

CLIMATE ACTION PLAN



CASE WESTERN RESERVE
UNIVERSITY EST. 1826

think beyond the possible™

Table of Contents

2	Letter from President Barbara R. Snyder	19	Carbon Mitigation Strategies: Long-term
4	Executive Summary	20	<i>Supply Efficiency and Combined Heat and Power Systems</i>
5	Introduction	22	<i>Additional Long-term Opportunities</i>
6	Greenhouse Gas Emissions Profile	23	Conclusion
6	A Tradition of Sustainability	23	Appendix A: Case Western Reserve and the Medical Center Company
7	Sustainability and the Case Western Reserve Curriculum	24	Appendix B: Working Group Results
8	Goals and Structure of the Planning Process	28	Appendix C: Model Description
8	<i>The University's Vision</i>	30	Appendix D: Project Team
8	<i>Structure of the Planning Process</i>		
10	<i>Guiding Policies and Actions</i>		
11	Carbon Mitigation Hierarchy		
11	Carbon Mitigation Strategies: Near- to Mid-term		
11	<i>Behavior Change</i>		
12	<i>Building Design and Construction Standards</i>		
13	<i>Space Management</i>		
15	<i>Energy Conservation Measures</i>		
15	<i>Green Information Technology</i>		
16	<i>Steam Line Improvements</i>		
16	<i>Reduced Air Travel</i>		
17	<i>Reduced Automobile Reliance</i>		
17	<i>Waste Reduction</i>		
18	<i>Central Chiller Plant Expansion</i>		
18	<i>Coal Conversion to Natural Gas</i>		
19	<i>Building Scale Renewable Energy Systems</i>		
19	<i>Offsets</i>		



From the President

I often say that universities touch the future. Our graduates go on to shape and reshape society. Our innovations change lives. Our explorations enrich understanding.

It is a privilege to be part of a community committed to the pursuit of knowledge. It is also an obligation. Here, on this campus, we get to show how ideas drive discovery, create new opportunities and, in the best of circumstances, improve the very fabric of our lives. We achieve these aims in the classroom and the laboratory, in the courtyard and on the quad. They come through research, and teaching, and even our own individual actions.

This document, the Climate Action Plan of Case Western Reserve University, embodies all of these themes. In the pages that follow, we detail the ways in which we hope to achieve carbon neutrality within the next four decades. To say this goal is ambitious represents the height of understatement. But this institution will not embrace anything less. After all, three years ago we titled our strategic plan *Forward Thinking*. Our tagline is “think beyond the possible.” We want to be challenged—it is the best way to become even better.

As with nearly all that we do well, the key to our success in this venture will be our ability to collaborate. Just as *Forward Thinking* called upon the university to pursue interdisciplinary alliances in unprecedented ways, so too does this document encourage partnerships across departments and schools, offices and the community at large. We will learn together, draw upon one another’s expertise and, now and again, even engage in friendly rivalry in hopes that competitive fires will spur even greater triumphs.

Achieving our goals will require enthusiasm, ingenuity and unwavering focus. It will also involve constant communication, regular celebrations and a willingness to hold one another accountable for results. We will

encounter setbacks, and perhaps pursue an ill-advised path or two. Such experiences may disappoint in the moment but ultimately will stand as proof of our commitment to innovate. Continuing the same practices is not an option. We must be willing to try new approaches, to abandon those that fail and to refine good ones until they become great. Most of all, we must persist. This process is no sprint. As in a marathon, we will make progress one well-paced step after another, always remembering the value of the goal at the end of our journey.

Today, we are buoyed by the knowledge of our past victories. Case Western Reserve already has made extraordinary progress in sustainability, thanks largely to the vision and passion of select individuals. They laid the foundation on which this document rests, and we owe each one an enormous debt of gratitude.

In the same manner, we also are fortunate to have seen so many individuals across the campus engage in the discussions that produced this document. They showed both great interest and expertise, and we look forward to calling on them for more of both qualities. Their energy and insight will be essential to building on past progress. We have created a plan. Now, together, we move to execute it.

A handwritten signature in black ink that reads "Barbara R. Snyder". The signature is written in a cursive, flowing style.

Barbara R. Snyder
President

May 15, 2011

Executive Summary

This Climate Action Plan is a guide for how Case Western Reserve University intends to achieve carbon neutrality. It reflects the insights and ideas of people across the campus—students, staff, faculty and administrative leaders—as well as technical support from outside experts. Over the past several months, working groups focused their efforts around two primary objectives:

1. Creation of a plan that gives equal consideration to education, research, community and facilities.
2. Emphasis on acceleration of the university's carbon emissions mitigation activity through strategic and immediate investment in existing and new initiatives.

Case Western Reserve's inventory of its greenhouse gas emissions in fiscal year 2009 identified 263,218 metric tons of carbon dioxide equivalent (MTCO_{2e}). This plan looks at ways to reduce these emissions, and employs a cost-effective hierarchy of:

- First, working to avoid demand for additional energy
- Second, reducing energy demand in existing facilities and equipment
- Third, making investments that replace carbon-intensive fuel sources with alternatives
- Fourth—and as a measure of last resort—purchasing offsets to balance remaining emissions

This plan details both near- and long-term mitigation strategies, along with their expected impacts on greenhouse gas emissions. A graphic summary of approaches and results is found in Figure 1 on page 11. Strategies include programs to stimulate behavior change, new

architectural design standards, more efficient use of building space, energy conservation initiatives in existing buildings, and investments in existing- and new-energy infrastructure. Working groups considered each mitigation strategy not only for its carbon impact and position in the carbon hierarchy, but also for its financial impact on the university. As a complement to these facilities-related strategies, the plan also recommends innovation in the undergraduate and graduate curricula, community life, program activity and administrative policies and procedures.

Of the full collection of steps, four immediate initiatives are critically important:

- Creation of a sustainability officer position within Campus Planning and Facilities Management.
- Formation of a committee of administrators and faculty to review the undergraduate and graduate curricula with regard to issues of climate neutrality and sustainability.
- Engagement in the Medical Center Company's strategic planning process, specifically with regard to its transition away from coal use.
- Renewed commitment to sustainability leadership in Cleveland and the region.

Introduction

The decision to pursue carbon neutrality makes Case Western Reserve a leader among the more than 2,600 colleges and universities in the U.S. The way in which Case Western Reserve will pursue this goal is unique to its circumstances and character. This plan describes the path that university constituents established to achieve this objective.

President Barbara R. Snyder made the university's commitment to climate neutrality public by signing the American College and University Presidents' Climate Commitment in 2008. This step corresponded with the launch of *Forward Thinking*, the university's 2008-2013 strategic plan. *Forward Thinking* articulated the university's commitment to solving society's greatest challenges through a strategy that promotes key academic alliances, including energy and environment, human health, culture, creativity and design, and social justice and ethics. It pledges that the university will find new ways of collaborating to advance discovery and prepare students to become tomorrow's leaders.

Like *Forward Thinking*, the Climate Action Plan is meant to inspire and guide activities across the campus. It describes short- and long-term steps that the university will take to reduce and ultimately eliminate its carbon impact. In addition, it describes plans for educational opportunities that help ensure that Case Western Reserve graduates stand among tomorrow's sustainability leaders. As with the university's strategic plan, the Climate Action Plan encourages enhanced collaboration to advance greater discoveries, attract the best possible students and faculty, and stimulate alumni engagement.

As we look toward future efforts, it is important to celebrate earlier progress. In recent years, Case Western Reserve has benefitted from the passion and initiative of sustainability champions across the campus. The first wave of lighting retrofit efforts, for example, generated savings of nearly 200,000 kilowatt hours per year. From 2005 to 2009, annual recycling totals grew from 10 to 30 tons. The university offers a range of courses and programs focused on environmental studies, sustainable value and energy innovation; these efforts have generated significant momentum during the implementation of *Forward Thinking* and increased global recognition of the vital importance of these subjects. The university is grateful to all of the individuals who helped develop and advance these efforts; they provide a broad platform from

which to launch this Climate Action Plan.

Four initiatives proposed during the planning process are particularly important to realizing the university's goals and, therefore, deserve specific mention:

- Creation of a sustainability officer position within Campus Planning and Facilities Management. During the course of the development of this document, the university created such a position, recruited and screened candidates, and ultimately appointed Stephanie Corbett, an experienced leader in this field. She is expected to begin work in June 2011 and will use the Climate Action Plan as a guide for sustainability initiatives.
- Formation of a committee of administrators and faculty to review the undergraduate and graduate curricula with a goal of more effectively engaging tomorrow's leaders on the issues of climate neutrality and sustainability. This process will generate recommendations for curricular and extracurricular revisions and innovations.
- Engagement of the Medical Center Company (MCCo) in the university's Climate Action Plan objectives. In 2010, MCCo announced it would phase out the use of coal, and that phase-out is expected in the near term. The university, through its membership on MCCo's governing board, will participate in MCCo's strategic planning process and help explore innovative ways of serving MCCo's customers' needs. The university will use its Climate Action Plan as a platform for this interaction.
- Renewed commitment to leadership in Cleveland and regional sustainability initiatives. Created in 2009, the city's "Sustainable Cleveland 2019" campaign addresses issues of sustainability, such as energy conservation, sustainable food and transportation in

the decade that ends 2019. Already an important participant, the university's focus on carbon mitigation, as expressed in this plan, promises additional substance expertise and engagement in this municipal initiative. Similarly, the Collegiate Sustainable Practices Consortium has become a venue for Case Western Reserve to collaborate with its peers in pursuit of improved and shared carbon reduction and sustainability initiatives. This collaborative group seeks to enhance campus sustainability and capture the collective efforts in a campaign to establish a reputation for leadership for the region.

