# Appendix 1: Members of Dane County Council on Climate Change

| | |
|---|---|
| Nadeem Afghan, *BIOFerm Energy Systems* | Elizabeth Katt-Reinders, *Sierra Club* |
| Abby Attoun / Kelly Hilyard, *City of Middleton* | Andy Kellen, *WPPI Energy* |
| Lauren Azar, *Azar Law LLC* | Paul Lenhart, *Krupp General Contractors* |
| Chris Beedle / Lane Wenner, *H&H Energy Services* | Jessie Lerner / Claire Oleksiak, *Sustain Dane* |
| Mary Blanchard / Gary Radloff, *Wisconsin Energy Institute* | David Liebl, *Wisconsin Initiative on Climate Change Impacts* |
| Jim Bradley, *Home Savings Bank* | Erik Lincoln, *Ho Chunk Nation* |
| Zach Brandon, *Greater Madison Chamber of Commerce* | Ashwat Narayanan, *1000 Friends of Wisconsin* |
| Brad Bruun, *City of Monona* | Karl Niemi, *Fiskars* |
| Tom Content, *Citizens Utility Board of Wisconsin* | David Poklinkoski, *IBEW Local 2304* |
| Drake Daily, *City of Sun Prairie* | Mark Redsten, *Clean Wisconsin* |
| Jamie Derr, *Derr Farms* | Paul Robbins, *UW Nelson Institute for Environmental Studies* |
| Mary Evers-Statz, *UW Health* | Joel Schriever, *Exact Sciences* |
| Ellen Geisler, *City of Fitchburg* | Chad Sorenson, *SunPeak* |
| John Haeckel, *Clean Fuel Partners* | Wesley Sparkman, *Dane County Office of Equity & Inclusion* |
| Janel Heinrich / Doug Voegeli, *Public Health Madison and Dane County* | Wayne Strong, *Urban League of Greater Madison* |
| Jeanne Hoffman / Stacie Reece, *City of Madison* | Charles Tubbs, *Dane County Emergency Management* |
| Tyler Huebner, *RENEW Wisconsin* | Libby Tucci, *YWCA Madison* |
| Steve Jackson / Michele Pluta, *Alliant Energy* | William Walker, *Madison Metropolitan Sewerage District* |
| Jeff Jaeckels, *Madison Gas and Electric* | Gary Werner, *Capitol Region Advocacy Network for Environmental Sustainability* |

# Appendix 2: Office of Energy & Climate Change Working Groups

These Working Group members contributed to the climate action recommendations in this CAP. (Chairs in bold.)

## Agriculture, Forestry and Food

Marcia Caton-Campbell, *Center for Resilient Cities*
Fred Clark, *The Forest Stewards Guild*
**Jamie Derr, Derr Farms**
John Haeckel, *Clean Fuel Partners*
Robin Lisowski, *Slipstream*
Michelle Olson, *Alliant Energy*
Pam Porter, *UW Center for Integrated Ag Systems*
**Gary Radloff, *Wisconsin Energy Institute***
George Reistad, *City of Madison*
Caryl Terrell, *Capital Region Advocacy Network for Environmental Sustainability*
Maria Woldt, *Yahara Pride & DBA*
Darrell Zastrow, *UW-Extension*

## Buildings

Jeff Adams, *Alliant Energy*
**Marge Anderson, *Slipstream***
Jim Bradley, *Home Savings Bank*
Lee DeBaillie, *UW-Madison*
Ross DePaola, *WESTlab*
Mary Evers-Statz, *UW Health*
Jeanne Hoffman, *City of Madison*
*Joanne Kelley, Madison Gas and Electric*
Paul Lenhart, *Krupp Construction*
Mary Meunier, *Wisconsin Department of Administration - Energy Division*
Eric Truelove, *Green Building Resources LLC*

## Efficiency

Jeff Adams, *Alliant Energy*
Chris Beedle, *H & H Energy Services*
Jim Bradley, *Home Savings Bank*
**Sara Conzemius, *Illume Advising***
Tyson Cook, *Clean Wisconsin*
Sue Hanson, *TetraTech*
Joanne Kelly, Madison *Gas and Electric*
Kathy Kuntz, *Cool Choices*
Erinn Monroe, *APTIM - Focus on Energy*

## Renewable Energy

Nadeem Afghan, *BIOFerm*
Lauren Azar, *Azar Law LLC*
Sherrie Gruder, *UW-Extension*
John Haeckel, *Clean Fuel Partners*
**Tyler Huebner, *RENEW Wisconsin***
Tom Karman, *Wisconsin DNR (formerly)*
Elizabeth Katt-Reinders, *Sierra Club*
Andy Kellen, *WPPI Energy*
David Poklinkoski, *IBEW Local 2304*
Dave Sinner, *Alliant Energy*
Scott Smith, *Madison Gas and Electric*
Chad Sorensen, *SunPeak*
Niels Wolter, *Madison Solar Consulting*

