



# **Kent State's Energy Efficiency Evolution and a look at Collaborative Efforts with the City of Kent to Achieve Sustainability Goals**

Presented by Melanie Knowles and Julie Morris

# Kent State University

- **8 Ohio Campuses with 33,000 students**
- **Kent campus has**
  - 950 Acres
  - 127 Buildings
  - 25,000 Students
  - 18 Dining Locations



# Heating Plant - 1916



# Heating Plant 1980s

## Delta 2000...

### Computer rules campus lights, heating

By DIANNE ROOK and ERIC DURR

Lurking in a dark corner on the first floor of the heating plant is a force powerful enough to turn off lights and heat in classrooms clear across campus.

What may sound like something from the year 2020 is actually a Delta 2000 Environmental Central

Control System, a "force" that constantly turns off lights and heat in unused buildings.

The heating plant relies on two main boilers and two emergency boilers to produce steam, Malcom Avery, physical plant administrator, said. A web of pipelines, walking tunnels and crawlways with pipelines running through

them, carry the steam to the buildings.

The steam runs the heating equipment in each building. Temperatures in individual buildings vary because each building's heating equipment is different, Avery said. he said if all university buildings had the same type of system, many problems would

be solved.

Only the Nursing Building and parts of the Education Building were designed with heat conservation in mind, Avery said. The hardest building to heat is the Business Administration building. Most complaints come from there, he said.

Problems have also occurred with the library, because blowers designed to keep temperatures down malfunctioned, he added.

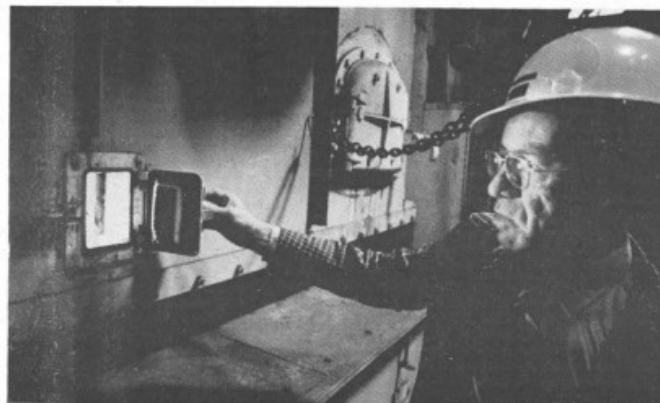
The system is leased for about \$44,000 a year from Honeywell Corporation. It was installed about four years ago, Ted Curtis, university architect said.

Class schedules received from the administration are programmed into the system to shut down operations in the Art and Business buildings, Bowman, Satterfield, Rockwell, Smith, Cunningham, Williams, the Library, Memorial Gym and the Nursing building.

The new HPER building and the Music and Speech buildings will also be included in the system's program, Curtis said.

"We hope to be able to use this system in some of the older buildings on campus," he said, "but it all depends on further funding."

The system not only controls heat and lighting, but also acts as a fire alarm system. In addition, the Delta 2000 serves as a listening device. "We can listen into the mechanical rooms in the various buildings to make sure the motors



Malcom Avery, physical facilities director, examines a coal-burning boiler which provides steam to heat the campus. A complex electrical system, the Delta 2000 Environmental Central Control System, regulates the use of steam produced by this and other boilers.

Daily Kent States, February 2, 1979



# Center for the Visual Arts



# Summit Street Combined Heat and Power Plant

2000 - Opened 13 MW  
Cogeneration Plant

2005 - Governor's Award for  
Excellence in Energy



# Energy Efficiency

- **HB 251 target 20% reduction by 2014 (from 2004 baseline)**
- **HB 7 financing tool – 10 year payback, then 15**
- **Phases Completed**
  - 2011 - Stark Campus-Wide Energy Conservation Project
  - 2013 - Ashtabula, East Liverpool, Geauga, Salem and Trumbull Campus-Wide Energy Conservation Project
  - 2014 - Kent Campus Residence Services Energy Conservation Project
  - 2015 - Kent Campus Classroom, Laboratory, Auxiliary Buildings and Utility Assets Energy Conservation Project, Phase I
  - 2018 - Kent Campus Classroom, Laboratory, Auxiliary Buildings and Utility Assets Energy Conservation Project, Phase Two
  - 2023 - College of Podiatric Medicine Energy Conservation Project
- **Performance contracting to guarantee payback**
- **Kent campus reduction of 24%, Regional campus reduction of 22%**



Since the project's start in 2011, new windows have been installed in Dunbar, Prentice, Verder, Lake, and Olson Halls.



Intelligent Power Strip in resident rooms throughout Centennial Court, Stopher, Johnson, Dunbar, Prentice, Verder, Lake, Olson, Engleman, Beall, Korb and Allyn Halls



New thermostats in resident rooms throughout Centennial Court, Stopher, Johnson, Dunbar, Prentice, Verder, Lake, Olson, Engleman, Beall, Korb, and Allyn Halls



# Johnson Controls Inc. Energy Optimization Solution (EOS)

- Part of Kent Campus Energy Conservation Project Phase 2
- Industry first model predictive control software application developed by Johnson Controls Inc. for Kent State's Summit Street Combined Heat and Power Plant.
- Constantly monitors roughly 400 critical variables in near real time and predictably optimizes plant costs, efficiencies.
- The algorithm (consisting of 1,700 separate calculations) is continuously repeated, projected out for 7 days and creates 15-minute increment dispatch signals.
- EOS also considers factors like current loads and operating conditions, campus activities, building occupancy, ambient environment and utility rates. It also considers projected market energy prices and the NOAA seven-day weather forecast, both via directly connected inputs to EOS.
- Equipment conditions and efficiency are continuously monitored along with equipment availability to account for maintenance, for consideration in the modeling.
- Kent State's EOS System is the second in the world, and the first that includes a Combined Heat and Power Plant.

# Energy Efficiency Behavior Change

- Do It In the Dark – Residence Hall Energy Competition
- Winter Shut Down
- Peak Load Days

**KENT STATE UNIVERSITY**

**ENERGY EXERCISE OF THE WEEK**

## We're Training for Peak Load Days!

*WE'RE TAKING STEPS TO CUT ENERGY WASTE. AND WITH HELP FROM YOU, WE CAN PICK UP THE PACE!*

*LOOK FOR THE "ENERGY EXERCISE OF THE WEEK" FOR TIPS TO HELP OUR CAMPUS PERFORM AT ITS PEAK!*

**Did you know?**

- ✓ Commercial buildings account for 20 percent of U.S. greenhouse gas emissions.
- ✓ Small actions add up to big energy savings, if we all work together!