Greenhouse Gas Emissions Profile

Case Western Reserve inventoried its greenhouse gas emissions (excluding the West Campus) for fiscal years 2008 and 2009 with the Clean Air-Cool Planet™ calculator. For fiscal year 2009, the university generated 263,218 MTCO_{2e}, broken out as follows:

- Scope 1 emissions (direct emissions from sources owned or controlled by the university, including: on-campus stationary combustion of fossil fuels; mobile combustion of fossil fuels by institution-owned/controlled vehicles; and "fugitive" emissions) equal 19,171 MTCO_{2e}
- Scope 2 emissions (indirect emissions generated in the production of electricity consumed by the university) equal 183,003 MTCO_{2e}
- Scope 3 emissions (all other indirect university emissions that occur from sources not owned or controlled by the university) equal 61,176 MTCO_{2e}
- Purchased renewable energy credits equal 132 MTCO_{2e}

A Tradition of Sustainability

While creation of the university's *Climate Action Plan* is significant, it by no means represents the university's first foray into the realm of sustainability or climate change.

The Weatherhead School of Management's Fowler Center for Sustainable Value has embraced the concepts of "appreciative inquiry" and "sustainable value" as a response to contemporary challenges in business, such as generating wealth and stimulating competition while addressing stakeholder demands in a resource-constrained environment. The center's influence reaches from Cleveland to the United Nations.

Case Western Reserve's Great Lakes Energy Institute was founded in 2008. It supports faculty research that benefits the alternative energy industry and the region's economic development. This institute has been recognized widely for its contributions and honored by the state as a Center of Excellence. The institute has nearly 70 faculty members working across disciplines. Characteristic of Case Western Reserve, the Great Lakes Energy Institute is actively engaged with industry, philanthropic organizations, government and other universities to design new and improved means of supplying renewable energy and sequestering carbon.

Case Western Reserve is host to a strong and growing community of individuals who are concerned about the environmental impact of their lifestyles. Founded in 2009, the Sustainability Alliance emerged to engage researchers and educators from the humanities, engineering, law, management, medicine, and natural and social sciences in interdisciplinary study of problems affecting the health of the planet and society. The alliance's goal is to promote research, scholarship, education and community connections that translate into action. Its Green Teams are the structure for grassroots outreach programs. The Student Sustainability Council also offers an avenue for involvement and impact on

campus. The university supports sustainability interests through an aggressive program of recycling and composting. The university farm's four-part pledge to support the university through research, education, conservation and preservation brings the global issue of sustenance directly to the campus community.

Facility investment parallels the university's commitment to sustainability-focused research, teaching and community engagement. Case Western Reserve serves its community of about 15,800 people (9,800 students and 6000 faculty and staff) on its 567 acres in Cleveland and the Squire Valleevue and Valley Ridge Farms in Hunting Valley, Ohio, where it has constructed more than 7.6 million gross square feet (gsf) of space. Case Western Reserve's program of building investment in energy conservation measures, launched a decade ago, has improved energy demand in 30 buildings. In 2010, the university collaborated with The Ohio Solar Cooperative to install a 60-kilowatt photovoltaic array on Adelbert Gymnasium. In addition, the university is in the process of adding three wind turbines, the first of which is a 100-kilowatt turbine already installed on campus. The other two turbines will be near campus, but offsite, and will be 250 kilowatt and 1 megawatt in scale. These installations are intended to decrease reliance on fossil fuels, support the efforts of the Wind Energy Research Center and demonstrate prominently the university's commitment to its community and neighbors.

The university's concerns about facilities also focus on the institution's prime energy sources and those of its neighbors. Case Western Reserve and many of its neighboring not-for-profit institutions in University Circle are served by the MCCo, a not-for-profit district energy company that supplies steam, electricity and chilled water to its member entities. Founded in 1932, MCCo is able to deliver capital and operating efficiencies because of the size of its aggregated customer base. In 2010, MCCo's executive committee, which includes representation from Case

Western Reserve, urged the company to develop a plan to phase out its two coal-fired boilers. Further, MCCo has embarked on a strategic planning process to fully transition from reliance on coal as an energy source. MCCo has undertaken this strategic planning process to ensure its facilities will continue to satisfy its member entities' long-term demands in a reliable, economic, safe and environmentally acceptable way. This affords the university an opportunity to align MCCo's operation with Case Western Reserve's commitment to climate neutrality. More information on MCCo and its planning process can be found in Appendix A on page 23.

Sustainability and the Case Western Reserve Curriculum

University scholars in the social sciences, natural sciences, humanities, engineering, management and medicine—to name a few areas of study—are working on sustainability issues. Case Western Reserve is committed to supporting and expanding the work of these scholars through the efforts of the Fowler Center for Sustainable Value, Great Lakes Energy Institute, the Sustainability Alliance and other sustainability initiatives.

In many areas, the curriculum at Case Western Reserve already actively engages students on problems of climate and sustainability. In the Weatherhead School of Management, sustainability is one of the two MBA program themes from which students choose. Additionally, sustainability is woven into every core class at some level. The school is moving forward with plans to include sustainability, as one of two theme options, into undergraduate curriculum, as well.

Additionally, a multidisciplinary undergraduate major and minor in environmental studies has been offered in the College of Arts and Sciences since 1995. Faculty in seven departments teach required courses, and electives are available across four areas: arts and sciences, engineering, medicine and management.

University faculty members continually pursue research opportunities to expand the curriculum and broaden the institution’s research endeavors. Active engagement of emerging technologies is a constant concern for the technically focused disciplines on campus.

Finally, Case Western Reserve has several active sustainability-related student groups. These include the Student Sustainability Council, Engineers Without Borders and Net Impact. The Residence Hall Association also has an active sustainability program.

Case Western Reserve is committed to improving student engagement with sustainability-related issues. As an outcome of the *Climate Action Plan*, the university is considering a number of steps, including:

- Initiating a clearly focused review of environmental/sustainability education to produce a plan that will guide revisions to curriculum
- Creating incentives to increase the development rate of sustainability-related courses and/or course content
- Sponsoring an ongoing campus-wide lecture series that will feature speakers in sustainability and climate neutrality
- Developing content for new-student orientation as a tool for undergraduate engagement
- Expanding the Summer Undergraduate Research in Energy and Sustainability program to further support undergraduate research in energy-related fields. Expansion will focus on increasing activity overall; broadening the scope beyond the natural sciences and engineering to include fields such as the humanities, social sciences, arts, management and health; and to support work in sustainability areas other than energy.
- Creating an idea bank—an internally funded competition for research projects that would use the campus as a laboratory to investigate potential improvements for long-term benefits related to campus carbon reduction and energy/utility costs.

- Running an annual competition for university-funded externships that would enable undergraduates to work with external (local, national or international) organizations doing sustainability or climate-change related work.

Goals and Structure of the Planning Process


The University’s Vision

The university’s commitment to become carbon neutral by 2050 is aligned with the following vision of the university:

- The university will be characterized by a culture of sustainability that engages the entire campus community.
- The university will be recognized for its climate change-focused research, education and culture, including local social action, in such a way that these activities will attract faculty, staff and students.
- The university will be a place where its climate change-related advances result from collaboration across disciplines and involve faculty, staff and students.
- The university will advance its relationships within Cleveland and the surrounding region to realize local transformation relating to climate change.

Structure of the Planning Process

President Snyder served as chair of the Climate Action Plan Executive Committee and provided broad oversight of the process and outcomes of the plan. In addition to the executive committee, Case Western Reserve established a Climate Action Plan Steering Committee and an At-large Working Group to guide the efforts of eight topic-specific working groups responsible for recommending elements of the plan. Open forums were hosted for the community to learn about carbon reduction at Case Western Reserve and contribute ideas.



In November 2010, the university installed a 156-foot wind turbine on campus. It provides a portion of the Veale Athletic Center’s power and offers opportunities for alternative energy research.

The eight working groups included faculty, staff, students and community stakeholders. These groups met regularly to craft the plan and will continue their work to guide the plan’s implementation. Each working group proposed means of reducing the university’s greenhouse gas emissions. Proposals were screened by the At-large Working Group and Steering Committee to consider feasibility and financial sustainability. The preliminary proposals were then considered for their potential visibility, the extent to which they represented values-based ideas that align with those of the university, the potential for these proposals to attract financial support, and the ways in which they might perpetuate the university’s desired reputation and image relating to climate change. The objective of this process was creation of a portfolio of potential actions that addresses each of the stated criteria and collectively advances the social, environmental and economic platforms of sustainability.

Guiding Policies and Actions

University policy and campus activity in the next decade will set the course for achieving climate neutrality. Updates to this plan will be issued on a five-year basis and will reinforce the plan’s long-range goal of carbon neutrality. Thus, years one through five (2011 to 2016) are considered near-term and years six through 10 (2016 to 2021) are considered mid-term.

