Modifying Williams' Greenhouse Gas Emissions Goal
Campus Environmental Advisory Committee, Spring 2015

Introduction

In 2005-06, a student movement spurred the creation of a Climate Action Plan and carbon emissions target. The "Climate Initiative" petition, spearheaded by a student environmental organization and calling for the College to adopt a 10% reduction in CO_2 emissions by 2010 and a 20% reduction by 2020, was signed by 1000 students and 100 faculty and staff, and presented to then-president Morty Schapiro and the Board of Trustees in January 2006. President Schapiro responded by creating a Climate Action Committee to examine the possibilities and to determine a feasible goal for the reduction of Williams' greenhouse gas emissions. That goal, established in 2007, was a reduction in greenhouse gas (GHG) emissions to 10 percent below 1990-91 levels by 2020, reversing and improving upon the 44 percent increase in the College's GHG emissions between 1990-91 and 2006-07.

The goal was intended to be a bold one, with "Williams tak[ing] a leadership role in setting an aggressive target," according to the Committee's 2006 report. Upon adoption of the goal, the College began to implement energy conservation projects, including projects focusing on lighting, insulation, building controls and operational changes, and also switched to using cleaner fossil fuels (primarily natural gas instead of residual oil) in the central heating plant.

These initiatives coincided with improvements in lighting technology, a decrease in the cost of natural gas, and an increase in the efficiency of the central heating plant, making the goal a less challenging one than it was originally thought to be. The 2007 goal called for the College to be halfway toward meeting its 2020 goal by 2012; in reality, the College had achieved 97 percent of the target by 2012.[1] It is clear that the original goal, however appropriate in 2007, is now far too modest. The College community has recognized this in several ways—directing the focus of this committee to GHG emissions; formulating and circulating a petition to President Falk in spring 2014 calling for a new emissions reduction goal in line with Massachusetts' goal of a reduction in GHG emissions of 80 percent from 1990 levels by 2050 that was signed by over 1500 students, faculty, staff, and alumni; and adopting a resolution in the 2014-15 College Council calling for a new, more ambitious emissions goal.

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[1] Primarily as a result of emissions associated with construction, we have lost some ground in recent years so that as of fiscal year 2014, Williams is approximately 75 percent of the way toward reaching the current GHG emissions reduction goal. When construction abates, we expect to recover that lost progress.

Climate change is the defining issue of our time. It is already having significant and harmful effects, and these effects are accelerating. Students (prospective, current, and alumni), faculty, and staff care about our college's willingness to address climate change, what United Nations Secretary-General Ban Ki-Moon calls "the defining issue of our times." In the words of the 2014-15 College Council resolution, "Commitment to an aggressive decrease in greenhouse gas (GHG) emissions must be an essential component of the agenda at any environmentally responsible institution." Williams has the country's oldest Environmental Studies program, but we are no longer viewed as the leader in this increasingly important field. Renewing our commitment to Williams' sustainability principles should be viewed as a step toward reclaiming our leadership in this arena, both within the academic world and beyond. When we speak of carbon emissions reduction as an important goal for the College, we refer technically to our "carbon footprint." However, our "leadership footprint"—the scope of Williams' global influence—is substantially larger than that of our campus alone, and it offers Williams a real opportunity to contribute to the reduction of greenhouse gases on a much broader scale. We know that when we educate our students, faculty, and staff in both the theory and practice of sustainable living, we influence the many parts of the world that our community touches.

Other top liberal arts colleges are adopting ambitious programs of GHG emissions reduction, and Williams has lost its claim to a leadership position. Colby achieved carbon neutrality in 2013. Middlebury is aiming for carbon neutrality by 2016, Dickinson by 2020 and Smith by 2020. Green Mountain College is aiming to meet all its energy needs with 100 percent renewable sources by 2020. Indeed, Williams' GHG emissions reduction goal is far less ambitious than even Massachusetts' medium-term state goal to reduce GHG emissions to 25 percent below 1990 levels by 2020. Given our current trajectory, Williams will not come close to achieving Massachusetts' long-term goal of a reduction in GHG emissions of 80 percent from 1990 levels by 2050, much less carbon neutrality.