## Transportation and Land

Debbie Branson, *Madison Gas and Electric*
Phillip Gritzmacher, *City of Madison*
Steve Jackson, *Alliant Energy*
Chuck Kamp, *Madison Metro*
Chris McCahill, *State Smart Transportation Initiative*
**Ashwat Narayanan, *1000 Friends of Wisconsin***
Peter Rafferty, *Traffic Operations and Safety Laboratory*
William Schaefer, *Madison Area Transportation Planning Board*
Cassandra Steiner, *Sierra Club*
Steve Steinhoff, *Capital Area Regional Planning Commission*
Gary Werner, *Capital Region Advocacy Network for Environmental Sustainability*

## Water

Chuck Dunning, *WellIntel*
Greg Fries, *City of Madison*
John Haeckel, *Clean Fuel Partners*
Tom Heikkinen, *Madison Water Utility*
Ezra Meyer, *Clean Wisconsin*
Wesley Sparkman, *Dane County Office of Equity*
**William Walker, *Madison Metropolitan Sewerage District***
Emily Jones, *Madison Metropolitan Sewerage District*

### Finance

Jim Bradley, *Home Savings Bank*
Sherrie Gruder, *UW-Extension*
Paul Lenhart, *Krupp Contractors*
Robin Lisowski, *Wisconsin Energy Conservation Corp*
Nancy O'Brien, *Wisconsin Energy Conservation Corp*
Mary Schlaefer, *Wisconsin Energy Conservation Corp*
**Jason Stringer, *Wisconsin Energy Conservation Corp***
Eric Truelove, *Green Building Resources LLC*
Niels Wolter, *Madison Solar Consulting*

### Modeling

Tyson Cook / Scott Blankman, *Clean Wisconsin*
Jeff Jaeckels, *Madison Gas and Electric*
Andy Kellen, *WPPI Energy*
Michele Pluta, *Alliant Energy*
Evelyn Wright, *Sustainable Energy Economics*
Chris McCahill, *State Smart Transportation Initiate*
Jon Koliner, *Apex Analytics, LLC*

### Public Outreach

Bill Davis, *Sierra Club*
Sam Dunaiski, *RENEW Wisconsin*
Sharon Dunwoody, *UW-Madison, School of Journalism and Mass Communications*
Kathy Kuntz, *Cool Choices*
Jessica Niekrasz, *Clean Fuel Partners*
Stacie Reece, *City of Madison*

# Appendix 3: Methods Used for "Climate Change in Wisconsin: The Historical Record & Future Projections"

Historical changes for Wisconsin are estimated using the NOAA nClimDiv data set (Vose et al. 2014) which contains monthly temperature (based on daily minimum and maximum) and precipitation averages at a US Climate Division scale. Daily mean temperature is calculated as the average of the daily maximum and daily minimum. The nClimDiv data set is used by NOAA in it is monthly and annual "State of the Climate" analyses. Historical trends are calculated for each of the nine Wisconsin climate divisions over the time period 1950-2018, and the resulting trend (in units of °F per year) are multiplied by 68 years (the period of analysis) to obtain estimates of historical warming since 1950. Trends begin in 1950 due to increases in data availability at that time.

Future changes for Wisconsin are estimated from the University of Wisconsin Probabilistic Downscaling data set, version 2.0 (UWPD2.0). Downscaling refers to a process by which large-scale climatic conditions (as might be produced by a global climate model) are used to estimate local-scale conditions (as might be measured at a station). The UWPD uses statistical methods to relate large-scale climatic conditions to probability distributions of the local-scale conditions; this technique more accurately represents day-to-day climate variability as well as extreme local climate events (Kirchmeier-Young et al. 2014) than other statistical methods. The UWPD version 1 data set is described in more detail in Notaro et al. (2010), Kirchmeier et al. (2014) and Kirchmeier-Young et al. (2016). UWPD2.0 uses the same methodology as version 1 but applies the downscaling to 24 different climate models from the Coupled Model Intercomparison Project, version 5 (CMIP5); these models are the same models that contributed to the Intergovernmental Panel on Climate Change 5$^{th}$ Assessment Report (IPCC 2013).

Projections for 2050 are calculated as the 2041-2060 average minus the 1981-2010 (climate normal) average from each model. Data for the historical period 1981-2010 are taken from the historical simulations through 2005, and from the RCP8.5 scenario for 2006-2010. Future projections for the 2041-2060 time period are taken from the RCP8.5 scenario, which represents a "business as usual" global emissions scenario. By 2050, differences between the RCP8.5 and RCP4.5 (a more moderate emissions scenario) are small: for reference, the expected change in annual average temperature for Wisconsin by 2050 is 3-9 °F for the RCP8.5 scenario, and 2-8 °F for the RCP4.5 scenario. Counts of extreme events (e.g. days per year when temperature exceeds 90 ºF) are calculated using the daily probability distributions for each month of the year. When a

range of expected change is presented, that range represents the 10th to the 90th percentile of expected change, as estimated across the distribution of the 24 climate models that contribute large-scale information to the UWPD2.0 data set.