**OVER BREAK!**

- UTTERS
- HERALS (monitors, etc.)
- ANCES (aves, toasters, heaters, etc.)
- WINDOWS
- OR DRAPES
- TS
- NEEDED
- ST

**R STRIPS IF POSSIBLE. .UG IS INACCESSIBLE. ainability**

**LEARN MORE AT [energystar.gov](http://energystar.gov)**

**KSU** [WWW.KENT.EDU/SUSTAINABILITY](http://WWW.KENT.EDU/SUSTAINABILITY) **KENT STATE UNIVERSITY**

## Did You Know...

**Washing in cold water saves enough in 1 year to....**

• Drive 3,600 miles



# Renewable Energy

- **2011 Renewable Energy Master Plan**
  - Looked at all campuses and buildings for viability for solar
  - Locations for wind
  - Prioritized by most cost effective.
    - As energy costs go up and solar prices come down, more options are viable.
    - Leverage incentives.



## Renewable Energy Master Plan

Project #KSU-11L901

Phase I Summary  
May 5, 2011

Prepared by:  
Gravity Renewables Group, Ltd.  
Boulder, CO  
KSU\_Phase I Summary\_5.5.2011.E  
Confidential

## Field House Solar Array



- **0.5 Megawatt roof mounted array**
- **2012 PPA with Third Sun Solar**
- **Purchased in 2020**

# Wind

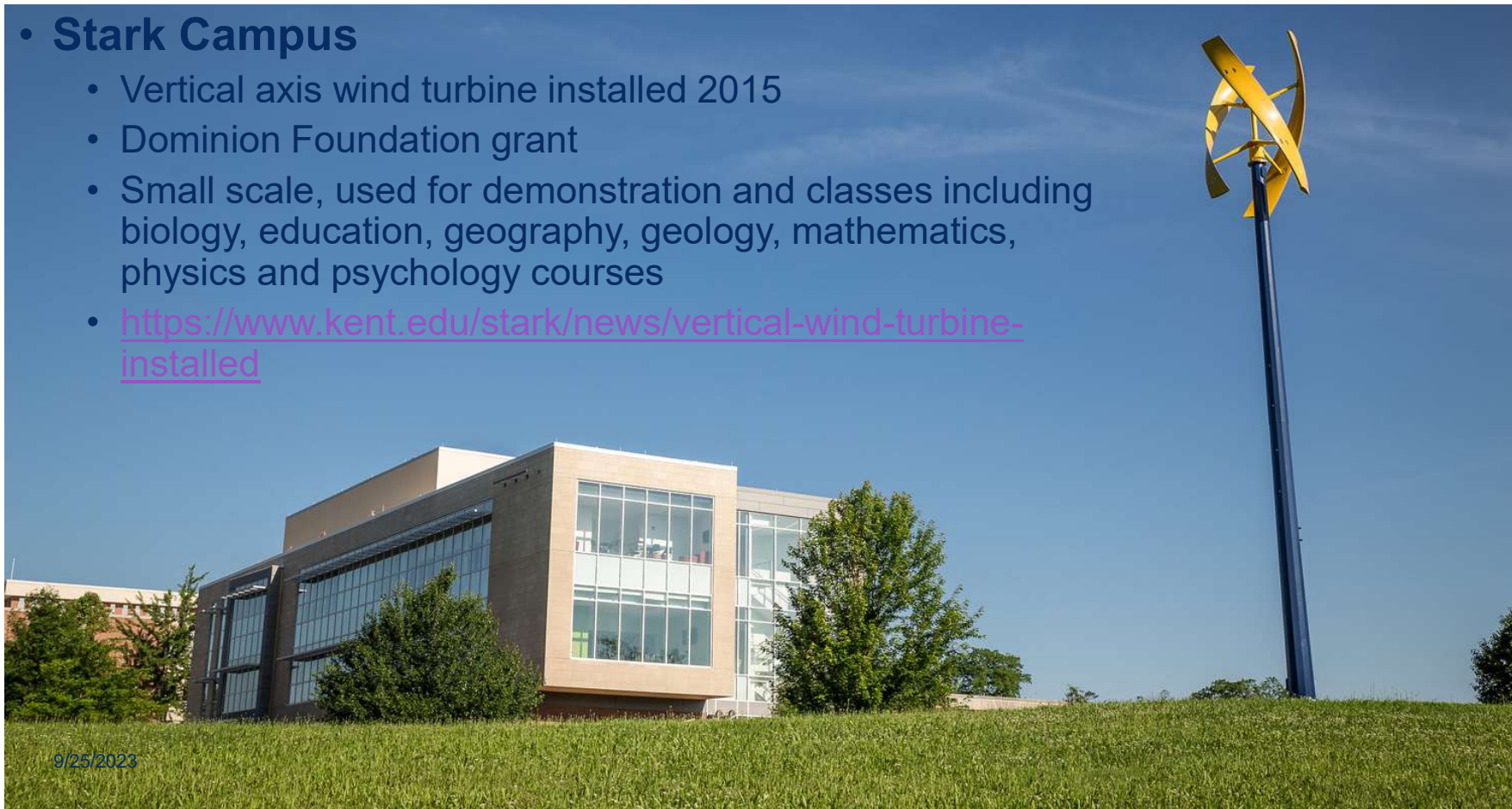
- **Geauga Campus**
  - 2014 Donation from Don Clark
  - 300 watts
  - Can power about 70% of lights in parking lot



# Wind

- **Stark Campus**

- Vertical axis wind turbine installed 2015
- Dominion Foundation grant
- Small scale, used for demonstration and classes including biology, education, geography, geology, mathematics, physics and psychology courses
- <https://www.kent.edu/stark/news/vertical-wind-turbine-installed>



# Regional Campus Solar

- **Completed 2021**
- **3.75 MW (plus Field House)**
- **Projected to save Kent State \$2 million over 25 years**
- <https://www.kent.edu/sustainability/national-solar-tour>

Regional Campus	Installation	Annual Energy Production (kWh)
Ashtabula	Ground mounted	1,161,216
East Liverpool	Rooftop mounted	114,329
Geauga	Ground mounted	392,489
Salem	Ground mounted	791,829
Stark	Rooftop mounted	323,169
Trumbull	Ground mounted	1,647,591
College of Podiatric Medicine	Ground mounted	348,062
Kent- Field House	Rooftop mounted	500,000

