatons of carbon dioxide equivalent released which is approximately 8% of the total human

GHG emissions each year, according to Hawken. The Council felt it important to have a specific set of recommendations focused on food.

Recommendations

1. The Office of Energy & Climate Change should develop a model local, low-carbon farms act to promote low-carbon, regional food systems.
2. The Office of Energy & Climate Change will work with the Department of Waste & Renewables and municipalities to develop a plan for collection and diversion of food waste that includes digestion, composting, and other management tools that maximize the GHG emission reductions associated with food waste.
3. The Office of Energy & Climate Change should investigate the feasibility of a wholesale food terminal that keeps fresh food cold so that more food may flow through our region.
4. The Office of Energy & Climate Change should provide matching funds for the food projects portion of the Partners in Equity grants program.

Creating a Circular Economy

The world's population and the global economy are growing and with them so is the demand for raw materials. Our supply of crucial raw material is limited, so fully utilizing materials and products is paramount to sustainable development.

A circular economy is a model of production and consumption which is an alternative to our current linear "take-make-consume-throw" pattern. In practice, it implies reducing waste to a minimum, keeping materials in the economy for as long as possible, and retaining and fully utilizing the value of products, parts, and materials. To promote the idea of a circular economy, industrial symbiosis programs where one company's waste stream becomes another's raw material have been implemented across the world. This program brings companies together in innovative ways, identifying and enabling mutually beneficial resource exchanges.

One of the oldest and most successful examples of this is the National Industrial Symbiosis Program (NISP) in the U.K. NISP connects businesses of various sectors

Climate Champions

Building Sustainable Food Systems

Food waste is one of the biggest drivers of GHG emissions. The much-celebrated book *Drawdown; The Most Comprehensive Plan Ever Proposed to Reverse Global Warming* ranks reducing food waste as the third most impactful action that can be taken globally to reverse global warming. The authors suggest that 70.53 gigatons of carbon dioxide can be reduced by mid-century with a concerted effort to reduce food waste. Data shows that up to 35 percent of food in high-income economies is discarded, whereas in low-income economies, very little food is wasted at the household level.

Here in Dane County there are several groups that are doing great work to reduce food waste. One is the Badger Prairie Needs Network in Verona. Badger Prairie runs a food recovery program, a kitchen-to-table program, a food pantry, community meals, nutrition classes, cooking classes, and more.

The food recovery program collects perishable and non-perishable food from large institutional and business cafeterias, including Epic, CUNA Mutual, UW Hospital, Festival Foods, and Pick-n-Save. Badger Prairie enables the redistribution of tons of quality food from these sources to many other food pantries and community outlets in Dane County. In all, Badger Prairie keeps more than 50 tons of good food out of the landfill and delivers it to people across Dane County who need it.



▲ The Saturday community meal at Badger Prairie Needs Network brings the community together for a nutritious hot lunch, socializing, and often a hearty laugh.

Another important organization building sustainable food systems is REAP Food Group. REAP is a non-profit that has established several sustainable food programs including the Farm to School and Farm to Business programs. Fresh produce is delivered from cooperative farms in western and central Wisconsin to kitchens at Madison College where food is processed in their culinary arts school and then distributed to schools and institutions in Dane County. Sourcing food from Wisconsin farms not only ensures that it is fresh and healthy, but the hyper-local supply chain results in significant GHG emission reductions by decreasing transportation.

These are just two of many ongoing efforts to reduce food waste and reduce GHG emissions from food systems in Dane County, but they are two incredibly important efforts. ☀

and sizes and identifies potential uses for unwanted materials. The program seeks to reduce waste and emissions and produce economic benefits through reduced disposal costs and new commercial opportunities. Since its launch in 2005, NISP has affected Britain's economy and environmental performance significantly, among other things reducing CO₂ emissions by 42 million tons and creating additional sales worth one billion British pounds (see Fig. 9.3). Similar programs of industrial symbiosis have been implemented across the world with visible, positive results as well (see Fig. 9.4 and Fig. 9.5).