Finally, we note that while no attempt has been made to attribute the historical warming to anthropogenic climate change, the similarity between the amount and characteristics of the warming between the observed record and model simulations does suggest that the observed record has been influenced by anthropogenic climate change.

# Appendix 4: Utility Initiatives Supportive of the Dane County Climate Action Plan

| Initiative | Description | Company |
|---|---|---|
| **Focus on Energy programs - Residential and Business** | Focus on Energy empowers the people and businesses of Wisconsin to make smart energy decisions with enduring economic benefits. Learn more at focusonenergy.com. | Adams-Columbia Electric Cooperative, Alliant Energy, Black Earth Electric Utility, Madison Gas & Electric (MGE), Mazomanie Electric Utility, Mount Horeb Utilities, Stoughton Utilities, Sun Prairie Utilities, Waunakee Utilities, We Energies |
| **Clean Energy Vision** | By 2030:<br>• Renewables will be over 30% of our energy mix<br>• Carbon dioxide ($CO_2$) emissions from fossil-fueled generation will be reduced by 40%<br>• Water supply needs from fossil-fueled generation will be decreased by 75%<br>By 2050:<br>• We will eliminate all existing coal from our energy mix<br>• $C0_2$ emissions from fossil-fueled generation will be reduced by 80%<br>More information at: sustainability.alliantenergy.com/energy-climate/ | Alliant Energy |
| **Clean Energy Blueprint** | Powering What's Next initiative accelerating our transition to cleaner energy for our Wisconsin customers by expanding solar energy generation by up to 1,000 megawatts by the end of 2023. More information at: alliantenergy.com/poweringwhatsnext. | Alliant Energy |
| **Company-Owned Fleet Transition and Employee Electric Vehicle Charging** | Company fleet electrification initiative including hybrid bucket trucks; hybrid and electric fleet vehicles; electric forklifts and other equipment. Also provide on-site employee electric vehicle charging. More information at: alliantenergy.com/sustainability. | Alliant Energy |
| **Madison Solar Learning Lab** | Energy learning lab with several types of solar structures, multiple electric vehicle charging stations and an energy battery storage system. More information at: alliantsolar.epri.com/madison. | Alliant Energy |

| Initiative | Description | Company |
|---|---|---|
| **Prairie du Sac Hydro, Kilbourn Hydro and Wisconsin River Power Company** | Own and operate two hydro facilities combined 41-megawatts and also receive power from and own a 50% interest in Wisconsin River Power Company, which operates the Petenwell and Castle Rock Dams on the Wisconsin River. More information at: alliantenergy.com/OurEnergyVision/AdvancingCleanEnergy/HydroEnergy. | Alliant Energy |
| **Bent Tree Wind Farm** | 201-megawatt wind farm in operation since 2011. More information at: alliantenergy.com/OurEnergyVision/AdvancingCleanEnergy/WindGeneration. | Alliant Energy |
| **Cedar Ridge Wind Farm** | 68-megawatt wind farm in operation since 2008. More information at: alliantenergy.com/OurEnergyVision/AdvancingCleanEnergy/WindGeneration. | Alliant Energy |
| **Forward Energy Wind Farm** | Acquired 55-megawatt ownership interest as of April 2018. More information at: alliantenergy.com/OurEnergyVision/AdvancingCleanEnergy/WindGeneration. | Alliant Energy |
| **Kossuth Wind Farm** | New 150-megawatt wind farm. Planned completion in fall 2020. More information at: alliantenergy.com/OurEnergyVision/AdvancingCleanEnergy/WindGeneration. | Alliant Energy |
| **Customer Electrification** | Various programs and rebates to support electrification for industrial, commercial and residential customers. More information at: alliantenergy.com/InnovativeEnergySolutions/SmartEnergyProducts/ElectricVehicles. | Alliant Energy |
| **Business demand-response program** | Industrial and commercial business interruptible program during peak energy use times, more information at: alliantenergy.com/WaysToSave/SavingsTipsandPrograms/InterruptibleProgramBIZ. | Alliant Energy |
| **Energy Edge program** | Online digital platform for commercial and industrial customers to benchmark energy usage and set goals to improve performance by providing cost comparisons over time, weather impacts, and usage breakdowns. More information at: alliantenergy.com/More/ContentPages/EnergyEdge. | Alliant Energy |