In issuing this plan, Case Western Reserve commits to the following activities that today form the basis for campus sustainability and carbon management:

Academic Excellence The Fowler Center for Sustainable Value, the Great Lakes Energy Institute and the Sustainability Alliance will be among the groups to advocate for programs that support the goals of this plan.

Community Engagement Campus organizations will continue to engage in on- and off-campus sustainability activities in the community. This includes the Sustainability Alliance, the Student Sustainability Council and the Staff Advisory Council Climate and Work Environment Committee.

On-campus Energy Sources The Wind Energy Research Center will continue to work on its plans to construct and operate three wind turbines. The university will continue to seek to collaborate with The Ohio Solar Cooperative to install photovoltaic arrays on campus buildings. Outreach and engagement will support use of these facilities for related industry investment and innovation.

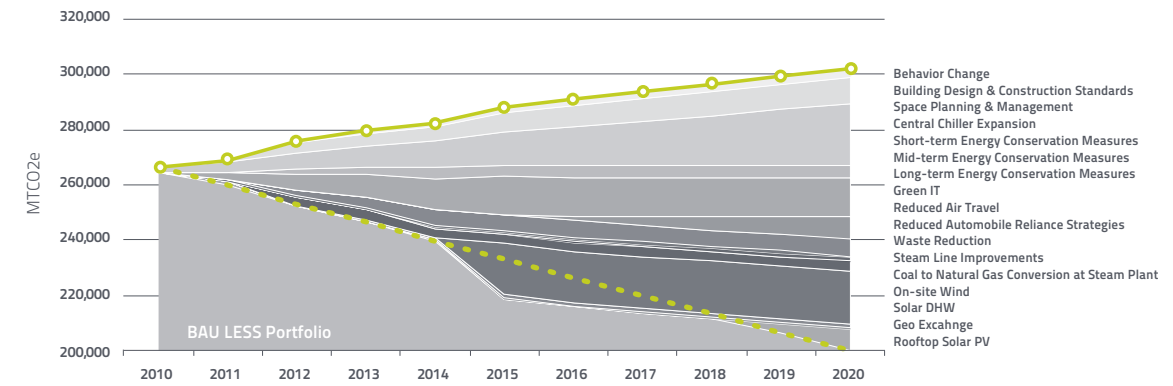
Waste Stream Reduction Campus recycling and composting will continue to be supported through campus services and education campaigns to stimulate the community’s active participation.

Information Tracking The university will participate in information-reporting with the American College and University Presidents’ Climate Commitment through required information reporting.

University Farm Squire Valleevue and Valley Ridge Farms will be maintained as campus property. Today, it supplies a portion of the campus’ food and provides learning experiences related to sustainability initiatives.

Medical Center Company The university will continue to participate on the MCCo board as MCCo aggressively pursues carbon reduction for Case Western Reserve and other member entities. The process will provide ample opportunity for MCCo and partner institutions to collaborate.

FIGURE 1



Carbon Mitigation Hierarchy

Case Western Reserve plans to achieve climate neutrality through carbon management and by reinforcing leadership, scholarship and community engagement. The university’s approach to carbon management will follow a hierarchy driven by the practical objective of ranking the most cost-effective investments for reducing emissions. Industry, government and academia generally share the experience that these investments adhere to the following hierarchy:

- The most cost-effective investments avoid demand for additional energy.
- Second to this are steps that reduce energy demand in existing facilities and equipment.
- Still less cost efficient are investments that replace carbon intensive fuel sources with alternatives.
- Finally—and as a measure of last resort—purchased offsets are used to balance any remaining emissions.

Carbon Mitigation Strategies: Near- to Mid-term

A number of carbon abatement strategies are being considered for the near term to provide the foundation for long-term carbon abatement. The short- and mid-term strategies address energy efficiency, policies that support efficient operations and supply-side energy resource investments that are less carbon intensive than business-as-usual strategies.

The near-term actions are illustrated in figure 1 above and described in the order of their respective position in the carbon hierarchy. Each option provides details of the financial and carbon metrics that were used to develop the near-term portfolio. All financial metrics are displayed in 2011 dollar values. For each option, the present value of capital costs,

energy costs and total net present value are provided, even for those options that have no additional capital costs. Also, avoided or additional non-fuel-based operating costs are noted to emphasize changes to the business-as-usual operations. Finally, annual average carbon reductions are shown to compare the relative impact of each abatement option on the university’s total carbon inventory.

Appendix C on page 28 provides brief background on the model that generated the analysis upon which these financial/carbon calculations were made.

Behavior Change

Financial (Millions of Dollars in 2011 Dollars) & Carbon Snapshot

Present Value New Capital Costs	\$0.20
Present Value Avoided Capital Costs	\$0
Average Annual Primary Energy (Fuel) Savings (Cost)	\$0.44
Average Annual New Non-Fuel Operating Costs	(\$0.05)
Average Annual Avoided Non-Fuel Operating Costs	\$0
Net Present Value	\$4.40
Average Annual Carbon Abatement (MTCO _{2e})	3,400

Case Western Reserve has focused on cultivating the citizenry of its students. Thus, this plan starts with recognition of the importance of encouraging members of the community—faculty, staff and students—to contribute to reducing their carbon footprints. The university’s role is to inform and motivate the campus community about how to act as individuals and as a community toward this end.

Other campuses have shown that targeted outreach can reduce energy demand by 5 to 20 percent. Successful campuses integrate real-time feedback mechanisms to track energy consumption and provide a sense of responsibility and capacity for change. Existing programs will be enhanced and new programs will be introduced to address what individuals can do to reduce energy consumption on campus.

Implementation

- The university will lead by example through its prominent role as a partner in innovative planning and investment in University Circle, Cleveland and Northeast Ohio.
- The university will drive culture change by expanding educational options related to carbon reduction and sustainability. The university will consider programs that recognize individual contributions and sponsor internships and externships to provide students with carbon reduction- and sustainability-related employment. This and other strategic initiatives will improve and broaden outreach in the Cleveland community.
- The university will seek to institute a regular process of reviewing the effectiveness of its carbon reduction-related community engagement. These reviews will help inform funding decisions.
- The university will institute use of surveys to learn about attitude, awareness and engagement of the university community.
- A communication campaign will raise awareness for the university and its sustainability efforts.
- The university will develop a “sustainability dashboard” infrastructure to be considered for installation in every building that will provide information on energy usage and patterns.

Building Design and Construction Standards

Campus Energy Use Intensity

Energy Use Intensity (kbtu/gsf) for New Space	Business as Usual	Projected
Purchased Electricity	66	46
Purchased Steam	102	72
Purchased Cooling	27	19

Financial (Millions of Dollars in 2011 Dollars) & Carbon Snapshot

Present Value New Capital Costs	(\$9.60)
Present Value Avoided Capital Costs	\$0
Average Annual Primary Energy (Fuel) Savings (Cost)	\$1.70
Average Annual New Non-Fuel Operating Costs	\$0
Average Annual Avoided Non-Fuel Operating Costs	\$0
Net Present Value	\$9.80
Average Annual Carbon Abatement (MTCO2e)	13,400

Building design, construction, operation and utility-use collectively represent the largest campus contribution to energy demand. Currently, design standards do not include thresholds for energy efficiency. To that end, Case Western Reserve will create building design standards to ensure a maximum level of energy efficiency. Applicable to new construction and major renovations, these standards can drive reductions of at least 30 percent as compared to current energy-use intensity

levels. The premium for increased energy efficiency is anticipated at 5 percent of construction cost. Typically, that added investment in building design is captured as energy savings within seven years.

Implementation

- The university will create standards and policy to drive the design and construction/renovation of buildings and landscapes. These policies will reference the standards for ASHRAE, an international group dedicated to advancing heating, ventilation, air conditioning and refrigeration while promoting sustainability. Policies will promote an energy-use intensity level lower than that currently found on campus. The policy also will address other elements of building sustainability, such as water and chemical usage.
- Campus landscape policies will employ plant materials that are sustained with less water and chemical use than current standards allow.

Space Management

Financial (Millions of Dollars in 2011 Dollars) & Carbon Snapshot

Present Value New Capital Costs	\$0
Present Value Avoided Capital Costs	\$377.00
Average Annual Primary Energy (Fuel) Savings (Cost)	\$5.60
Average Annual New Non-Fuel Operating Costs	(\$0.01)
Average Annual Avoided Non-Fuel Operating Costs	\$4.30
Net Present Value	\$480.00
Average Annual Carbon Abatement (MTCO2e)	43,300

The university is committed, to the fullest extent possible, to providing space to faculty, staff and students that supports their needs and comfort within the existing building stock. Recognizing that each square foot of space has an associated energy usage, the university recommends that space management include metrics for defining associated energy effect. This direction is motivated both by the will to preserve the important historic buildings on or near campus and the desire to improve space management, along with the desire to reduce excessive energy consumption. It represents a financial benefit as well, when compared to the cost of constructing new buildings and the operational cost that additional building spaces require.

Establishing a better understanding of building use and crafting space standards will launch this initiative, which is expected to avoid construction of about 2,955,000 gsf of new building space from 2010 to 2050.