While most industrialized nations in the world have robust industrial symbiosis programs, the U.S. has no such nationwide program. It turns out that southeast Wisconsin, with its strong and diverse manufacturing base, is one of the best places in the nation to incubate such a program. The Office of Energy & Climate Change will reach out and partner with like-minded governments along the southern Lake Michigan shore, such as Milwaukee and Racine to work together to get a pilot industrial symbiosis project off the ground there. If that pilot takes off Dane County businesses will be able to help grow the program faster. The more businesses that participate the more waste-to-resource matches will be made.

Finance Solutions

Most of the projects, programs, and clean energy goals in this climate action plan will require up-front funding, even if they will eventually save money for the owners or participants. There are a wide variety of different clean energy and climate finance tools used across the country. One of these financial tools is well-developed and already available in Dane County – Property Assessed Clean Energy (PACE). PACE can be used for commercial buildings and multifamily housing of more than four-units, and since the enabling laws are in place it will make sense for the Office of Energy & Climate Change to initially prioritize working with the PACE program to finance clean energy projects.

Working with Dane County and Wisconsin energy service provider companies on performance contracting can provide funding for large institutional entities such as governments, health care organizations, and schools. In the medium to long-term, more sophisticated, and flexible financial organizations and tools may be required to achieve the GHG emission reduction goals in this report. Here is a brief description of some of the leading candidates.

▼ Fig. 9.3 National Industrial Symbiosis Program, NISP (Great Britain) results from 2005-2013

Metrics	In Year Benefits*	Lifetime Impact
Landfill diversion	5.9 million tons	47 million tons
CO ₂ reduction	5.3 million tons	42 million tons
Virgin material savings	7.5 million tons	60 million tons
Haz waste eliminated	225,000 kg	1.8 million tons
Water savings	9.1 million tons	73 million tons
Cost savings	125,000,000 £	1,000,000,000 £
Additional sales	125,000,000 £	1,000,000,000 £
Jobs	1,250	10,000

1.00 GBP = 1.286 USD

*independently verified.

▼ Fig. 9.4 Western Cape Industrial Symbiosis Program, WISP (South Africa) 2012-2017

Metrics	In Year Benefits*	Lifetime Impact
Landfill diversion	1040 tons	5200 tons
CO ₂ e reduction	4200 tons	21,000 tons
Cost savings	R2,700,00	R13,400,000
Additional revenue	R2,280,000	1R11,400,000
Private investment	R20,800	R104,000
Jobs	7.2	36

13.84 ZAR = 1.00 USD

*independently verified.

▼ Fig. 9.5 Industrial Symbiosis in Tianjin Binhai New Area (China) 2009-2013

Metrics	In Year Benefits*	Lifetime Impact
Landfill diversion	357,500 tons	1.4 million tons
CO ₂ reduction	41,750 tons	167,000 tons
Cost savings	18,250,000 CNY	73,000,000 CNY
Additional revenue	28,000,000 CNY	112,000,000 CNY

6.76 CNY = 1.00 USD

*independently verified.

Recommendations

Loans with Credit Enhancement

Traditional consumer loans can be tied to energy efficiency, renewable energy, and water efficiency measures, and deployed through installation contractors. The credit enhancements can be offered through government entities or other sponsoring entities. Sponsoring entities offer a financial insurance product to incent private investors to offer more favorable financing terms. Additional credit enhancements to reduce interest rates can be the equalization of interest rates across credit scores and extending the loan repayment terms up to 15 years. These measures particularly support low- and moderate-income households that might otherwise not qualify due to their credit score or debt-to-income ratio. This product has been deployed across the nation in leading efficiency programs.

PACE

PACE financing is secured by property tax assessments that may be repaid through the property tax bill. Capital is available from lenders to cover up to 100% of the project cost. Eligible improvements are related to energy efficiency, water conservation, and renewable energy and storage. Loan terms can equal the economic useful life of the measures, which may be more than 20 years, and up to 30 years for solar projects. PACE financing is tied to the property, and therefore may be transferred to subsequent property owners. Currently Wisconsin has available PACE Wisconsin (pacewi.org) which is a statewide commercial PACE program (see Fig. 6). Commercial PACE (C-PACE) helps make a business case for installing clean energy improvements in qualified buildings by offering non-recourse financing that lowers the cost of capital for owners compared to competing sources (equity and mezzanine debt), is transferable to subsequent building owners, and allows landlords to share benefits and costs with building tenants.

