Climate Action Planning Strategies for Achieving Carbon Neutrality and Net Zero Campus Operation

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ABSTRACT

Scientists, business leaders and heads of government around the world are in agreement: climate change is one of the most serious issues facing our global society today. Colleges and universities have an opportunity to exercise leadership in their communities by providing the knowledge, research, practice, and informed graduates that can create a positive and more sustainable future.

The process of Climate Action Planning, used by over 680 colleges and universities in the U.S., provides a useful template for sustainable campus operation, incorporating deep energy efficiency and reduced carbon emissions. The planning includes on-site renewable energy and retro-commissioning aimed at achieving carbon neutrality and net-zero campus operation within the conceivable future.

This paper will explore Climate Action Planning implemented on several higher education campuses in the Midwest, including two recent case studies completed between 2011 and 2015. The tools and processes for carbon footprint inventory will be discussed to inform other institutions and professionals pursuing similar goals.

The planning process starts by conducting a carbon emissions inventory, compiled using scope-based methodology: Scope 1 (equipment on campus), Scope 2 (off-site energy production) and Scope 3 (transportation). The carbon emissions data is then translated into a set of actionable goals and strategies, while the planning process continues through a series of workshops including representatives of the institution's administration, operations, students and faculty.

The proposed goals and strategies are envisioned as complementary tools for achieving carbon neutrality and net zero campus operation. The final plan consists of four complimentary strategy areas: Mitigation, Renewable Energy, Adaptation and Resilience, Engagement. These strategies are broken down into actionable, quantifiable and measurable goals that will be implemented through standard campus operation.

The Climate Action Planning process reduces the likelihood of unmanageable change, helps manage the risks, and takes the advantage of new opportunities created by our changing climate.

Keywords: *climate change, sustainable neighbourhood, energy measurement and verification*

1. INTRODUCTION

Since 1993, over 4,000 faculty and administrators at hundreds of U.S. colleges and universities collaborated with Second Nature1 to coordinate their joint response to global warming and climate change, and make the principles of sustainability essential to every aspect of higher education. In late 2006, twelve visionary college and university presidents initiated the American College and University Presidents' Climate Commitment (ACUPCC)2, a reporting system which was later expanded into Second Nature's Climate Leadership Commitments, consisting of the Climate Commitment, the Carbon Commitment and the Resiliency Commitment.

Today, over 680 higher education institutions in the U.S. have signed the Second Nature's Climate Leadership Commitments. The Commitments are requiring them to implement annual tracking and planned reduction of their overall CO_2 emissions and related carbon footprint. As the current number of signatories reached hundreds of institutions nationally, many participating colleges and universities are faced with a significant dilemma: if unchecked, needed campus expansion and building modernization would increase their existing building area and in turn, simultaneously increase overall energy use, long-term utilities and maintenance costs and resulting carbon emissions. This realization opened the path to tighter integration on previously not closely related areas of academic programming, building design, energy use and campus planning and operation, which often had competing or mutually conflicting goals.

1.1 Opportunities for climate action on higher education campuses

This paper will briefly review Climate Commitment requirements, the process of initiating and implementing Climate Action Plans. Additionally, two case studies will be explored to illustrate how similar issues could be addressed by integrating climate action into campus operation and sustainable master planning process. The case studies also showcase the new sustainable master plan model which incorporated the Climate Action planning into traditional master planning process.

Resulting hybrid approach evaluated and proposed climate action strategies and technologies designed to improve campus-wide energy efficiency, reduce greenhouse gas emissions and firmly integrate sustainability into campus operations and the academic curriculum.