Implementation

- The university will develop key policies and studies, such as a green-building policy and space standards, as a foundation and then will develop a new campus plan that considers the logic of this roadmap and those policies.
- The university will consider a policy that requires a needs assessment at the beginning of new building projects.
- The university will update its master plan to assess the impact of its space standards and otherwise realize a building program that seeks to maintain the scope that now exists, rather than dramatically increasing square footage. The new plan will respond to the *Climate Action Plan* through greater focus on sustainability, including investment in the university’s existing building stock.



The university earned a Leadership in Energy and Environmental Design (LEED) silver rating for the Village at 115 residence hall complex, which opened in 2005.

Energy Conservation Measures

Financial (Millions of Dollars in 2011 Dollars) & Carbon Snapshot

	Short-term	Mid-term	Long-term
Present Value New Capital Costs	(\$1.60)	(\$3.40)	(\$2.90)
Present Value Avoided Capital Costs	\$0	\$0	\$0
Average Annual Primary Energy (Fuel) Savings (Cost)	\$1.60	\$1.30	\$0.73
Average Annual New Non-Fuel Operating Costs	\$0	\$0	\$0
Average Annual Avoided Non-Fuel Operating Costs	\$0	\$0	\$0
Net Present Value	\$21.00	\$11.10	\$3.20
Average Annual Carbon Abatement (MTCO ₂ e)	12,700	10,200	5,500

Case Western Reserve has a program of regular investment in energy conservation. The Facilities Management Department undertakes lighting retrofits, envelope upgrades and a number of low-cost energy efficiency investments in campus buildings. Still, the university's building stock is ripe for additional investment in aging systems and improved building operations.

The university estimates about 10 percent of total energy consumption can be reduced through short-term activities in this area and an additional 20 percent can be reduced in the mid- and long-term. These activities include retro-commissioning and updating control systems. Older building HVAC systems can be updated with great controls and

flexibility. Lighting-control updates can continually be made to the building stock to ensure a lower lighting power density.

Implementation

- In the near term, Case Western Reserve will continue to implement energy conservation measures that have the shortest payback. After that, and in combination with building renovation projects, the university will undertake more substantial energy- and cost-effective investments in building-energy conservation. An energy-management plan is recommended to ensure a strategic and holistic effort for future campuswide energy conservation.
- Monitoring and tracking of energy return on investments in building upgrades should be calculated and verified with all building projects.
- Case Western Reserve will continue to monitor building energy consumption and create a benchmarking protocol to document campuswide energy use.

Green Information Technology

Financial (Millions of Dollars in 2011 Dollars) & Carbon Snapshot

Present Value New Capital Costs	(\$0.02)
Present Value Avoided Capital Costs	\$0
Average Annual Primary Energy (Fuel) Savings (Cost)	\$0.72
Average Annual New Non-Fuel Operating Costs	(\$0.02)
Average Annual Avoided Non-Fuel Operating Costs	\$0
Net Present Value	\$9.70
Average Annual Carbon Abatement (MTCO ₂ e)	5,400

The university's information technology patterns follow that of other campuses: Information technology has become a substantial source of energy demand. Given that, a centralized power-down option will likely generate electricity savings of about 90 watts per hour per computer. Purchase and use policies are an important augment to this savings.

Implementation

- A user audit will form the basis for realizing greater centralization of services and reduced energy demand associated with information technology.
- Policies will be developed and related investments will be made to realize improvements to equipment procurement and system management.
- A centralized asset management system will be considered to best manage all network-based IT infrastructures to maximize energy efficiency.

Steam Line Improvements

Financial (Millions of Dollars in 2011 Dollars) & Carbon Snapshot

Present Value New Capital Costs	(\$0.68)
Present Value Avoided Capital Costs	\$0.00
Average Annual Primary Energy (Fuel) Savings (Cost)	\$0.42
Average Annual New Non-Fuel Operating Costs	\$0.00
Average Annual Avoided Non-Fuel Operating Costs	\$0.00
Net Present Value	\$4.90
Average Annual Carbon Abatement (MTCO2e)	3,800

Steam distribution lines ensure heat delivery to buildings but can, over time, also represent a major source of heat loss. At Case Western Reserve, the age of most of the steam distribution lines (at least 40 years) and the efficiency losses of the steam distribution loop as measured by the flow and temperature of condensate returns, are evidence of the need for investment and renewal.

Implementation:

- The university will undertake steam line upgrades that will include increasing insulation and examination of steam trap performance.

Reduced Air Travel

Financial (Millions Of Dollars in 2011 Dollars) & Carbon Snapshot

Present Value New Capital Costs	\$0
Present Value Avoided Capital Costs	\$0
Average Annual Primary Energy (Fuel) Savings (Cost)	\$0
Average Annual New Non-Fuel Operating Costs	\$0
Average Annual Avoided Non-Fuel Operating Costs	\$0.18
Net Present Value	\$2.60
Average Annual Carbon Abatement (MTCO2e)	800

Some air travel is unavoidable; faculty and staff attend conferences and workshops that are critical to their work and to Case Western Reserve's visibility. Additionally, students participate in an athletic conference that covers considerable geography. The university recognizes the great opportunity that teleconferencing offers as an alternative to air travel

for some activities but ultimately concludes that it has limited opportunity to reduce air travel, a scope 3 emission.

Implementation

- Case Western Reserve will continue to offer alternatives, such as teleconferencing, and develop a policy to guide air travel decisions.

Reduced Automobile Reliance

Financial (Millions of Dollars In 2011 Dollars) & Carbon Snapshot

Present Value New Capital Costs	\$0
Present Value Avoided Capital Costs	\$0
Average Annual Primary Energy (Fuel) Savings (Cost)	\$0
Average Annual New Non-Fuel Operating Costs	(\$0.16)
Average Annual Avoided Non-Fuel Operating Costs	\$0
Net Present Value	(\$2.20)
Average Annual Carbon Abatement (MTCO2e)	1,400

The university will explore a transportation demand management program. Such programs elsewhere include increased on-campus parking fees, potential reduction in available on-campus parking spaces, subsidies for use of public transportation, improved circulation system and facilities for bicyclists and an improved pedestrian circulation system.

Implementation

- Policies will be considered to guide transition of commuting patterns away from single-occupancy vehicle use, to guide at-home

work scheduling within certain units of university staff and to limit air travel.

- The university will increase its collaboration with the Greater Cleveland Regional Transit Authority to ensure the best possible public transit services are provided to the university community.

Waste Reduction

Financial (Millions of Dollars in 2011 Dollars) & Carbon Snapshot

Present Value New Capital Costs	\$0
Present Value Avoided Capital Costs	\$0
Average Annual Primary Energy (Fuel) Savings (Cost)	\$0
Average Annual New Non-Fuel Operating Costs	\$0
Average Annual Avoided Non-Fuel Operating Costs	\$0.01
Net Present Value	\$0.04
Average Annual Carbon Abatement (MTCO2e)	200

Campus waste recycling and composting is cost competitive with waste disposal. The university plans to shift its resources to accomplish greater waste diversion, including introducing new rigor to procurement policies and practices with the aim of reducing volume and toxicity of university waste. This strategy will enable the university to increase the proportion of waste diverted while reducing total volume of the waste stream.

Implementation

- The university's procurement office will craft policies to drive university procurement that will generate less waste in general and

less toxic waste in particular. It will look for collaborative opportunities with neighboring institutions, both for learning and for bulk procurement.

- The university's food service will increase its waste-reduction activities and the visibility of these efforts.
- Campus waste management services will regularly wage efforts to inform the university community and encourage individual participation in recycling programs.

Central Chiller Plant Expansion

Financial (Millions of Dollars in 2011 Dollars) & Carbon Snapshot

Present Value New Capital Costs	(\$1.70)
Present Value Avoided Capital Costs	\$5.20
Average Annual Primary Energy (Fuel) Savings (Cost)	\$1.10
Average Annual New Non-Fuel Operating Costs	\$0
Average Annual Avoided Non-Fuel Operating Costs	\$0
Net Present Value	\$15.70
Average Annual Carbon Abatement (MTCO ₂ e)	4,900

Multiple phases of connecting Case Western Reserve buildings to the MCCo central plant are anticipated. Phases I and II are under way and will result in the Millis and Crawford loops being connected. Phase III will connect the Nord loop and Phase IV will connect Bingham.

By adding chiller capacity to include buildings that are either not being cooled or are being cooled through unitary building chillers, the university can expect to see some changes in its purchased chilled water and electricity usage. By connecting to larger central chiller plants,

those buildings that are currently conditioned will be conditioned more efficiently because of economies of scale and decreased need for purchased electricity to operate unitary chilled water systems and direct expansion systems on campus.

Implementation

- Increase the number of buildings connected to the Central Chiller Plants as proposed by Starr & Sons' Potential Medical Center Company Chilled Water Loop Study (2009).