| Initiative | Description | Company |
|---|---|---|
| **Residential customer demand response** | Residential time of day energy savings program - more information at: alliantenergy.com/WaysToSave/SavingsTipsandPrograms/NightsandWeekendsPlanWISRES. | Alliant Energy |
| **Second Nature** | Voluntary green energy program that allows residential and business customers to support renewable energy growth. More information at: alliantenergy.com/InnovativeEnergySolutions/SustainableEnergyChoices/SecondNature. | Alliant Energy |
| **Alliant Energy® Community Solar** | Alliant Energy® Community Solar provides residential and business customers the option to buy blocks of renewable energy generated from solar panels in a nearby community. Customers will receive a monthly bill credit for 20 years based on solar production. More information at: poweringwhatsnext.alliantenergy.com/my-energy-my-choice. | Alliant Energy |
| **Customer-Hosted Renewable Energy** | Alliant Energy is partnering with commercial and industrial customers to find new locations for rooftop solar and/or battery storage systems. More information at: poweringwhatsnext.alliantenergy.com/my-energy-my-choice/#renewable. | Alliant Energy |
| **Renewable Energy Partners** | Renewable Energy Partners provides customers a way to offset energy use with renewable energy for one or multiple sites. Alliant Energy builds, owns and maintains a dedicated renewable energy facility. Customers buy the energy generated at a contracted rate. More information at: poweringwhatsnext.alliantenergy.com/my-energy-my-choice/#renewable. | Alliant Energy |
| **Energy 2030 - Carbon Goal** | Reduce $CO_2$ emisisons at least 40% by 2030 from 2005 levels. Visit mge2050.com to learn more. | MGE |
| **Energy 2030 - Renewable Energy Goal** | Increase renewable energy to at least 25% by 2025 and 30% by 2030. Visit mge2050.com to learn more. | MGE |
| **Net-Zero by 2050** | Work with customers to achieve net-zero carbon electricity by 2050. Visit mge2050.com. | MGE |
| **Reduce coal-based generation** | Committed to transition away from coal. | MGE |

| Initiative | Description | Company |
|---|---|---|
| **Saratoga Wind Farm** | 66-megawatt (MW) wind farm near Saratoga, Iowa, came online February 2019. Learn about Saratoga at mge.com/Saratoga | MGE |
| **Badger Hollow/Two Creeks Solar** | 100 MW of new solar capacity from two Wisconsin-based projects approved in 2019; expected online in 2020. | MGE |
| **Badger Hollow II** | 50 MW of new solar capacity expected to be approved in 2020 and online in 2021. | MGE |
| **Shared Solar - MOC** | 500-kilowatt community solar project at Middleton Operations Center in City of Middleton is a unique way of providing residential customers locally generated solar energy. | MGE |
| **Shared Solar - Morey** | 2019-2020 expansion of Shared Solar program with new, large-scale (5-MW) solar array at Morey Field in Middleton; expansion opens program to commercial customers, in addition to residential. Visit mge.com/SharedSolar. | MGE |
| **Lyft** | Partnering with the ridesharing company Lyft to spread the use and awareness of electric vehicles. | MGE |
| **Vehicle Fleet Transition** | Fleet transition process for the monitoring of emerging technologies and the adoption of alternative fuel vehicles including EVs, hybrid bucket trucks, hybrid service vehicles and other technologies. | MGE |
| **Charge@Home Program** | Quick, convenient charging at home with no upfront cost for charger and installation of EV charger for residential customers. Visit mge.com/LovEV for EV-related programs and information, including a total cost of ownership tool called Explore My EV. | MGE |
| **Public EV Charging** | 35+ EV public charging stations around the Madison area sourced with wind energy. | MGE |
| **Multifamily EV Charging** | Facilitation of EV charging at multifamily properties. | |
| **Fleet, Workplace EV Charging** | Facilitation of fleet and workplace charging programs for customers. | |
| **Green Power Tomorrow** | Green pricing program to purchase up to 100% of energy from renewable sources. Visit mge.com/GPT. | MGE |