# Kent State Geauga

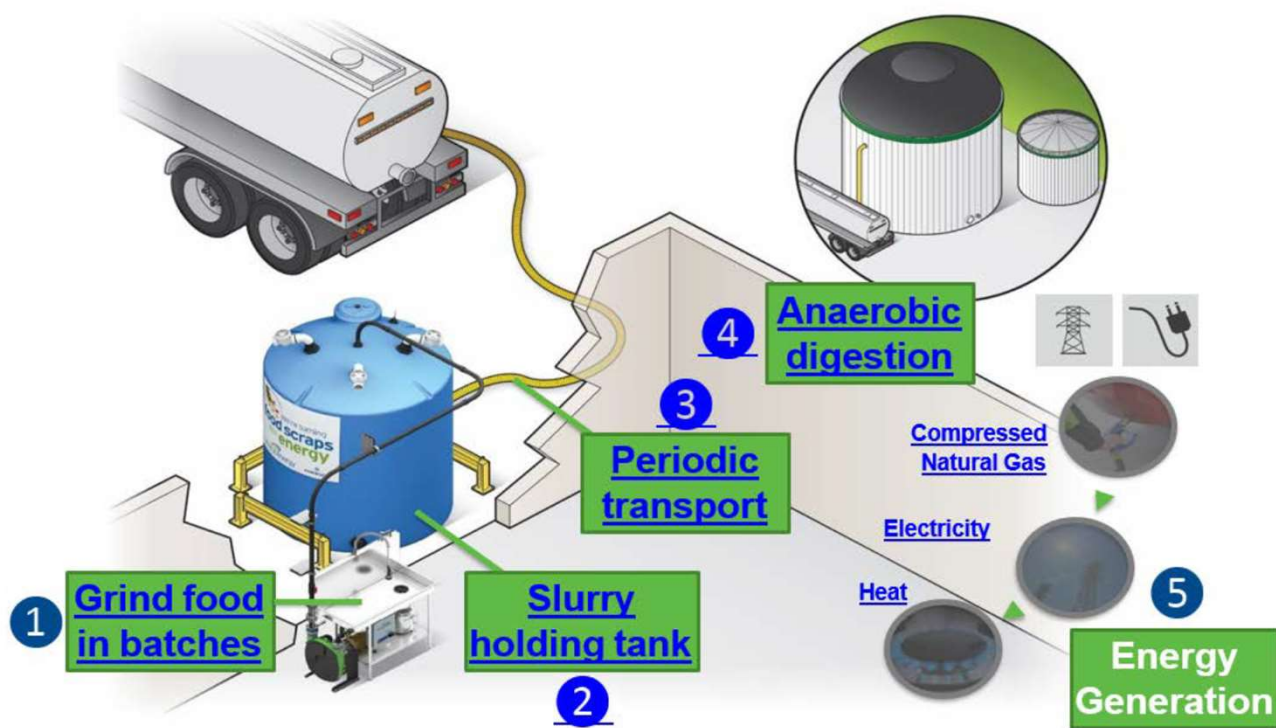




# College of Podiatric Medicine



# Grind2Energy



# Grind2Energy

Diverted 258 tons of inedible food waste from September 2020 to August 2023



## Sustainability Report

**PREPARED FOR:** Kent State University - Kent  
**PERIOD:** 2020 to 2023 (through August)  
**LOCATION(S):**  
 KSU - Eastway Dining Hall (17 Eastway Dr., Kent, Ohio 44243)  
 KSU - Design and Innovation Hub (400 Janik Dr., Kent, Ohio 4...)



**Powering 52 homes for one month**

**Energy**  
 Your slurry was used to generate 47,009 kWh of additional electrical power

**428,083 fewer miles driven**

**CO2 Reduction**  
 By diverting your waste from landfills, you reduced carbon emissions by 177 tCO<sub>2</sub>e

**15 tons of fertilizer**

**Bio-solids for Fertilizer**  
 The remainder of the slurry after extracting the energy yielded 15 tons of fertilizer

Technical References:  
 - Carbon emissions and heat generated from EPA Waste Reduction Model (WARM), assuming national average for landfill gas recovery, no curing of digestate after digestion and digestate land application.  
 - Typical food waste mix adopted: Beef 9%, Poultry 11%, Grains 13%, Fruits and Vegetables 49%, Dairy Products 18%.  
 - Miles from EPA's Greenhouse Gases Equivalencies Calculator.  
 - Heat to electricity conversion efficiency adopted of 44%.  
 - Average Household consumption from U.S. Energy Information Administration (EIA).  
 - Fertilizer based on 0.99gTS/gTSfw & 30%TS, Kim et al. 2016, Synergism of co-digestion of food wastes with municipal wastewater treatment biosolids. Waste Management.

## **In Development**

- **Kent Campus 33 acre parcel near S.R. 261**
- **Current design is for a 7 MW fixed, ground mounted array with 1.5 MW battery energy storage system**
- **Construction anticipated 2024**

# Purchase of Renewable Energy


- **Reverse Auction for purchase of grid power**
  - Ohio Renewable Portfolio Standard is 7%
  - Kent campus purchase is 5% renewable (plus 7% standard = 12%)
  - Regional campus purchase is 25% renewable (plus 7% = 32%)
- **The premium paid for renewable was minimal.**
- **This may be even more cost effective in the future, and we will continue to explore it.**



*Direct Energy Business proudly recognizes*


**KENT STATE UNIVERSITY**

**for outstanding leadership in addressing climate change through their purchase of 14407.04 MWhs of renewable energy attributes. This purchase will offset 25.00 % of their energy consumption and support the growth of renewable energy generation projects.**


March 08, 2023  
Date

Robert Gaudette  
Senior Vice President, NRG Business


**Source Type(s): National Green-E Wind**



**Green-e Certified**

\* Green-e has not verified this statement.

Through the Green-e® Energy program, the Center for Resource Solutions certifies renewable energy that meets the highest standards in North America. It must be generated from new facilities, marketed with complete transparency and accuracy, and delivered to the purchaser. Green-e staff verify the entire chain of custody of certified renewable energy, from generation to retirement, to ensure that individuals and businesses are getting exactly what they paid for. [www.green-e.org](http://www.green-e.org).



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Renewable Services

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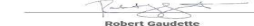
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[directenergybusiness.com/renewables](http://directenergybusiness.com/renewables)

# How will Kent State University be powered in 2050?

- **Good stewards of tuition dollars and state funding**
- **Reliable sources of power**
- **Adequate for demand (consider increasing EV infrastructure)**
- **Promote healthier air and environment**