Coal Conversion to Natural Gas

Financial (Millions of Dollars in 2011 Dollars) & Carbon Snapshot

Present Value New Capital Costs	\$0
Present Value Avoided Capital Costs	\$0
Average Annual Primary Energy (Fuel) Savings (Cost)	(\$0.35)
Average Annual New Non-Fuel Operating Costs	\$0
Average Annual Avoided Non-Fuel Operating Costs	\$0
Net Present Value	\$4.30
Average Annual Carbon Abatement (MTCO ₂ e)	21,600

Coal, the university's prime energy source for both steam generation and electric power purchased from third parties, is the most carbon intensive fuel available. Changing MCCo's steam plant systems to combust natural gas or other fuels instead of coal increases the carbon efficiency by more than 30 percent. This will likely reduce associated greenhouse gas emissions by more than 40 percent, which constitutes

the largest single carbon reduction option within this plan's abatement portfolio.

This fuel switch would address community concerns about the long-term impacts of coal. More information on this effort, and associated efforts with MCCo, can be found in Appendix A on page 23.

Implementation

- Through participation on the board of MCCo, the university will support MCCo's execution of its 2010 commitment to eliminate the use of coal as an energy source.

Building Scale Renewable Energy Systems

Financial (Millions of Dollars in 2011 Dollars) & Carbon Snapshot

Present Value New Capital Costs	(\$3.20)
Present Value Avoided Capital Costs	\$0
Average Annual Primary Energy (Fuel) Savings (Cost)	\$0.06
Average Annual New Non-Fuel Operating Costs	\$0
Average Annual Avoided Non-Fuel Operating Costs	\$0
Net Present Value	(\$2.50)
Average Annual Carbon Abatement (MTCO ₂ e)	500

The Adelbert Gymnasium and One-2-One Fitness buildings are currently being supplied with a 60 kilowatt photovoltaic system belonging to The Ohio Solar Cooperative. The system represents the university's commitment to investing in renewable energy. Anticipated improvements to building-scale energy systems are expected within the next decade to improve the financial viability of these investments.

Implementation

- The university will track industry innovations, monitor the availability of government incentives to employ these technologies and cultivate potential donor interest with the goal of installing at least three building-scale alternative energy systems within the decade.

Offsets

Reflective of the university's commitment to its regional economy and society, Case Western Reserve will undertake activity and invest in offsets within greater Cleveland. For example, carbon offset projects can take the form of low-income home weatherization and installation of solar water heaters, geo-exchange systems and wind turbines. In addition, Case Western Reserve University will seek to leverage its partners in University Circle and MCCo to realize greenhouse gas reductions. In some cases, the environmental credit for this activity would be attributed to the university. To the extent that projects like this still fall short of the university's offset needs, the university will turn to traditional vendors from whom it will purchase offsets.

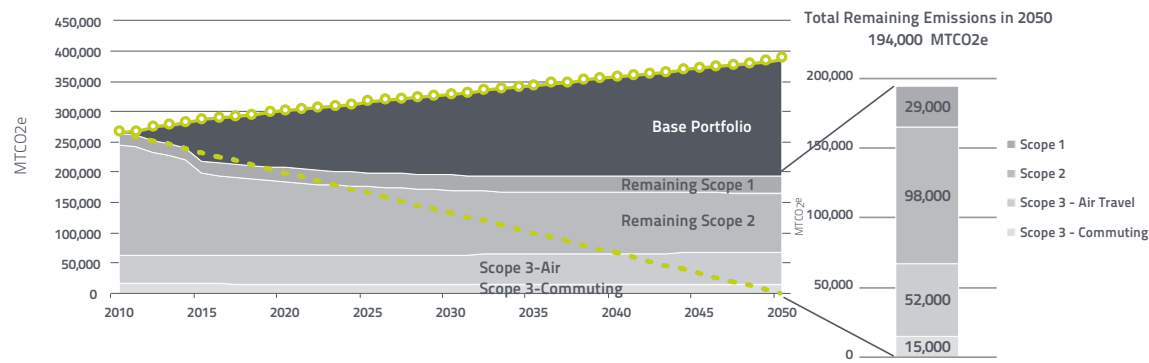
Implementation

- The university will look to offsets to keep pace with its desired reduction in greenhouse gas emissions.

Carbon Mitigation Strategies: Long-term

Through implementation of near- to mid-term strategies, the university expects to make major progress toward climate neutrality by 2020. Assuming these strategies are successfully implemented, the university still estimates more than 190,000 MTCO₂e will remain and must be abated, as shown in figure 2. The remaining scope 1 emissions are

FIGURE 2



associated with distributed combustion of natural gas on campus. For example, this includes building-level boilers and hot water heaters and the use of refrigerants. The scope 3 emissions, as labeled, are associated with faculty-, staff- and student-related commuting and university-sponsored air travel. The largest portion of the remaining emissions will continue to be scope 2 emissions associated with purchased utilities. The university anticipates that on-campus conservation and efficiency opportunities will continue to be a primary focus in the long term, just as they will be in the short term, to minimize scope 2 emissions. One of the key opportunities available to the university in the longer term is leveraging the valuable partnership with MCCo to investigate the possibility of implementing a combined heat and power system or another supply efficiency option at MCCo’s central plant.

Supply Efficiency and Combined Heat and Power Systems

If the near-term action of changing the central plant systems to natural gas combustion instead of coal is pursued, it will increase the carbon efficiency of MCCo’s central plant. The carbon efficiency of the central plant could improve even more by implementing a supply efficiency opportunity. One such opportunity that has been used successfully throughout the world, including at many top-tier research universities, is combined heat and power. Combined heat and power, also known as cogeneration, can improve campus energy efficiency and reduce greenhouse gas emissions by 15 to 30 percent.

Cogeneration is the sequential production of two forms of useful energy from a single fuel source. A typical central heat and power system recovers heat from electricity generation for productive uses, such as heating, cooling and dehumidification. This heat is usually rejected to the environment at conventional power plants, wasting usable energy. In addition, because the electricity is generated near the point of use, it is subject to fewer transmission losses than electricity supplied by

distant central power plants. For these reasons, properly designed central heating and power systems are potentially 70 to 85 percent more efficient and, therefore, can be more than twice as efficient as the average U.S. fossil fuel power plant. Such systems also can increase power quality and reliability while increasing the energy security of a facility, an important consideration for research universities.

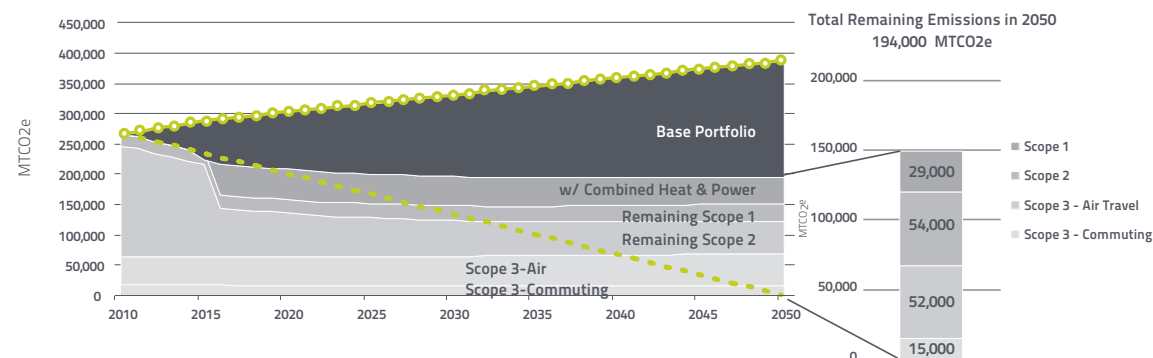
Implementation

- The university will continue to partner with MCCo to understand possible supply efficiency opportunities available to MCCo and the university and to potentially investigate the implications of implementing a combined heat and power system at the MCCo central plant. For illustration purposes, a conceptual combined heat and power system was modeled to understand the impact such a supply efficiency opportunity could have on greenhouse gas emissions for the university. The conceptual system modeled was a 15 megawatt system sized to offer base-load electricity supply and to provide a significant portion of the steam currently purchased by the university. This conceptual system could potentially provide 30,000-50,000 MTCO₂e of additional greenhouse-gas abatement beyond the savings of simply switching to natural gas. One of the primary sources of greenhouse abatement in this scenario results from avoiding the purchase of electricity from the grid, which is primarily supplied by generation units that combust coal.
- Implementation of a significant supply efficiency concept, such as a combined heat and power system, would keep the university on the path toward carbon neutrality through nearly 2030, and the remaining emissions could drop to nearly 150,000 MTCO₂e.
- It should be noted that these values are conceptual and directional only. Any supply efficiency opportunity of this magnitude



Produce harvested from the university’s farms in Hunting Valley, Ohio, supplies fresh and local food for campus dining facilities.

FIGURE 3



will require significant research and investigation by the university and MCCo. Implementing these types of central supply opportunities traditionally requires a significant amount of up-front capital, and they are frequently subject to additional risk and uncertainty (ie. switching to a fuel source that may be subject to greater price volatility). Additionally, the concept above was modeled at the university scale; a larger scale will need to be investigated if this opportunity is pursued for the entire MCCo system.

Additional Long-term Opportunities

Beyond supply efficiency opportunities, the university will continue to investigate other potential opportunities for implementation. For example, the largest portion of the remaining emissions in figure 3 above continues to be the scope 2 emissions associated with purchased utilities. One option for future consideration may be to investigate a carbon-neutral fuel source that would be complimentary to the combined heat and power system, such as a liquid or biofuel. Other alternative fuel source opportunities will be investigated, as well, and given the long-term nature of this plan, new technologies previously not considered may emerge.