| Initiative | Description | Company |
|---|---|---|
| **Commerical customer demand response** | Business customers participate in pilot to curb demand during peak use. Visit mge.com/ODS. | MGE |
| **Residential customer demand response** | 2019 expansion of smart thermostat initiative known as MGE Connect to reduce peak residential demand. | MGE |
| **Renewable Energy Rider, Middleton** | Partnering with City of Middleton and Middleton-Cross Plains Area School District on solar array at Morey Field under Renewable Energy Rider, which gives MGE ability to negotiate customer-specific contracts for renewable energy projects. | MGE |
| **Renewable Energy Rider, Dane Co.** | Partnering with Dane County on up to 9-MW of solar capacity adjacent to Dane Co. Regional Airport. | MGE |
| **City of Madison/MMSD RER** | Partnering with City of Madison and Madison Metropolitan School District on 7-MW solar array under Renewable Energy Rider agreements; array expected in 2021, if approved. | MGE |
| **Madison Metro Transit EV Initiative** | Partnering with Madison Metro Transit to expand use of electric buses. | MGE |
| **Living in Balance/Viviendo en Balance** | Digital format designed and developed to engage with communities of color on energy efficiency, sustainability, green energy, and Focus on Energy. It is available in English and Spanish. | MGE |
| **GENRE 2030** | Digital format designed and developed to engage with Millennials and Gen Z on energy efficiency, sustainability, green energy, and Focus on Energy. | MGE |
| **Sustainability Design for Multifamily Development.** | Offering workshops on sustainability practices including net zero carbon for Multifamily sector. Participate in consultation for sustainable design with multifamily development. | MGE |

| Initiative | Description | Company |
|---|---|---|
| **Community Partnerships** | Partnerships with community organizations give us the opportunity to reach customers in environments that are familiar and comfortable to them. It is an effective way to engage with customers that are difficult to reach with other approaches. Some customers have difficulty accessing information due to language and cultural barriers. Our community partnerships help us bridge these barriers and provide energy, sustainability, and Focus on Energy information and resources to customers that may otherwise go without it. Information is available in English, Spanish, and Hmong. | MGE |
| **Conservation Education and Engagment** | Serve diverse residential customers through our channels of Ask the Experts (email), Home Energy Line, (telephone), MGE social media, and interactive workshops. Target customer segments include: low income customers, Older adults,Engish language learners and Hmong, Chinese, Latinx, and African American communities, and sustainability conscious congregations. Information offered in English, Spanish, and Hmong. | MGE |
| **EV 101, Kick the Tires Workshops** | MGE brings together people interested in EV's and EV owners with their vehicles. Workshop begins with overview from MGE then questions from audience to EV owners. It ends with owners opening up their vehicles for attendees to see. Workshops are held in partnership with libraries, events, and community organizations, such as, Madison Area Chinese Community Organization. | MGE |
| **Sustainability Resources in Libraries** | We provide "Watts Up" portable energy meters (PEM), tools, and books to help people control their energy costs and implement sustainability measures through partnerships with local libraries. This includes information about Home Performance with ENERGY STAR® and other Focus on Energy programs. People check out the PEMs to find out operating costs for their plug loads. The libraries issue comment postcards to the users, and the comments that we receive back are very supportive of this kind of energy efficiency equipment being available for customers to use. | MGE |

| Initiative | Description | Company |
|---|---|---|
| **Community Media Engagement** | Provide energy information and advice in community media serving communities of color and through 35 neighborhood newsletters. E.g., biweekly show Viviendo con Energia de MGE, on La Movida Radio; Capital City Hues; ConNEXTions, Cambodian digital media platform; and Northside News. | MGE |
| **Smart Thermostats in Homes of Low Income Customers** | Provide eduation and advice to low-income customers that have one of the 310 Nest-e smart thermostats installed through our partnership with Project Home. Inc and Dane County Housing Authority. | MGE |
| **Multifamily Owners/ Managers Engagement** | Provide energy information and advice to owners, managers and developers in the multifamily sector, including site visits, presentations at trade shows and business meetings, quarterly e-newsletter, targeted emails and phone calls. | MGE |
| **Simple Energy Efficiency (SEE) kits direct distribution pilot with Focus on Energy** | Partnering with schools, community organizations, energy assistance providers and Focus on Energy we offer one-to-one energy efficiency consulation, SEE kits, and applications for energy assistance and weatherization programs to customers in neighborhoods with low incomes and low participation rates in programs. | MGE |
| **Bishop Hill III Wind Energy Center** | 132 MW wind project in Illinois, came online in 2018. | WPPI Energy |
| **Point Beach Solar Energy Center** | PPA with NextEra Energy for 100 MW Wisconsin solar project, scheduled to come online in 2021. | WPPI Energy |
| **Choose Renewable Program** | Green pricing program allowing residential and commercial & industrial customers to purchase their energy from renewable sources. | WPPI Energy Dane Co Members |
| **RFP for Energy Efficiency** | Competitive bid program for commercial & industrial energy efficiency projects, used in conjunction with Focus on Energy. | WPPI Energy |
| **Renewable Energy Grants for Non-Profits RFP** | Competitive bid program for non-profits aimed at replacing the tax incentives for renewable energy that for-profit companies receive. | WPPI Energy |
| **New Construction Design Assistance Program** | Program aimed at incentivizing integrated design systems geared toward overall new building efficiency improvements vs. spec designs. | WPPI Energy |

| Initiative | Description | Company |
|---|---|---|
| **Energy Management for Schools Program** | Program to work with school districts to energy benchmark all their schools in Energy Star's Portfolio Manager, provide incentives and assistance in auditing, strategic energy planning and working with school board to set goals. | WPPI Energy |
| **Utility and Municipal Building Energy Efficiency Program** | Program to provide incentives for energy efficiency improvements and commissionoing services for utility and municipal-owned facilities. | WPPI Energy |
| **Member Energy Efficiency and Renewable Energy Loan Program** | Provides interest-free loans to member utilities for qualified energy efficiency and renewable energy projects. | WPPI Energy |