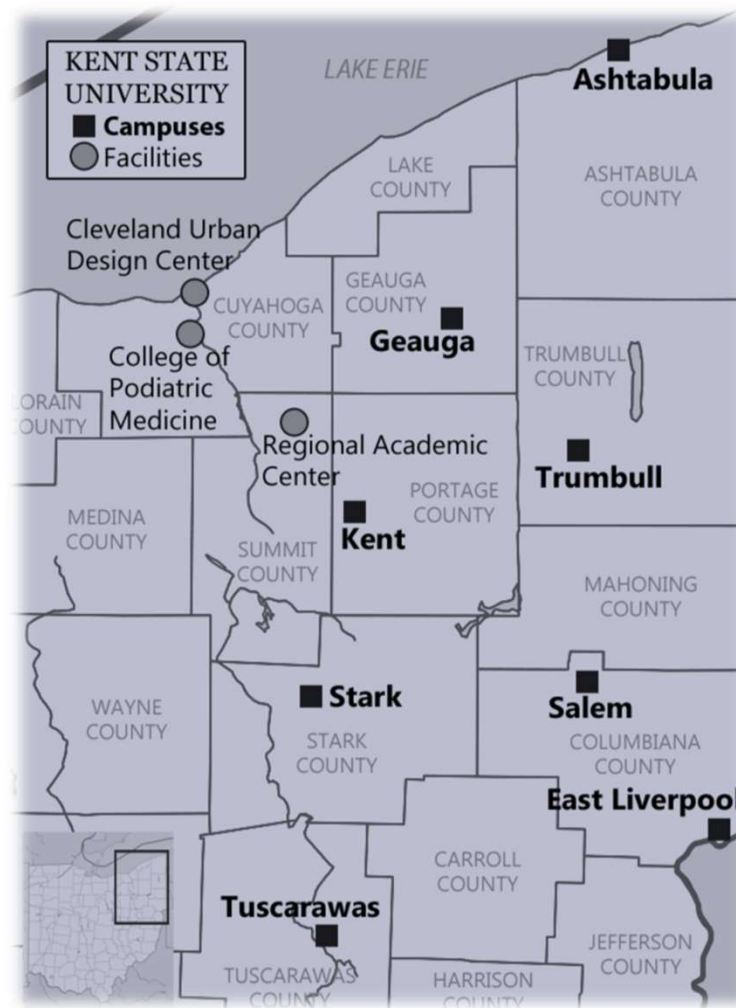
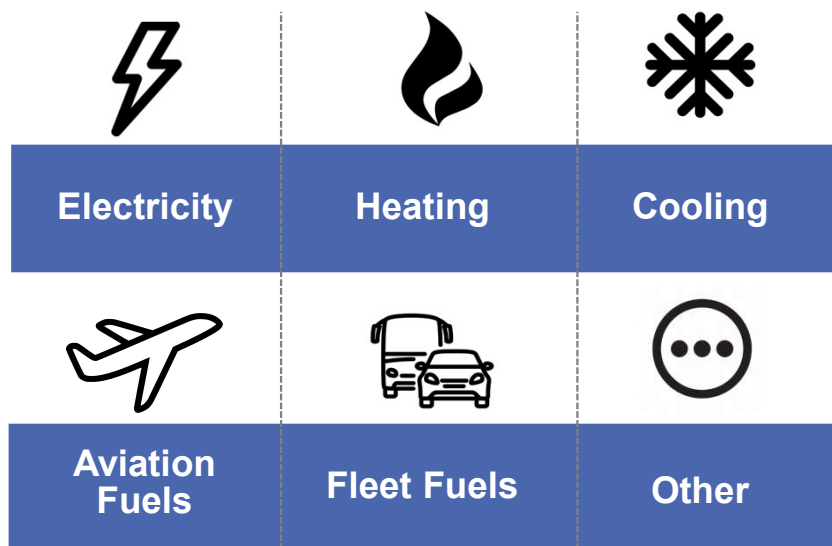
# Baseline

## GHG Emissions Inventory & BAU Forecast



# Boundaries and GHG Sources

WHAT IS INCLUDED IN THE PLANNING SCOPE?