The second-largest source of remaining emissions is associated with university-sponsored air travel for faculty, staff and students. A future option to consider might be the implementation of a voluntary carbon offset program where the individual traveler or the university purchases offsets to be applied toward the greenhouse gas emissions associated with travel. Offsets could be purchased through an airline-sponsored program, through a voluntary offset exchange such as the Chicago Climate Exchange or through programs available through companies that offer the opportunity to purchase offsets for which the proceeds are applied toward specific projects.

Opportunities such as a carbon neutral fuel source and an air-travel offset program may enable the university to remain on the path toward neutrality through 2045 as illustrated in figure 4. Additional opportunities exist for abatement of the remaining scope 1 and scope 3 emissions, but it is important to remember that the *Climate Action Plan* is a living document, and strategies and opportunities will change and evolve.

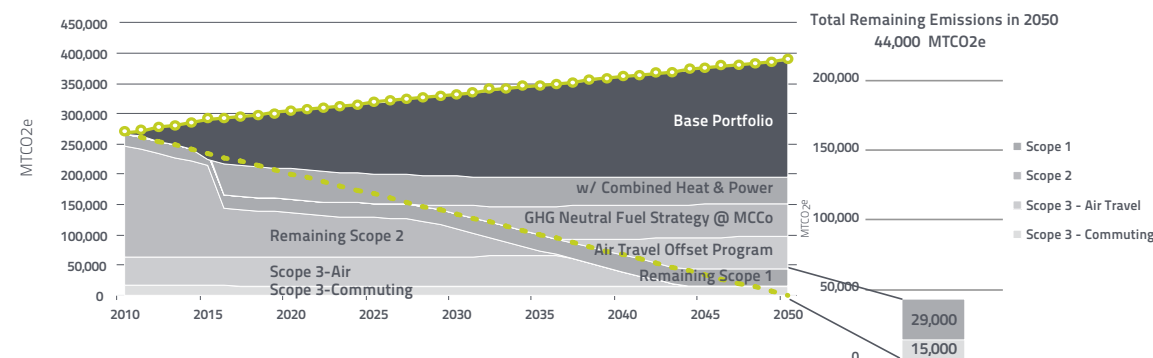
The *Climate Action Plan* will be revisited on a schedule of at least every five years. This will give the university the opportunity to collectively review the expected and actual outcomes of carbon abatement strategies. It also will serve as opportunity to set mid-course corrections on the selection and scheduling of mitigation strategies. At the time of the *Climate Action Plan's* creation, for example, carbon sequestration through biochar and other transformative means has little relevance to the university, but innovation may change its value. The university's identified abatement strategies represent a holistic approach at reducing Case Western Reserve's carbon output.

Where the measures show a gap between planned actions and carbon neutrality, two activities can be anticipated to fill the void. The first, regular updates to the plan will incorporate innovation in technologies that offer new and improved strategies. The second is through purchase of offsets. Many third-party verified entities exist from which the university could purchase carbon offsets; and as described above, the university's intention is to realize offsets that benefit Cleveland and its surrounding region.

Conclusion

Case Western Reserve is committed to achieving a zero-carbon footprint by 2050. However, even using all of the best conservation practices and cost-effective technologies known to be available at this time leaves the university with a significant shortfall beginning around

FIGURE 4



2020. Under the best of circumstances, projections show the university with a 44,000 MTCO_{2e} shortfall. At this point, an action of last resort would be to purchase carbon offsets; however, the university feels that for reasons cited below, such large-scale purchasing may be unnecessary. The university will:

- Embrace a sound strategy to
 - reduce energy requirements in all existing facilities
 - design future facilities to minimize energy demand
 - support investments needed to replace carbon-intensive fuels and systems with alternatives
- Evaluate the possibility of investing in local carbon offset programs, such as improving insulation in local single family dwellings of low- to moderate-income households
- Consider the possibilities of extensive geothermal energy sources and of making large-scale investments in facilities owned by University Circle institutions
- Continue to cultivate its investment in education, research and outreach to generate ideas and innovative actions that will reduce the forecasted carbon shortfall

The university fully expects that its committed and watchful community will seize upon appropriate social, economic and technological advances to achieve carbon neutrality and position Case Western Reserve locally, regionally and nationally as a leader in the field of carbon reduction.

Yet, perhaps the most important result of this *Climate Action Plan* will be the education of and investment in students, who will become tomorrow's sustainability leaders.

Appendix A

Case Western Reserve and the Medical Center Company

The MCCo is a not-for-profit district energy company. Its members are nine not-for-profit institutions located in the University Circle area of Cleveland. Two of those members, Case Western Reserve and University Hospitals, consume more than 90 percent of MCCo's output, and they share voting control of MCCo's board and direct its operations.

MCCo offers three principal "products" to MCCo customers: steam, chilled water and electricity. MCCo generates steam in on-site boilers, using both coal and natural gas as fuel. It produces chilled water in on-site chillers that are powered by electricity purchased from Cleveland Public Power, and it distributes electric power through an MCCo-owned system to its customers. Not every member purchases every MCCo product, although Case Western Reserve and University Hospitals purchase all three—steam, chilled water and electricity.

As a district energy company, MCCo provides substantial benefits to its customers in terms of both cost and reliability. The services provided by MCCo represented almost 70 percent of the university's greenhouse gas emissions in 2009.

As Case Western Reserve looks to the future, the criteria by which optimal utility services will be judged will become more complex. While cost of service and capital stewardship will remain critical metrics, other emerging considerations relate utility service to the institution's teaching, research and outreach missions. Thus, the university also must understand and guide the impact its operations have on the community and on greenhouse gas emissions.

The university's *Climate Action Plan* recognizes that the MCCo district energy model remains compelling for utility services and that it can be developed as a critical element of the university's strategic path to car-

bon neutrality. For example, MCCo is expanding its central chiller plant to enable the university to eliminate smaller, relatively inefficient chillers located in individual buildings. The near-term, 40 percent improvement in efficiency will translate directly to a 40 percent decrease in the associated emissions. Of greater significance, MCCo has committed to eliminate the use of coal, which will likely reduce associated emissions by more than 40 percent.

At the time of this plan's creation, MCCo is planning to modernize its facilities and satisfy its customers' long-term demands. MCCo also recently has hired its first director of sustainability, who will initiate a variety of demand-side management and other sustainability programs for MCCo and collaborate with MCCo members' sustainability directors.

MCCo's strategic planning process will determine how it will execute its commitment to phase out coal use, and it will evaluate a range of alternatives, including:

- Cogeneration of heat and power
- Heat recovery from chillers
- Alternative energy capabilities, such as pipeline quality biomethane and renewable power
- Purchases of renewable energy credits and carbon credits
- Distributed customer-owned generation resources
- Energy conservation

Among the metrics that will be used to consider strategies, each will be understood for its greenhouse gas impact on the university and for the "optionality" it represents relative to greenhouse gas mitigation. For ease in comparison, the employed methodology will be consistent with that used in the university's *Climate Action Plan*.

Appendix B Working Group Results

Climate Action Plan working groups and their recommendations are summarized below:

Campus Planning and the Built Environment Working Group

Led by the campus architect, Margaret Carney, members of this committee believe the university can address building-related energy demand through a combination of enhanced scheduling and assignment of campus space and building renovation that addresses energy conservation, incorporates green building standards and reconfigures interior space to respond to current and future needs. Through these strategies, the university will avoid the greater capital and operating expenses associated with implementation of the 2005 master plan for which there was a total predicted new building program cost of \$500 million. Before these efforts are undertaken, the Campus Planning and Built Environment Working Group would have the university develop standards to be used across the university in assigning space.

The group also recognizes that campus energy demand related to commuter travel can be reduced through circulation system improvements that support the needs of pedestrian and bicycle traffic.

Community Outreach/Campus Life Working Group

This working group, spearheaded by Latisha James, director of community relations, adopted two principles to guide the university's community outreach and campus life activities related to climate change. The first of those principles is that culture change is motivated by leadership-supported programs, services and initiatives that serve to educate, motivate and engage the campus community. The second is that citizenship is reinforced through constant and visible cues of asso-

ciated cultural norms. In other words, campus climate neutrality cannot be achieved without a culture of sustainability.

The group recommends steps to launch outreach and campus-life activities that support these principles. These include:

- Providing information about the university's commitment to supporting climate neutrality at a wide variety of major university-sponsored forums
- Regularly reviewing the university's sustainability successes and continuing to invest in those efforts that prove most effective
- Conducting regular surveys to gauge attitude, participation and best direction for community outreach and campus life initiatives.
- Rewarding individuals who make significant contributions to the university's carbon reduction-related initiatives
- Supporting and coordinating with carbon reduction-related curriculum
- Encouraging green practices by campus administrative units

Education and Research Working Group

Physics Professor John Ruhl had complete support from the other members of this working group in concluding that the university should immediately examine how its undergraduate and graduate curricula can better embrace the study of climate change. The group recommends that the university increase the number of internship and externship programs that focus on climate change/sustainability; initiating a clearly focused review of environmental/sustainability education to guide revisions to curriculum ; creating incentives to increase the development rate of sustainability-related courses and/or course content; and sponsoring an ongoing campus-wide lecture series that will feature speakers in sustainability and climate neutrality, among other suggestions.