# Appendix 5: Thanks to Contributors

This Climate Action Plan represents the vision and work of many people who care about Dane County. We especially thank the following individuals who contributed writing, analysis, graphs, and tables. After each name we list the section, or subject area, of the Climate Action Plan to which each person contributed. We are fortunate to have the benefit of their expertise.

Marge Anderson – Buildings

Lauren Azar – Energy Storage

Kyla H. Beard – Ho-Chunk Introduction

Ally Burg – City and County carbon emissions

Sara Conzemius – Energy Efficiency

Kathy H. Frogg – Ho-Chunk Introduction

Sherrie Gruder – municipalities' roles in renewables

Phil Grupe - City of Fitchburg

Kelly Hilyard – City of Middleton

Charles Hua – Organizing for Renewable Energy

Smilla Jepsen – Green Infrastructure, Global Climate Leaders, Circular Economy

Shree Kalluri – Zerology electric vehicles

Marcia Kasieta – Badger Prairie Needs Network and sustainable food systems

Kathy Kuntz – Energy Efficiency

Laura L. La Mere – Ho- Chunk Introduction

Leigh Leonard – ecosystem services

David Liebl – climate adaptation

Erik Lincoln – Ho-Chunk Introduction

Robin Lisowski – Voluntary Carbon Markets/Funds

David Lorenz – Climate Change in Wisconsin

Chris McCahill – Transportation and Vehicle Miles Traveled

Michael Notaro – Climate Change in Wisconsin

Greg Nemet – renewables and electric vehicles

Missy Nergard – UW-Madison

Nancy O'Brian – Finance Solutions

Stacie Reece – City of Madison

Stephanie Salgado – Climate Justice Hero

Mary Schlaefer – Finance Solutions

Jim Schultz – Geothermal at Edgerton Hospital

Sophia Seol – Photos throughout, references

Jason Stringer – Finance Solutions

Edna J. Topping – Ho-Chunk Introduction

Missy F. Tracy – Ho-Chunk Introduction and photos

Stephen Vavrus – Climate Change in Wisconsin

Dan Vimont – Climate Change in Wisconsin

John Welch – Waste Management and the Circular Economy

Lillian N. White Eagle – Ho-Chunk Introduction and photos

Maria Woldt – Yahara Pride Farms

Sandy Xiong – City of Sun Prairie

Darrell Zastrow – Forestry

# Appendix 6: Glossary

**additionality** is a term used in relation to carbon offsets or renewable energy credits (REC). A project has *additionality* if the project would not be completed in a market without carbon offsets. (That is, the carbon offset funding is necessary for the project to be completed.)

**afforestation** is the process of planting trees on land devoid of any trees to create a forest. This is different than reforestation, which refers to planting native trees into an existing forest. While reforestation increases the number of trees in an existing forest, afforestation is the creation of a "new" forest. For more information on afforestation and its potential impact on carbon emissions, see Project Drawdown's summary here: drawdown.org/solutions/land-use/afforestation.

**alley cropping** is a farming practice where crops are grown in wide alleyways between rows of trees. The practice can improve crop production, reduce crop failure risks, and increase ecosystem benefits. For more information on alley cropping see the US Department of Agriculture's summary here: fs.usda.gov/nac/practices/alley-cropping.php.

**anthropogenic** is an adjective that describes changes in nature that are made by people. So *anthropogenic* climate change is climate change caused by humans.

**biodigester** is a device and facility that processes (digests) organic waste (manure, food waste, etc.) into biogas and a nutrient-rich slurry.

**carbon footprint** is the amount of greenhouse gases (and especially carbon dioxide) emitted by something or someone. In most cases we measure the annual carbon footprint—which is the total emissions for a business or household in a year.

**carbon isotope ratios** is a methodology climate scientists use to measure the concentration of carbon in the atmosphere. For more discussion on this measurement, see this blog: skepticalscience.com/From-eMail-Bag-Carbon-Isotopes-Part-2.html.

**carbon offset** is an action, activity or investment that reduces emissions in a way that cancels out the carbon dioxide emissions from other activities. A business might, for example, offset the emissions associated with its business travel by investing in a solar energy farm that will reduce emissions equivalent to annual

emissions associated with its business travel. When considering carbon offsets the key is to ensure additionality—which means that the project would not have occurred without the additional investment from the entity purchasing the carbon offsets. To learn more about carbon offsets and additionality, check out this article from The Guardian: theguardian.com/environment/2011/sep/16/carbon-offset-projects-carbon-emissions.