2. CLIMATE ACTION PLANNING PROCESS

The Carbon Commitment defines climate neutrality as having no net greenhouse gas (carbon) emissions by a certain date selected by each reporting higher education institution. The process of climate action planning starts by conducting an institutional carbon emissions inventory, compiled using three-scope-based methodology based on Scope 1, Scope 2 and Scope 3. While the energy use, size and campus operation model of each institution varies, the Scope based-carbon emissions inventory allows for easier comparison and benchmarking between campuses. Scope 1 emissions are a result of equipment located and used on campus and operated by the institution. Scope 2 emissions represent carbon generated during the energy production derived from non-renewable sources, typically energy purchased from the utility grid. Scope 3 emissions are generated by transportation of students and faculty to and from the campus.

The collected carbon emissions data is translated into a set of actionable goals and strategies, while the planning process continues through a series of workshops including representatives of the institution's administration, operations, students and faculty.

2.1 Carbon footprint data collection

Participation in Second Nature's Climate Commitment requires detailed greenhouse gas (carbon emissions) accounting, which describes the ways to inventory and audit greenhouse gas emissions produced by the reporting entity. The accounting of greenhouse gas generates data used to create annual carbon emissions inventories.

Educational institutions can use carbon emissions inventories for a variety of reasons: to better understand the sources and trends in emissions on their campuses, as well as to plan how to mitigate and reduce them through proper building design and construction. Carbon emissions are calculated and reported over a 12-month period, as is standard practice, while climate action plans are devised to eliminate greenhouse emissions by a given date, selected by each participating institution.

A greenhouse gas inventory is a process of accounting for all carbon emissions resulting from a university or community college's operation. To simplify the data collection process, institutions may choose to calculate their emissions according to their fiscal year rather than by calendar year. All emissions data is reported in metric tons of carbon dioxide equivalent (CO_2e). The emissions data is further categorized based on scope.

3. CLIMATE ACTION STRATEGIES

The proposed goals and strategies are envisioned as complementary tools for achieving carbon neutrality and net zero campus operation. The final plan consists of four complimentary strategy areas: Mitigation, Renewable Energy, Adaptation and Resilience, Engagement.

These strategies are broken down into actionable, quantifiable and measurable goals that will be implemented through standard campus operation. Each of the proposed strategies was reviewed by several of the committees instituted to guide, advise and inform strategy formulation and the climate action planning process. Administration, Operations and Maintenance, Faculty and Students are some of the typical committees recommended as the best representation of all interested parties on a given campus.

3.1 Mitigation strategies

Mitigation strategies include various energy-efficiency measures, reduction of transportation related to student and faculty commute, improvements in operation and maintenance and overall reduction of waste generated on campus (Figure 1).

Figure 1: Mitigation strategies – Waste reduction and handling

3.2 Renewable energy strategies

Renewable energy strategies relate to on-site clean energy generation. Systems to be considered include wind-generated energy, solar, geothermal, renewable energy purchases and offsets. (Figure 2).

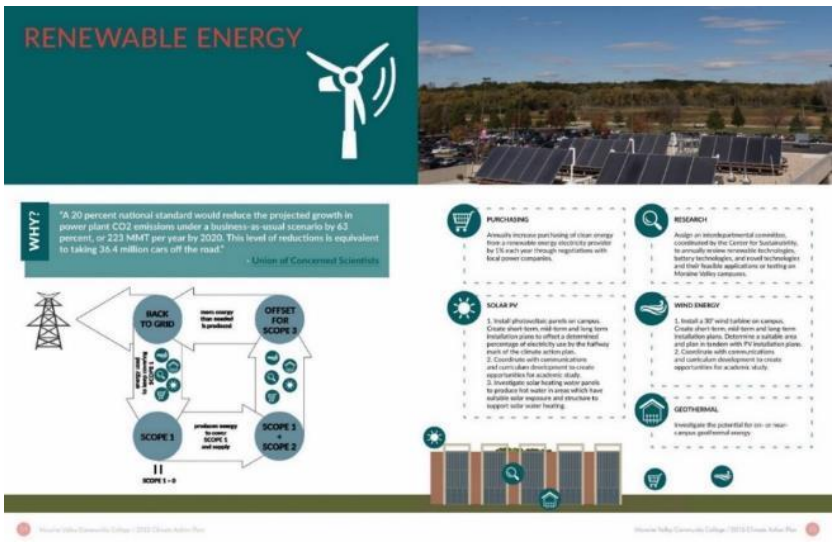

Figure 2: Renewable energy strategies – Wind, solar and geothermal

3.3 Adaptation and resiliency strategies

Resiliency strategies aim at increasing ability of the institutional systems to respond and resist impact of man-made and natural disasters. (Figure 3).