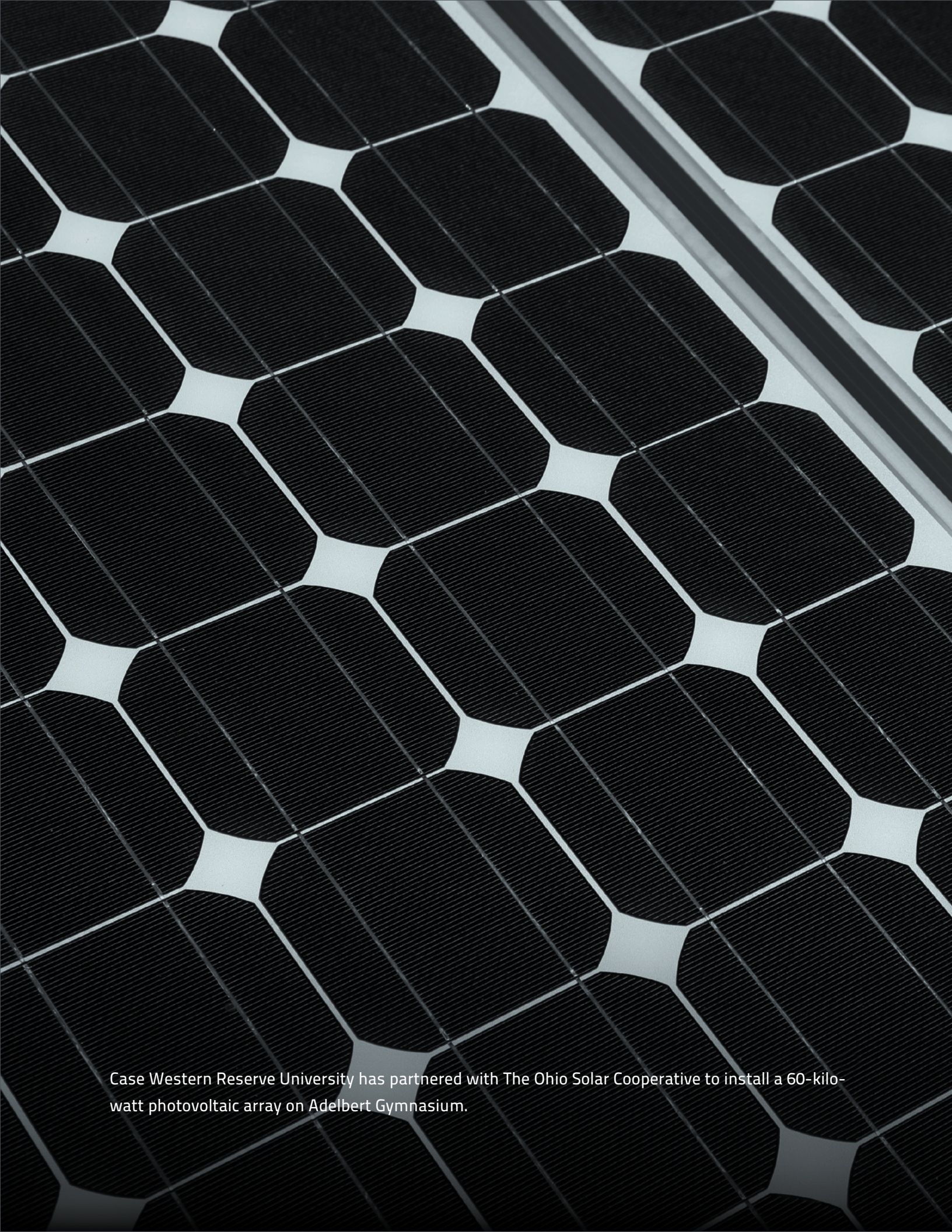
Like the Community Outreach/Campus Life Working Group, this group recommends that major campus forums should bring focus to this issue. It also recommends increased collaboration with the Great Lakes Energy Institute and increased research investment in the area of climate change with focus on energy storage and soil sequestration.

Energy Consumption and Conservation Working Group

Chaired by Gene Matthews, director of facilities services, this working group had many recommendations and most emphatically supported conversion of the MCCo fuel sources from a combination of coal to natural gas to entirely natural gas. Other important system-level innovations recommended by this group include: construction of a combined heat and power facility, intelligent building systems management, expanding the central chilled water plant and enhancing its network connections to university buildings, and upgrading campus steam lines. At the building level, the group recommended continued investment in energy conservation measures, upgrades to unitary chillers, building metering and monitoring, and pilot testing of building-level heat-recovery systems. Two critical policy directions were urged: creation of standards for building controls and examination of the existing rate structures to encourage users to decrease energy demand.

Information Technology Working Group

Director of Technology Infrastructure Services Jeff Gumpf led this working group to the conclusion that significant energy reductions related to information technology can be accomplished. However, the working group cannot quantify this potential because of the decentralized information technology system at Case Western Reserve. An audit to ascertain a baseline will provide an understanding of steps that can be taken to reduce the energy impact without forcing the university to adopt a fully centralized system. The working group recommends integration



Case Western Reserve University has partnered with The Ohio Solar Cooperative to install a 60-kilowatt photovoltaic array on Adelbert Gymnasium.

of asset-and-power management software along with information technology energy audits to better control the power-management settings of university-owned systems. This also will serve to improve related auditing capabilities and security. Server virtualization is recommended to reduce the increasing energy load on servers on campus. The efficiencies gained behind server utilization rely on the economies of scale of data centers offsite. Smaller on-campus data centers as well as individual servers use more energy than the growing market of centralized data centers.

Many of these opportunities challenge the Case Western Reserve culture. Power-management software may be considered invasive and server virtualization may be considered inconvenient for those that prefer smaller individual servers in their offices. Increased education and outreach must be considered as a parallel effort to all information technology options to ensure adoption.

Renewable Energy/Offsets Working Group

The Weatherhead School of Management's Fowler Center for Sustainable Value lent its expertise to this process through the leadership of Roger Saillant, executive director of the center. Saillant guided this working group through consideration of the relationship of the university to MCCo, which provides the majority of the university's energy supply. Based on its preliminary studies, this working group recommends that the university pilot two solar thermal domestic hot water installations. The findings of these pilots would be used to guide potential future installations. According to this working group, the Squire Valleevee and Valley Ridge Farms have potential as locations for a solar thermal installation. Government subsidies may be secured for such an investment, and electricity generated by the installation would support the farm's functions and be sold to the grid. Soil conditions on campus and in the community may be well suited for geexchange (ground source

heat pumps). This committee recommended that the university pursue preliminary testing to establish prime locations in combination with planned improvements and/or opportunities to secure government financing in support of such projects. The Ohio Wind Energy Research and Commercialization Center is in the process of installing three wind turbines on campus. These will generate nonfossil-fuel energy to serve campus needs and function as a laboratory for observation and study by university researchers and commercial entities.

Transportation Working Group

This group of staff and students was led by Beth Nochomovitz, director of auxiliary services. The group found that the most significant opportunities for reducing carbon associated with university travel will be accomplished through shifting commuter patterns. University policies can leverage more of the workforce to work from home. Incentives and improved facilities can encourage the entire community to more regularly use public transportation, carpool, bicycle and walk between home and campus. In studying university air travel patterns, the group concluded that relatively little of it could be expected to be replaced by teleconference.