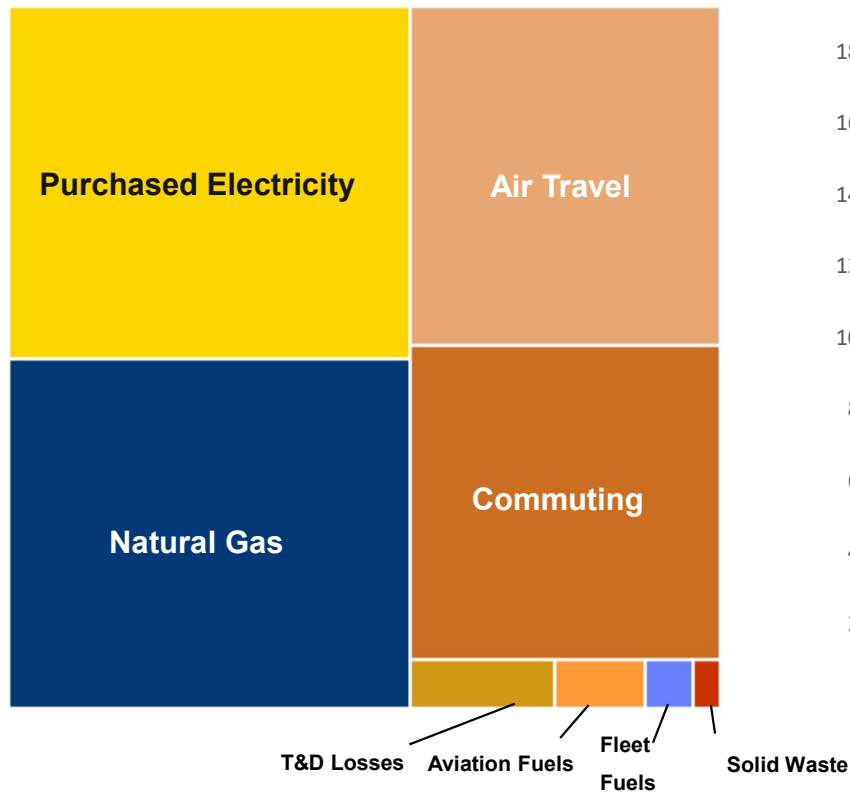




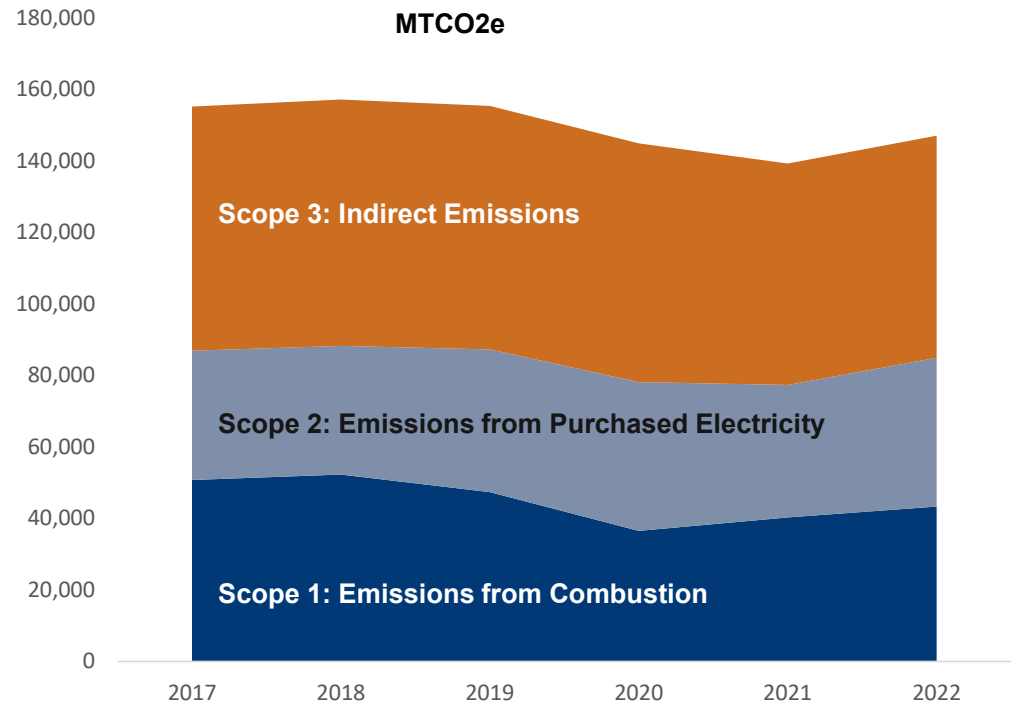
# Greenhouse Gas Inventory

## WHAT IS DRIVING EMISSIONS?

FYE 2022 Emissions

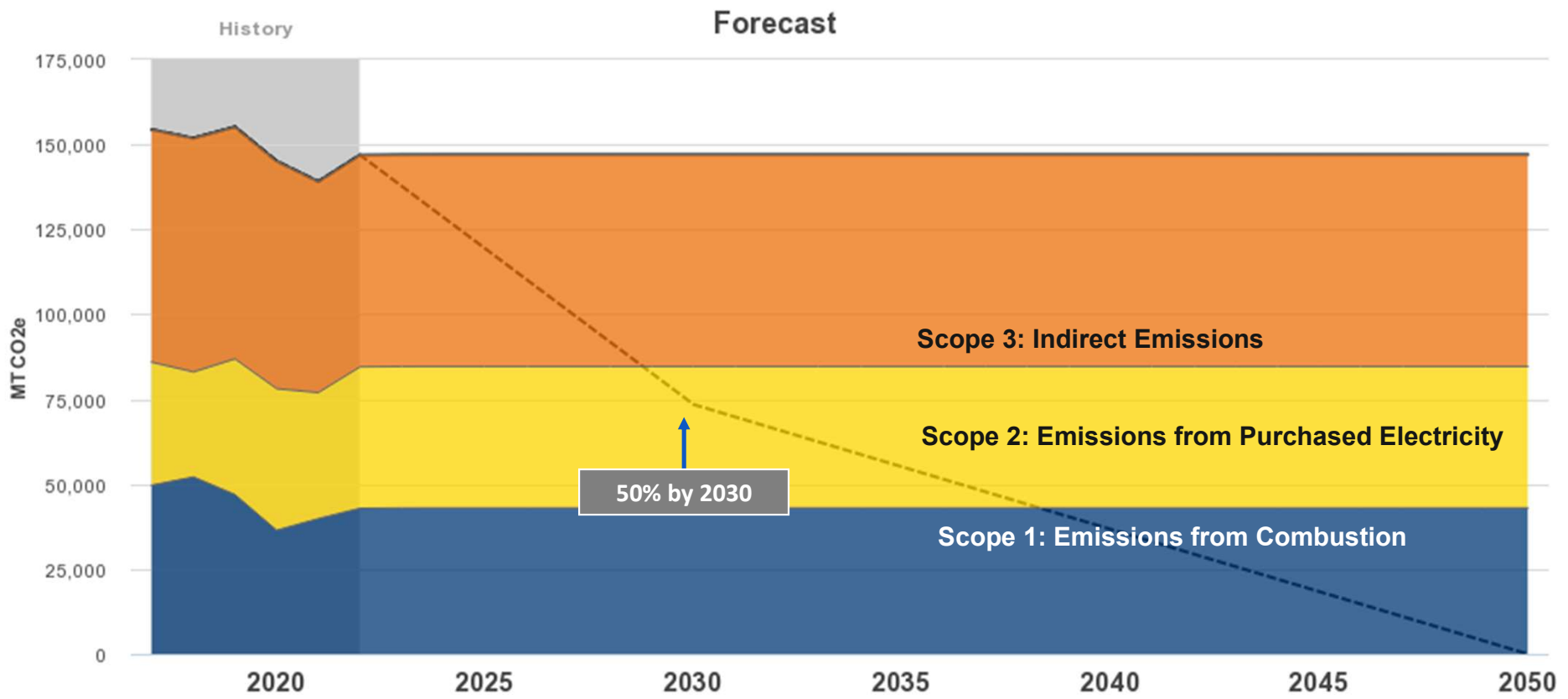


FYE 2017-2022 Emissions



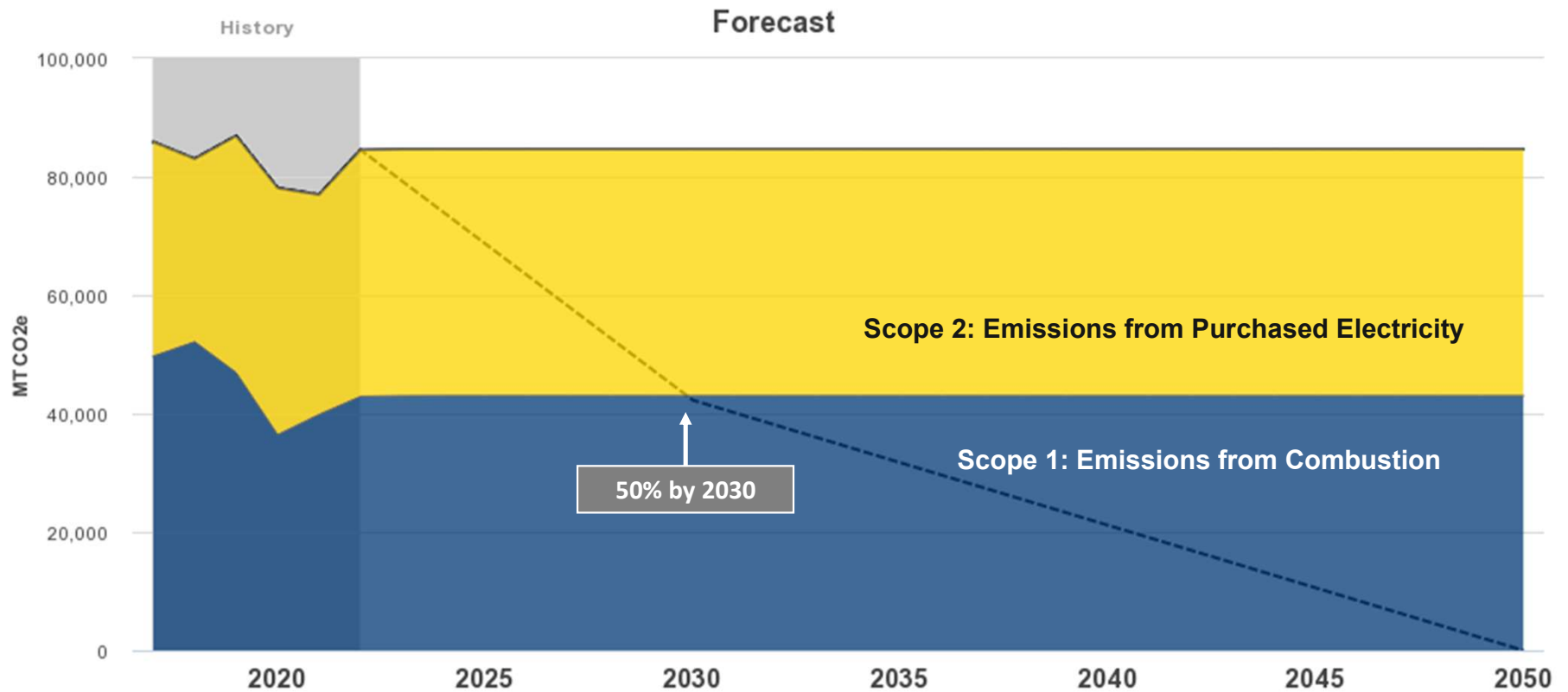
# Business-as-Usual Forecast

WHAT WOULD A 2050 CARBON NEUTRALITY TARGET LOOK LIKE?