**carbon sequestration** is a process by which carbon dioxide is removed from the atmosphere and stored in liquid or solid form. Sequestration can be a natural process (e.g., trees and other plants sequester carbon naturally by taking it from the air and storing it in roots and wood) or it can be a human-made process (like ongoing projects that sequester carbon dioxide in geological formations underground).

**circular economy** refers to a vision of the economy where products are used and re-used in a circular fashion so that there's no waste and no negative environmental impacts. To learn more about this model, see this discussion: ellenmacarthurfoundation.org/circular-economy/what-is-the-circular-economy.

**clean energy** refers to energy sources that produce energy without also producing greenhouse gases or other pollutants. Stakeholders tend to agree that solar power, wind energy and hydro power are clean energy.

**climate** is the long-term average of weather conditions. The temperature on a single day is weather; the average temperature for Dane County in July (based on 30 years of data) represents our typical July *climate*.

**climate adaptation** refers to changes humans make to adjust (or adapt) to a changing climate. In Dane County, the efforts to better handle large rain events is an example of climate adaptation—we are changing land use patterns to adjust to a new climate reality.

**climate bond** is a financial instrument that is used to generate revenue for climate-related activities. Much like a company or government could issue a bond to finance a new building, entities can issue climate bonds to finance climate-related activities.

**climate change** refers to a long-term shift in local or global climate patterns, including changes in temperatures, precipitation and wind patterns.

**climate mitigation** refers to efforts to reduce or prevent the emission of greenhouse gases. Planting trees (which will absorb carbon dioxide from the

atmosphere) and reducing vehicle idling (which prevents emissions) are both examples of climate mitigation.

**climate resilience (resiliency)** is the ability to anticipate, prepare for, and respond to hazardous events, trends, or disturbances related to climate change.

**co-benefits** refers to the additional positive outcomes that accrue from a specific action (in this case, climate actions). There are often multiple co-benefits of climate adaptation and mitigation. For example, a co-benefit of energy efficiency (which reduces emissions) is that it saves money, which makes business operations more profitable.

**credit enhancement** is a strategy used to improve the creditworthiness of a business. Through credit enhancement the lender receives assurances that the borrower will repay the loan, perhaps via additional collateral or some sort of insurance.

**deep de-carbonization** refers to a set of strategies for achieving dramatic reductions in greenhouse gas emissions; the strategies include shifting electricity production to clean energy sources (e.g., wind and solar), shifting all building and transportation energy use to clean electricity and reducing the energy intensity of buildings and transportation systems through more energy efficiency and conservation.

**demand-side nutrient removal** describes a process for achieving a specified amount of nutrient removal from wastewater using the least possible amount of oxygen. Nutrients are removed from wastewater through an aeration process and that aeration uses energy, so by decreasing the amount of aeration/oxygen used to remove nutrients, wastewater can be treated with lower energy inputs, and therefore, lower carbon emissions.

**discount rate** is the interest rate that entities use to determine how much future cash flow is worth in the present. In energy efficiency programs, the discount rate helps to determine the value of future savings, for example, which determines which energy-saving actions are cost effective in the present.

**dynamically downscaled model simulations** refers to a process climate scientists use to study climate change impacts within a specific region rather than at the global level. Global models provide a sound big picture whereas the downscaled simulations provide more specific local insights

**ecosystem benefits** refers to the specific results of natural processes, as well as

compounds from specific plant and animal species, that benefit humans and enhance life on Earth. Nature provides us with food, water, fiber and construction materials—all of those are *ecosystem benefits*.

**energy efficiency (EE)** refers to efforts to maximize the results associated with consuming energy. An *energy efficient* refrigerator, for example, uses less electricity to cool soda than does an inefficient model. Similarly, an *energy efficient* office building might include energy efficient lighting, heating and cooling systems as well as practices that encouraged occupants to conserve energy at their desks.

**energy security** refers to whether an entity—a household, a business, a nation—has access to an energy supply. Because there are no fossil fuel resources in Wisconsin, Dane County becomes more energy secure as we transition to solar and wind power (which can originate in our county).

**environmental justice** is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

**equity** is a strategy for addressing racial and social injustices. When we practice equity we give everyone what they need to be successful; this is different than equality, where we treat everyone the same.

**global warming** is the long-term rise in the Earth's global temperature, which is primarily due to increased greenhouse gas emissions associated with human use of fossil fuels.

**green bank** is an entity established to encourage private investments in low-carbon and climate-resilient infrastructure.