Figure 3: Adaptation and resiliency strategies

3.4 Engagement strategies

Community engagement and internal culture change are critical to communicate goals of Climate Action Plan and its strategies to students and faculty (Figure 4).

Figure 4: Community engagement strategies

4. CASE STUDIES

This section explores Climate Action Planning process implemented on two higher education campuses located in the U.S. Midwest region and completed in 2011 and 2016, respectively.

4.1 Case study 1: Joliet Junior College - 2011 Climate Action Plan

In 2009, Joliet Junior College (JJC) took a significant step in setting sustainability goals by committing to the former ACUPCC compact. This created an opportunity for the higher education institution to take the lead in reducing greenhouse gas emissions, achieving climate neutrality, applying sustainable practices and integrating sustainability into college curricula to ensure that future generations are equipped with the knowledge necessary to be environmentally responsible.

Historically, sustainable practices have been an integral part of JJC's culture. Between 2008 and 2010, various sustainability initiatives and practices culminated in the implementation of JJC's Sustainable Master Plan, later integrated with the Climate Action Plan, completed in 2011.

The JJC's Climate Action Plan sets goals for future action and develops a timeline for goal achievement. In order to determine the initial level of impact, an inventory of carbon emissions was conducted for fiscal years 2009-2010 and 2010-2011. Through this, strategies were developed to address the most significant sources of carbon emissions. Incorporated with these strategies are educational efforts intended to promote awareness about climate change and carbon emission throughout the College. These strategies will be open to constant updates and revisions, as greenhouse research and sustainable technology further develop.

It should be noted that JJC GHG calculations for FY 2010-2011 include projected emissions resulting from six new buildings that were going to be added by the end of 2013. In absence of historic data, design energy and GHG emissions data were used to project total GHG emissions. All new buildings on campus have been designed to achieve LEED-NC certification. Significant CO_2 footprint reduction came from JJC's vast, well-preserved natural areas. Some estimates indicate that as much as 600 metric tons of CO_2 emissions could potentially be mitigated by maintaining, improving or expanding existing natural areas.

Additionally, as a result of new building construction, the overall building area was increased by 43.95% between August 2010 and August 2011, while net GHG emissions have risen by only 30.77% during the same period. This data clearly demonstrates the benefits of energy efficient building design and construction. The data also suggest that implementation of the energy-efficient building systems can result in significant decreases in both overall campus energy use and GHG emissions per square foot of area.

JJC continues with the carbon emissions tracking and inventory data collection after initial Climate Action Plan was compiled in 2011. Their goal is to integrate sustainable campus master plan, climate action plan with the institutional sustainability plan,

4.2 Case study 2: Moraine Valley Community College - 2015 Climate Action Plan

In 2013, Moraine Valley Community College (MVCC) made a significant commitment by signing the Second Nature Carbon Commitment3. The goal of the commitment was to begin the process toward achieving campus carbon neutrality, support greater community resilience and provide structured climate change education and global citizenship opportunities for their students. MVCC further integrated their climate action with the goals of the current sustainable campus master planning process, making building energy efficiency, renewable energy integration, resiliency and adaptation integral part of their five-year campus master planning process.

The college implemented several key steps aimed at facilitating the climate action planning process: set up the institutional structure (committees, task force, office of sustainability; completed an initial inventory of greenhouse gas emissions; created and implemented the Climate Action Plan (completed during 2015-2016); defined target date and interim milestones for achieving campus carbon and climate neutrality. MVCC carbon emission inventory data was benchmarked with several other higher education institutions pursuing similar goals (Figure 5).