# Business-as-Usual Forecast

WHAT WOULD A 2050 CARBON NEUTRALITY TARGET LOOK LIKE?

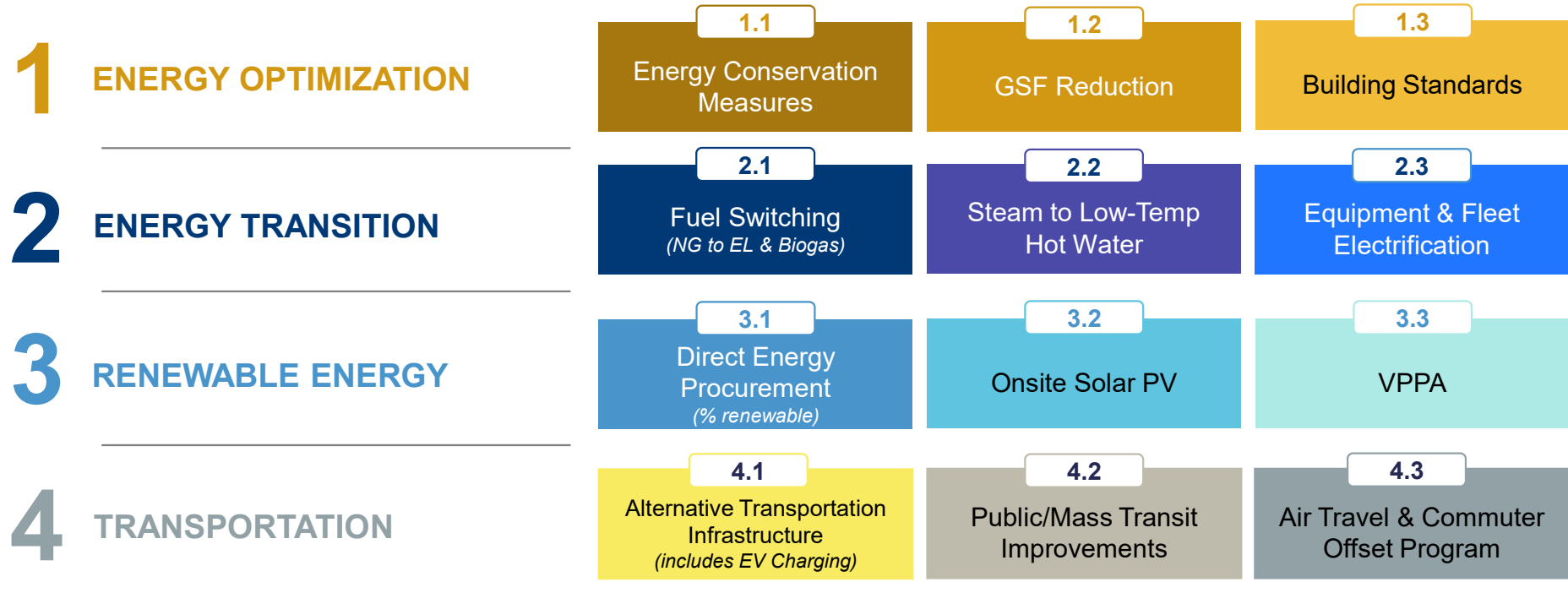


# Roadmap & Solutions



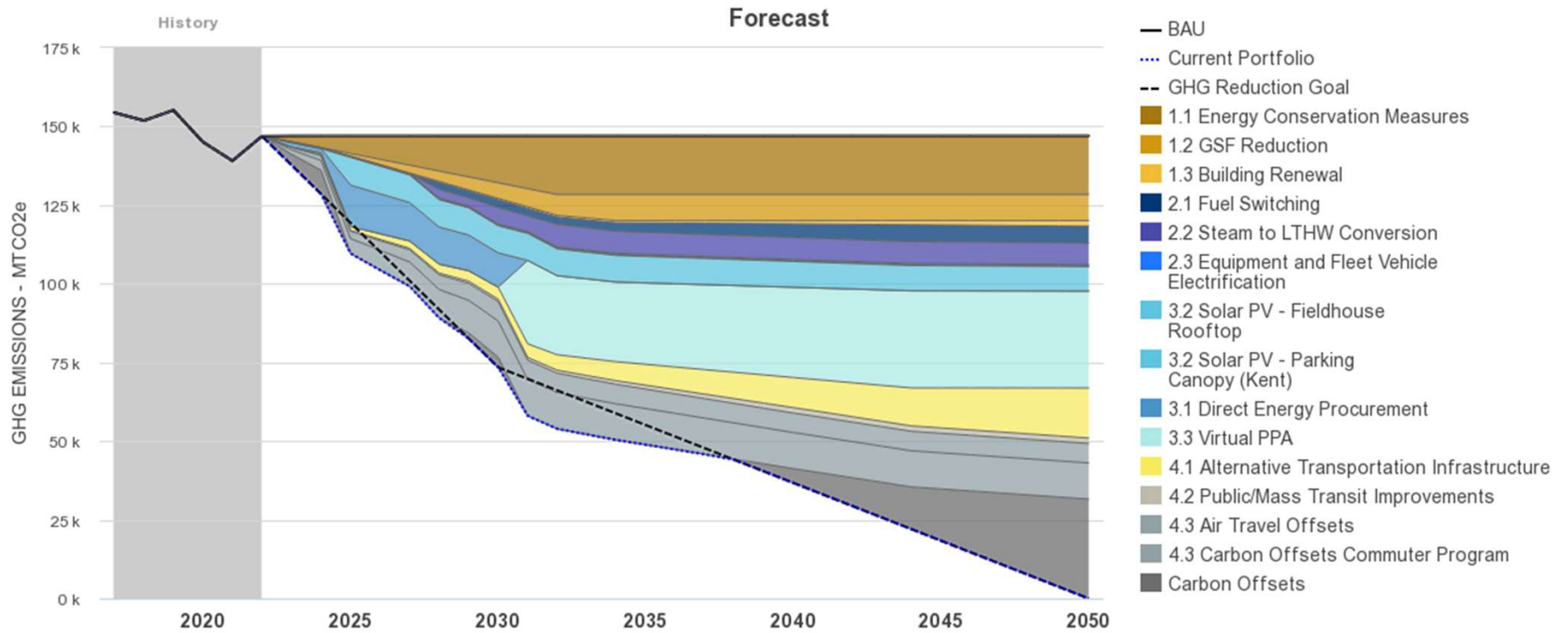
# Climate Action Roadmap – Draft

KENT STATE UNIVERSITY



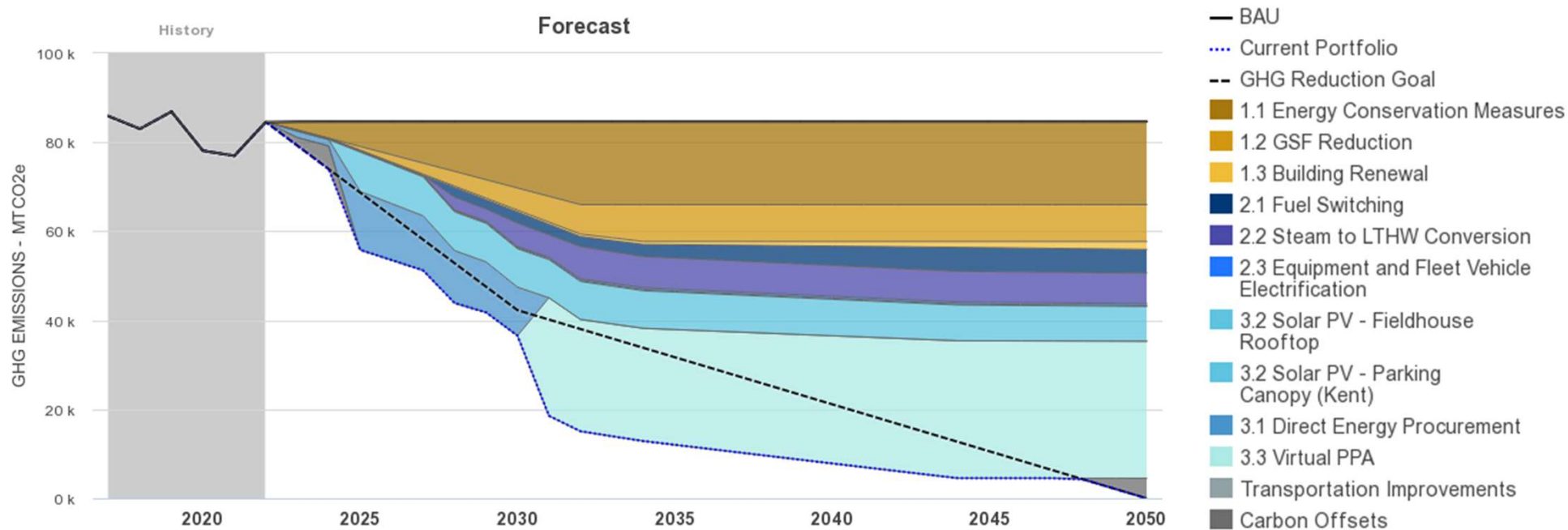
# Climate Action Road Map (Scopes 1, 2, & 3)

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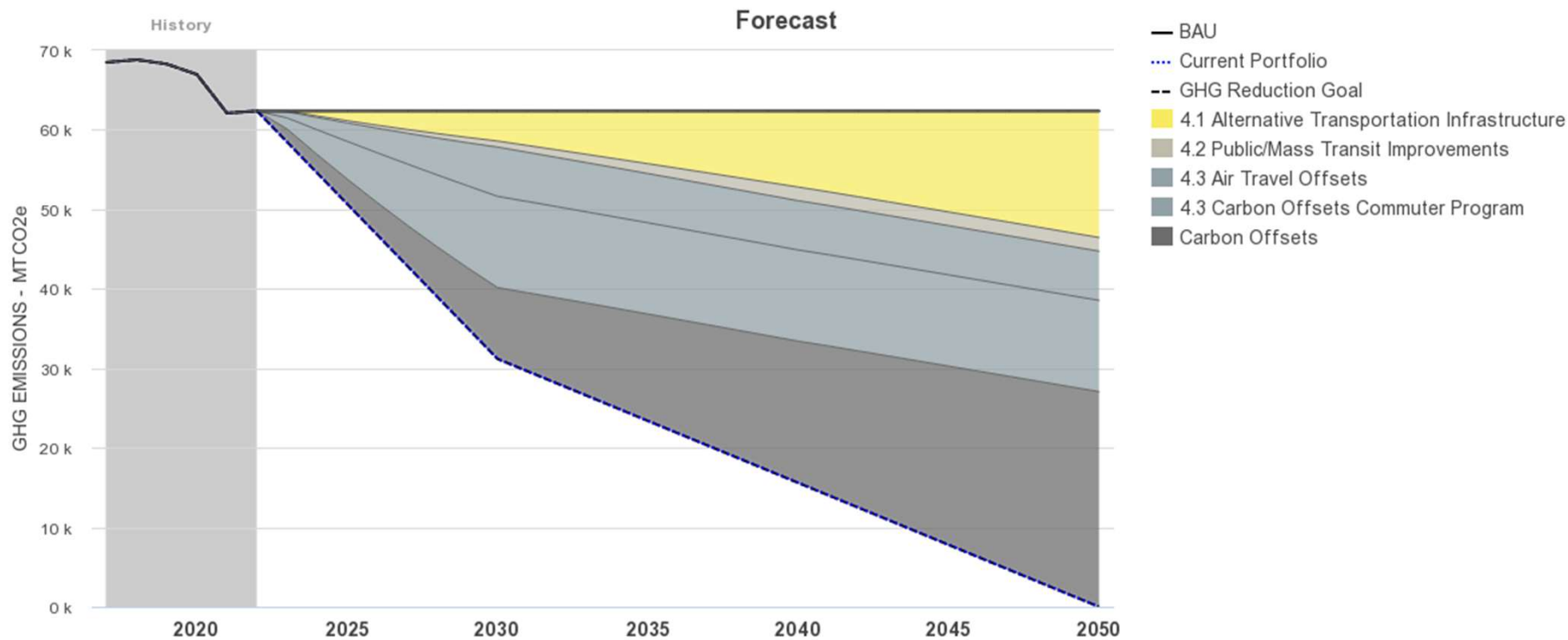
# Climate Action Road Map (Scopes 1 & 2)

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# Climate Action Road Map (Scope 3)

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# Uncertainty

- **Prices are changing**
- **Technology is changing**
- **We are looking further into the future to chart a path and prepare us when we reach decision points.**
- **Does a decision now reduce or enhance our options for cost effective, reliable, healthy energy in the future?**



# Town & Gown Strategies

- The City of Kent's Climate Action Plan and Kent State University's Sustainability Plan outline numerous ways they will work together to implement aspects of their respective goals, some of which involve shared:
  - Data
  - Education
  - Outreach
  - Funding Opportunities
  - Collaborative Communication and Oversight
  - Shared Sustainability Coordinator Position
  - Program Initiatives



# Benefits and Challenges of an Institutionally Shared Position



- Streamline work between overlapping areas of their plans and goals
- Point of contact for connection and support
- Shared cost burden of an additional paid staff person
- Challenges at this time are anticipated to be related to differing or conflicting areas of institutional needs

# 2023-2028 City of Kent Climate Action Plan directed and shared initiatives



The City of Kent, in partnership with Kent State University and the Portage Area Regional Transit Authority, has received a \$5.25 million RAISE grant for the Reimagining the Gateway East Main Street Corridor project.