Waste Working Group

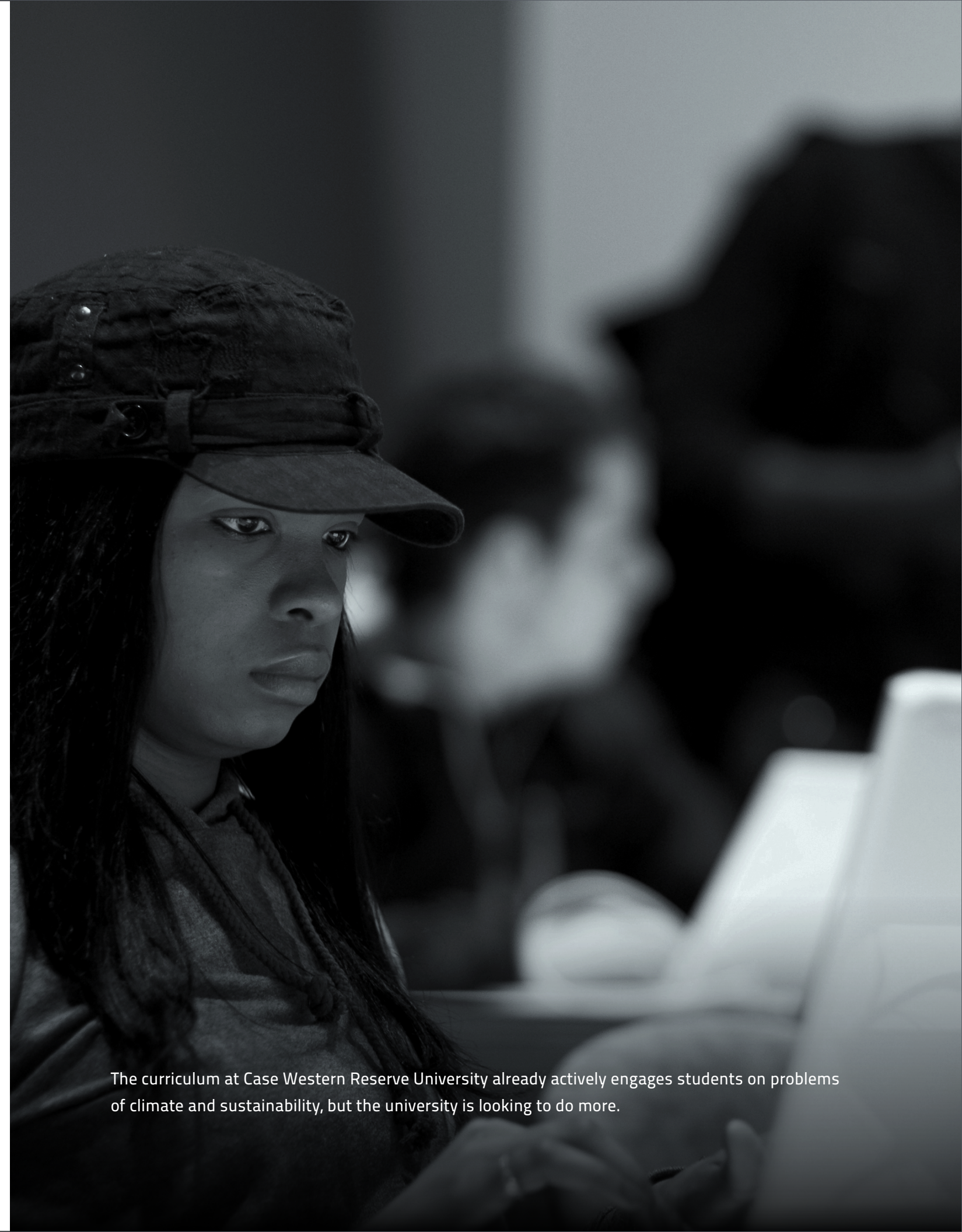
The university's Department of Custodial Services' Tangelia Scott Jones led this group of staff, students and an invited guest to study costs. The team concluded that the university's recycling/composting programs are cost competitive with its waste disposal but are inefficient in their capture rates. Future initiatives, as recommended by this working group, will increase community education and reinvigorate the recycling/composting program to realize better capture rates. Involvement from Procurement and Distribution Services will lead to a program for university goods and services that will reduce packaging, increase the

amount of packaging that can be recycled or composted, and reduce the toxicity of the materials that are procured.

Appendix C

Model Description

The Climate Action Plan Model is a spreadsheet-based model used in the development of Case Western Reserve's *Climate Action Plan*. A document outlining the key assumptions and sources of information used in the development of the model is available at case.edu/climateactionplan. The purpose of this document is to describe the business-as-usual reference case used in the planning process and familiarize the user with the intended use of the various sections of the Climate Action Plan Model. This document is organized according to the same flow and topics of information that are available in the model. Please reference this document at the link above for further information. The Climate Action Plan Model also available for download and review and can be found at case.edu/climateactionplan.



The curriculum at Case Western Reserve University already actively engages students on problems of climate and sustainability, but the university is looking to do more.

Apendix D : Project Team

EXECUTIVE COMMITTEE

Barbara R. Snyder

President

William A. Baeslack III

Provost and Executive Vice President

John F. Sideras

Senior Vice President, Finance and Chief Financial Officer

John D. Wheeler

Senior Vice President, Administration

STEERING COMMITTEE

Steve Campbell

Vice President, Campus Planning and Facilities Management

Margaret Carney

University Architect and Associate Vice President, Campus Planning and Design

Kathleen Dowdell

Staff Advisory Council Representative

John Lawyer

Associate Vice President, Campus Planning and Facilities Management

Gene Matthews

Director, Facilities Services

Linda Robson

Sustainability Coordinator

John Ruhl

Professor of Physics and Director, Sustainability Alliance

WORKING GROUPS AND CHAIRS

At-large

Linda Robson, Chair

Sustainability Coordinator

Ali Ahmed, Cisco Systems

Aparna Bole, University Hospitals

Steve Campbell, Campus Planning and Facilities Management

Kathleen Dowdell, College of Arts and Sciences; Staff Advisory Council

Jim Gross, Budget and Financial Planning

Quentin Jamieson, Student

Lara Kalafatis, University Relations

John Lawyer, Campus Planning and Facilities Management

Evan Meszaros, Student

Minh-Tri Nguyen, Student

Susan Tullai-McGuinness, Frances Payne Bolton School of Nursing; Faculty Senate

Campus Planning and the Built Environment

Margaret Carney, chair

University Architect; Associate Vice President, Campus Planning and Design

Joanne Brown, Campus Planning and Design

Tristan Chen, Student

Nick Christie, Construction Services

Paul Holter, Facilities Management, Case School of Engineering

Ruth Jacob, Student

Joseph Karas, Student

Ken Klika, Facilities Management, College of Arts and Sciences

Rick Pruden, Construction Services

Jill Stanley, Space and Facilities Planning, School of Medicine

Communications

Glenn Bieler, Chair

Associate Vice President, University Marketing and Communications

Stephanie Graves, Student

Elizabeth Irizarry, Student

Nick Kline, Information Technology Services

Sandhya Kotha, Student

Tricia Schellenbach, University Marketing and Communications

Chip Valleriano, University Marketing and Communications

Lei Yang, Student

Community Outreach and Campus Life

Latisha James, Chair

Director, Center for Community Partnerships

Betsy Banks, Center for Civic Engagement and Learning

Mayo Bulloch, Educational Enhancement Programs

Cathalina Gutierrez, Student

Keith Lupton, Student

Sue Nickel-Schindewolf, Student Affairs

Tatiana Riedel, Mandel School of Applied Social Sciences

Alma Sealine, Housing, Residence Life and Greek Life

Elena Stachew, Student

Patricia Waiwood, Student

Education and Research

John Ruhl, Chair

Professor of Physics, Director of the Sustainability Alliance

Willis Alala, Student

Trevor Allen, Student

Dianne Anderson, Great Lakes Energy Institute

Jeremy Bendik-Keymer, College of Arts and Sciences

Kyle Berkowitz, student

Mark DeGuire, Case School of Engineering

Julia Grant, Weatherhead School of Management

Jessica Green, College of Arts and Sciences

Peter McCall, College of Arts and Sciences

Evan Meszaros, Student

Sheila Pedigo, Support of Undergraduate Research and Creative Endeavors

Energy Consumption and Conservation

Gene Matthews, Chair

Director, Facilities Services

Iwan Alexander, Case School of Engineering

Sam Arlia, Facilities Services

Anshuman Chanrachud, Student

Joe Ferritto, Facilities Services

Mike Heise, Medical Center Company

Ryan May, Student

Dale Nenadal, Facilities Services

Neil Poria, Student

Todd Rasmussen, Housing, Residence Life and Greek Life

Brian Robb, Student

Laura Watt, Weatherhead School of Management

Information Technology

Jeff Gumpf, Chair

Director, Technology Infrastructure Services

Apoorva Chandar, Student

Maria Dimengo, Student

Thomas Dooner, Student

John Landers, Information Technology Services

Dennis Risen, Information Technology Services

Project Team (continued)

Bob Sopko, Information Technology Services

Renewable Energy and Offsets

Roger Saillant, Chair
Executive Director, Fowler Center for Sustainable Value

Gerasimos Houpis, Student

Ana Locci, Squire Valleevue and Valley Ridge Farms

Dave Matthiesen, Case School of Engineering

Gary Murphy, Weatherhead School of Management

Vahagn Yeranossian, Student

Transportation

Beth Nachomovitz, Chair
Director, Auxiliary Services

Rose Jemmy Demgne, Student

Robin Dubin, Weatherhead School of Management

Matthew Fieldman, Student

Camilla Gaitor, Controller's Office

Dick Jamieson, Campus Services

Michael Kurutz, Travel Services

Steven LaDelfa, Student

Aphroditi Mamaligas, Student

Loretta Sexton, Housing, Residence Life and Greek Life

Bill Wagner, Physical Education and Athletics

Patricia Waiwood, Student

Waste

Tangela Scott-Jones, Chair
Administrator, Department of Custodial Services

David Apthorpe, Bon Appétit Management Company

Chen-Dah Chiang, Student

Joe Cooper, Custodial Services

Toni Curry, Foundation Relations

Beau Daane, Student

Danny Merritt, Recycling

Evan Meszaros, Student

Jim O'Brien, Bon Appétit Management Company

Joe Tepley, Landscaping and Grounds

Yibo Wang, Student

Consultants

Brie Hensold, Sasaki Associates

Willa Kuh, Sasaki Associates

Jeannette LeBoyer, Affiliated Engineers Inc.

Andrew McClurg, Sasaki Associates

Robert McKenna, Energy Strategies LLC

Nick Travis, Energy Strategies LLC

Mike Walters, Affiliated Engineers Inc.

case.edu/climateactionplan



10900 Euclid Avenue
Cleveland, Ohio 44106-7017