**greenhouse gas (GHG)** is any gas that, in the atmosphere, absorbs heat radiating off of the Earth's surface and reflects that heat back to the Earth. Greenhouse gases—like carbon dioxide and methane—act as a "greenhouse" trapping heat in the Earth's atmosphere.

**ground-level ozone** is a colorless and highly irritating gas that forms just above the earth's surface that causes respiratory and other health ailments. It is called a "secondary" pollutant because it is produced when two primary pollutants react in sunlight and stagnant air. These two primary pollutants are nitrogen oxides (NOx) and volatile organic compounds (VOCs).

**homeostatic** refers to a dynamic state of equilibrium. The term comes from biology where organisms and cells maintain equilibrium in response to both internal and external conditions.

**ice cores** are cylinders of ice drilled from ice sheets and glaciers. These cylinders give scientists insights into the Earth's climate across hundreds of thousands of years. For more information on ice cores, visit the National Science Foundation discussion: icecores.org/about-ice-cores.

**industrial symbiosis** is a process by which the waste materials from one industry or business become the input resources for another industry or business (to help achieve a circular economy).

**manageable assets** refers to the non-financial assets held by public and private entities, which would include buildings, land, fleets, and other assets. As delineated in The Economist, climate change presents a substantial risk to these assets: eiuperspectives.economist.com/sites/default/files/The cost of inaction_0.pdf.

**net zero energy** describes a building that produces as much renewable energy as it consumes over the course of the year.

**net zero energy ready** describes a building that is so energy efficient that all or most of the annual energy consumption could be offset with renewable energy. In some cases buildings are built to be net zero ready so that renewable energy can be added later.

**net zero carbon** describes a highly energy efficient building that is fully powered from on-site and/or off-site renewable energy sources. For a more thorough discussion of net zero carbon, see the World Green Building Council's website: worldgbc.org/advancing-net-zero. Note, too, that none of these net zero definitions take into account the emissions associated with constructing the building or with transporting people and materials to and from the building while the building is being used.

**perennial cropping** is a farming strategy that plants and harvests crops that are alive year-round and that are harvested multiple times before dying. Perennial crops aren't new—apple trees are an example of a perennial crop, as is alfalfa.

**rainfall infiltration** is the natural process by which water on the ground enters the soil. When the amount of rainfall exceeds the infiltration rate the soil can't absorb all of the rain—which causes runoff and risks of flooding.

**reforestation** is an effort to add trees to an existing forest or replant trees in an area that once was a forest. This is different than afforestation, which refers to efforts to create a new forest. Reforestation efforts increase the number of native trees in an existing forest.

**renewable energy** is energy coming from a source that does not deplete–such as solar energy or wind power.

**renewable natural gas (RNG)** is a pipeline-quality gas, from sources that are not fossil reserves in the ground, that is fully interchangeable with conventional natural gas and thus can be used in natural gas vehicles. RNG is essentially biogas (the gaseous product of the decomposition of organic matter) that has been processed to purity standards. Learn more about the Dane County RNG facility here: daneclimateaction.org/initiatives/Landfill-Natural-Gas.

**resiliency** refers to the ability to recover quickly from disruptive change. Dane County created this Climate Action Plan to enhance our *resiliency* in face of the climate crisis.

**riparian buffer** is a vegetated "buffer-strip" near a stream, which helps to shade and partially protect the stream from the impact of adjacent urban, industrial or agricultural land use.

**sediment and nutrient loading** occurs when water, running over land to rivers or lakes, picks up and carries sediment and nutrients (like nitrogen or phosphorus) into the waterways. In the lakes, nutrients like phosphorus and nitrogen spur algae growth, which jeopardizes water quality.

**silvopasture** is the intentional combination of trees, pasture, and livestock together as an integrated, intensively-managed system. See Project Drawdown for a full discussion of silvopasture: drawdown.org/solutions/food/silvopasture.

**sustainability** is most frequently defined as an approach that "meets the needs of the present without compromising the ability of future generations to meet their own needs." simple.m.wikipedia.org/wiki/Sustainability

**tree canopy baseline** is a measure of the current tree cover in a community or neighborhood. Establishing a baseline is an important first step in any effort to increase trees in an area. The Wisconsin DNR offers tips and resources associated with measuring and increasing a tree canopy here: dnr.wi.gov/topic/urbanForests/ufia/canopyGoals.html.

**vector-borne diseases** are transmitted to humans and other animals by blood-feeding arthropods, such as mosquitoes, ticks, and fleas. West Nile virus is an example of a *vector-borne disease*.

**voluntary carbon market** provides an optional way for businesses, governments, NGOs, and individuals to offset their emissions by purchasing carbon offsets. There is no requirement to participate in a voluntary market.

**zoonotic diseases** refers to diseases that normally exist in animals but can be transmitted to people. Rabies is an example of a *zoonotic disease*.