Energy Service Companies & Performance Contracting

Energy Service Companies (ESCOs) are large commercial firms that provide a wide range of integrated technical solutions for institutions seeking to improve their energy performance. Typical ESCOs would be Johnson Controls, Siemens, Honeywell Building Solutions, and H&H Energy Services. They offer streamlined approaches, provide initial energy audits, develop comprehensive sets of recommended upgrades, engineer agreed-upon solutions, construct, implement,



- ▲ Jennifer Quimby, Mayor, City of Waterloo (left); Craig Ellsworth, Waterloo Technology Center; Paul Nikolic, Nikolic Group; and Dan Carey, McFarland State Bank pose for a photo at the Waterloo Technology Center. PACE financing provided by McFarland State Bank enabled efficiency measures that cut energy bills almost in half. McFarland State Bank is the leading PACE lender in Wisconsin.

and monitor. One hundred percent of each project can be funded, and the ESCO guarantees performance of the energy savings. This is generically referred to as “performance contracting.” The energy savings are used to pay for the upgrades in efficiency. ESCOs typically work with large commercial, government, or institutional customers when doing performance contracting.

Climate Bonds

Climate bonds are bonds issued specifically for the purpose of funding climate mitigation or climate adaptation projects or programs. Climate bonds could also be used to establish a loan loss reserve program. Like other bonds, climate bonds can be issued by governments, banks, or corporations. The Climate Bonds Standards Board, based in London, has developed a certification program for climate bonds.

Green Banks

A green bank is a dedicated public or non-profit entity, not a depository institution for the general public. There are multiple financing tools available through green banks, but the common theme is to invest public funds to leverage the access to cheap capital (based on government credit rating), and to stimulate the deployment of additional private capital. The bank invests in opportunities to overcome market barriers to clean energy adoption, models that advance clean energy in underserved markets, and companies or projects that test strategies to scale clean energy use. The Montgomery County Green Bank in Maryland is an example of a county-created green bank.

Voluntary Carbon Markets/Funds

Environmental markets and environmental credit trading are general terms referring to a range of market-like transactions where an entity undertakes an activity that provides environmental benefits in exchange for payment from another entity to meet environmental goals. A local carbon market could create credits for carbon emission reductions, carbon sequestration, climate resiliency such as flood control, water quality, ecosystem services, and many other climate-related projects. A variety of project types might generate any one of these credit types or a single project might generate multiple types of environmental credits, called credit stacking. A voluntary market can be established at any jurisdiction level, including county, state, or region.

The carbon market, or fund, needs an administrator and Dane County is very fortunate to have a non-profit organization with tremendous expertise and experience in clean energy finance and finance program administration. Slipstream is a clean energy research, policy, and implementation organization that was an architect of, and now administers, the Wisconsin PACE program. The carbon market fund and its administrative infrastructure are established financially through local government contributions, donations from businesses and individuals, and grants made by supporting foundations or other governmental agencies. Loan repayment, interest, and revenue from carbon offset sales help replenish the fund and enable its ongoing operation.

Specific Actions

The carbon market proposed here will have a strong equity focus in development and implementation of projects that create a healthy environment in which

to live, learn, and work. Dane County and Slipstream will partner with local businesses, community groups, and individual community members to identify specific attributes and project types. The Office of Energy & Climate Change and Slipstream will work with these partners to create a menu of projects that fit the specific circumstances and culture of the people here, as well as the built and natural landscapes. Some example project types might include:

- Anaerobic digester deployment.
- Afforestation.
- “Deeper” home retrofit.
- Residential heat pump technology deployment.
- Home weatherization.
- Electric vehicle and charging deployment.
- Community solar arrays in single family, multifamily, and manufactured home neighborhoods.
- Small business lighting, equipment, and envelope retrofits.
- Home electrification.

Projects can be bundled and scaled flexibly. For example, a local unit of government using this carbon fund platform and inaugural sponsoring businesses could select a multifamily solar array for an urban city block or a deeper home retrofit for all of the homes in a neighborhood, or a rural township or valley. The recommendation here is to launch this carbon fund at the Dane County regional level including Dane and contiguous counties, and expand it over time to statewide, and eventually the Midwest.