- The East Main Street Project was one of 162 projects to receive Rebuilding American Infrastructure with Sustainability and Equity (RAISE) funding
- Involves significant multi-modal improvements to a nearly one-mile, car-centric section of East Main Street
- Part of the funds will be used to install electric vehicle (EV) charging stations for public use. The stations will be located in four Kent State parking lots on the north side of campus adjacent to East Main Street.





## Community Anaerobic Composting Pilot Program utilizing Kent State's Grind2Energy system

- Path to community pilot implementation:
- Perform a literature review to understand best practices from town-gown anaerobic digestion system partnerships
- Conduct a small-scale pilot program with residents that allow us to work through logistics roadblocks including waste contamination, drop-off, staffing, and capacity management
- Should pilot go well, program could expand to include
  - Curbside Collection
  - On-site anaerobic digestion
  - On-site use of natural gas to generate electricity or steam for the Kent State campus

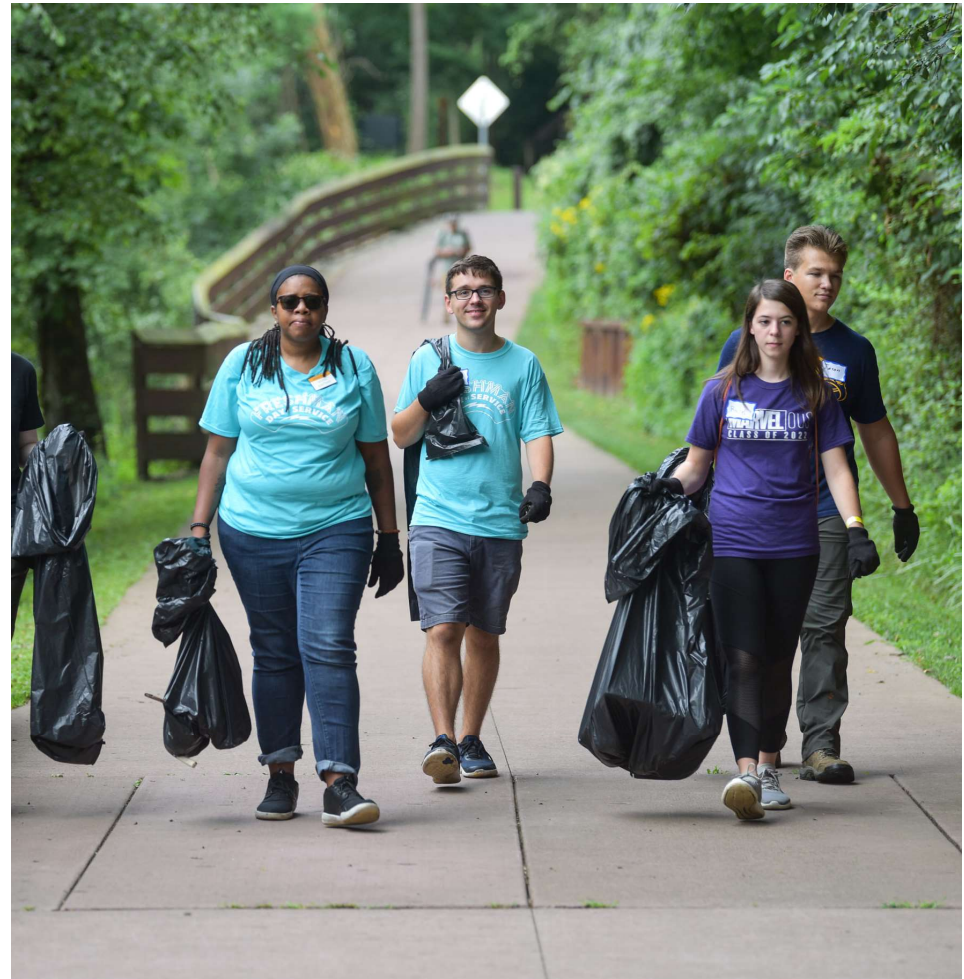
# Shared Energy Education Initiatives

- Increasing energy literacy can build urban and campus resiliency through education
- Examples include:
  - Promotion of using public transport for sports tournaments and Kent State games
  - Tabling together at variety of events around issues of energy use
  - Education programs for local schools around energy & climate
  - Sustainable traveling and tourism



# Academic Partnerships for Experiential Learning

- The City of Kent and Kent State can leverage our shared sustainability goals by partnering to offer students experiential learning opportunities
- Example projects include:
  - Community energy audits
  - CAP marketing
  - Urban tree inventory updates
  - GHG inventory updates
  - And many more!







**Thank You.**

## Biographical Information

**Julie Morris, Sustainability Coordinator**  
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**City of Kent, 930 Overholt Road, Kent, Ohio 44240**  
**330-678-8108**      [Julie.Morris@KentOhio.gov](mailto:Julie.Morris@KentOhio.gov)

Having grown up in rural Northern California, Julie has always held a deep, personal love of and connection to our natural world. In efforts to align her career with her passions for building equitable and resilient communities, she earned her Associates of Arts degree at Santa Rosa Junior College, in Santa Rosa, CA, and in 1999, earned a Bachelor of Arts degree in Liberal Studies, with a concentration in Environmental Studies, through the Hutchins School of Liberal Studies at Sonoma State University in Rohnert Park, CA. In 2016 she earned her Master's degree in Sustainability through the Falk School of Sustainability & Environment at Chatham University in Pittsburgh, PA. She brought her experience back to her adopted home of Kent, OH, where she served on the City of Kent's Sustainability Commission from 2016 to 2019 and worked with her local community on a variety of sustainability initiatives.

Her education, life and work experience over the years have crossed many disciplines, providing her with a multi-layered foundation and systems framework to examine pressing social, environmental, and economic issues from the local to global scales. She currently works in a shared position as the Sustainability Coordinator for the City of Kent, Ohio, and Kent State University, where she will be assisting with the implementation of their respective climate action and sustainability goals. In her spare time, she enjoys cooking with her husband and daughter, gardening, and exploring the beautiful parks of Northeast Ohio.

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**Melanie Knowles, Manager of Sustainability, Kent State University**  
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Melanie Knowles joined Kent State as the university's first sustainability manager in 2009. Over the last 14 years she has collaborated with many campus departments and faculty to develop and implement more sustainable operations, engage students, faculty, and staff, and support expanding sustainability in the curriculum. She also teaches the Business Case for Sustainability course in the Ambassador Crawford College of Business and Entrepreneurship.

Melanie has a BA in Anthropology and Economics, a Master of Environmental Science from Miami University's Institute of Environmental Sciences, and a Certificate in Nonprofit Management from Case Western Reserve University. Her professional experience includes the stock brokerage industry and the City of Cleveland's Department of Economic Development. But, for more than 20 years her career has been devoted to implementing sustainable solutions, including education and advocacy work for the Cleveland Green Building Coalition before coming to Kent State.

Melanie lives in Cleveland Heights with her husband Craig and their 13-year-old son. Spare time is spent being a hockey mom and serving on the board of Ruffing Montessori School and the Natural Resources and Facilities Committee for the Nature Center at Shaker Lakes.