Figure 5: Carbon emissions inventory benchmarking between higher education institutions

5. CARBON NEUTRALITY AND NET ZERO CAMPUS OPERATION

The institutional progress toward carbon neutrality is measured through annual greenhouse inventories, climate action plan updates and implementation of selected strategies. To simplify the planning process and implementation of strategies over time, the individual strategies are identified as short-term (0-5 years), mid-term (5-15 years) and long-term (15-25 years), depending on projected time horizon.

It is recommended that climate action planning should be fully integrated with the sustainable campus master planning process, which typically following the five-year planning and implementation cycle. In order to achieve carbon neutrality and achieve eventual net-zero campus operation, the Climate Action Plan envisions gradual replacement of grid-based fossil fuel electrical energy supply with on-site generated renewable energy. The remainder of carbon emissions that, cannot be displaced by clean (renewable) energy sources will be mitigated by carbon offsets (Figure 6).

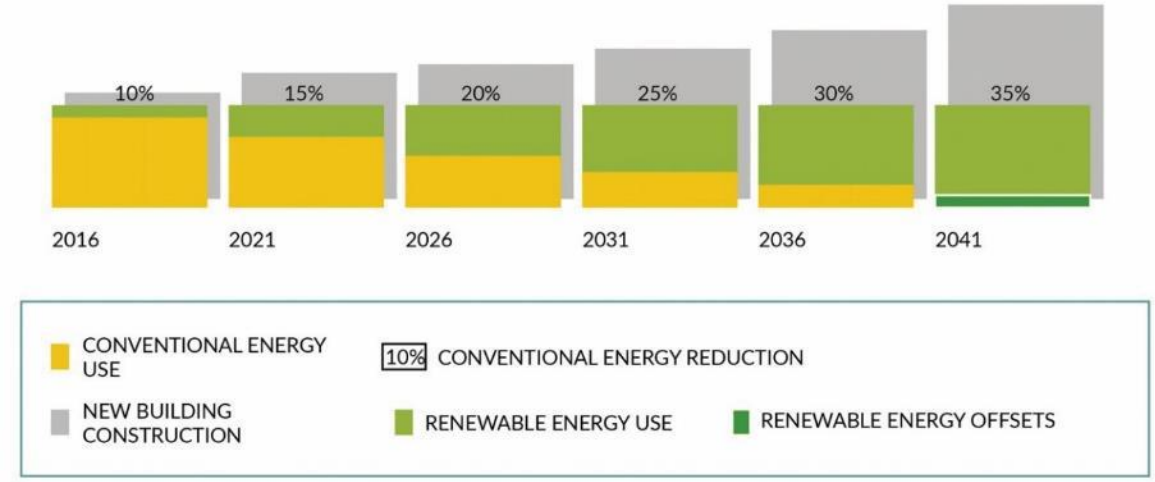

Figure 6: Climate Action Plan implementation process – Gradual energy source replacement

6. CONCLUSION

Achieving carbon-neutral or net-zero operation in a college campus education environment requires appropriate funding, continuous implementation of identified carbon emission mitigation strategies, planning flexibility to address future technological developments, and time to create meaningful culture change, implement necessary building upgrades, install renewable energy systems, and plan for and secure the necessary funding.

The short-term strategies on individual projects are easier to identify and implement, mid-term and long-term strategies that involve entire campuses or communities will be need to remain flexible and allow sufficient room for adaptation for future changes in the political, social, economic and natural environment. The critical element for securing success will be proper integration of carbon action plan goals and strategies into all subsequent sustainable campus planning, operations, and maintenance activities on college campuses. While some of the GHG emission will be difficult to completely eliminate, such as those related to commuting or air travel, sufficient funding should be allocated for carbon offsets, parallel to budgets developed for the implementation of the entire Carbon Action Plan.

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