Our relatively weak commitment to reducing our carbon footprint has not gone unnoticed. *Princeton Review*'s highest sustainability rating goes to Middlebury, Pomona, Stanford and Columbia, while the Association for the Advancement of Sustainability in Higher Education gives its highest rating to Columbia, Dickinson, Duke, Middlebury, Pomona and Stanford. Williams chose not to participate in the Sierra Club's rankings, which do include Harvard, Middlebury, Princeton, Bowdoin, Colby, Dartmouth and Brown. Williams is also not a signatory to the American College & University Presidents' Climate Commitment, unlike Bates, Bowdoin, Carleton, Colby, Davidson, Hampshire, Haverford, MCLA, Middlebury, Oberlin, Smith, Union, University of Massachusetts at Amherst and Wesleyan. The rankings themselves and our absence from ACUPCC are noticed: students attending our Previews events have asked why Williams is lagging behind other schools.

Possible Revised GHG Emissions Reduction Goals

Each college faces different challenges and opportunities with respect to reducing its carbon footprint, and, further, the various ways of achieving "carbon neutrality" are not all equal in their true impact on global CO2 emissions. Recognizing this, this committee has had difficulty selecting a "best" goal. We therefore will describe two different options for the goal, the likely efforts necessary to achieve each of them, and their respective costs and benefits.

Option #1: Reduce greenhouse gas emissions to 45 percent below 1990 levels by 2035

Option #1 entails strengthening somewhat the College's earlier greenhouse gas emissions reduction target. Although setting this goal will not put Williams on par with other colleges with which we are compared, it would, unlike our current target, put the College on a trajectory to accomplish the Massachusetts goal. It will be a significant challenge, but it can be accomplished using current technologies and markets. Further, we expect that as conservation, efficiency and renewable energy technologies change over the next 20 years, this goal too may become more easily attainable.

The steps necessary to pursue Option #1 take several forms. First are the actions that the College must take even to maintain its current level of GHG emissions. The College must maintain all emissions reductions to date in its *current* physical plant, which will require an ongoing commitment to burning natural gas at the central heating plant, even in the event of higher natural gas prices. The College would also need to rigorously question any proposal to add to our physical plant, taking into account not only whether that addition to physical plant is more important to our core educational mission than alternative ways of allocating funds, but also what impact it might have on our ability to achieve our GHG goal. If possible, any new building projects should be planned from their very inception to ensure that they decrease (or at a minimum do not increase) campus GHG emissions.

The College would also have to increase its financial commitment to energy conservation and to obtaining energy from sources with a lower carbon footprint. There are many ways to do this, each with different overall impact and emissions reduction per dollar of expenditure. These include increasing annual investment in energy conservation and efficiency improvements in existing buildings and purchasing 100 percent renewable electricity.

Option #2: Set a goal of net carbon neutrality by 2035

Adopting a goal of net carbon neutrality, along with a clear roadmap to attain the goal, would put Williams back in a leadership position in the environmental arena, adding Williams to the group of schools that have made a firm commitment to achieving net neutrality. It would, however, require additional College resources be devoted to sustainability.

The steps necessary to pursue Option #2 involve doing all of the actions outlined above, but to a greater extent, and would also require that the College purchase carbon offsets (defined below).

Summary of Strategies Used to Date

In order to meet any new goal, we must first commit to maintaining our current level of GHG reductions. As can be seen in Figure 1A below, which shows our actual emissions (black line) and our emissions in the absence of pursuing a particular strategy (colored wedges), two strategies have contributed the majority of our emissions reductions to date: energy conservation/efficiency projects, and burning natural gas at the central heating plant.

Williams has invested over $2,000,000 in energy conservation and efficiency projects over the past five years. Those projects have prevented an estimated 3200 metric tons of carbon emissions and saved an estimated $600,000 per year in utility costs.

The College's central heating plant provides heat and hot water to most campus buildings. It is designed to burn either natural gas or distillate fuel oil. While there is debate about the potential environmental impacts of natural gas production, for the same amount of energy output, combustion of natural gas emits approximately 73 percent of the GHG emissions of distillate fuel oil, making burning gas preferable to burning distillate oil.

Some of the energy conservation and efficiency projects are not easily undone and do not require ongoing commitment – efficient motors and lighting and insulation, for example. Others, such as making changes to building operations and/or hours, which generally require a commitment of staff time, or choosing to forgo opportunities to profitably sell our contracted natural gas access on the spot market and burn distillate fuel oil in our heating plant (as we did in 2013-14), do require an ongoing commitment.

Over the past six years, Williams has primarily burned natural gas – but that decision was made easy by the fact that natural gas was less expensive than distillate oil. As fossil fuel markets shift, Williams may need to prioritize the purchase of natural gas at some financial cost.

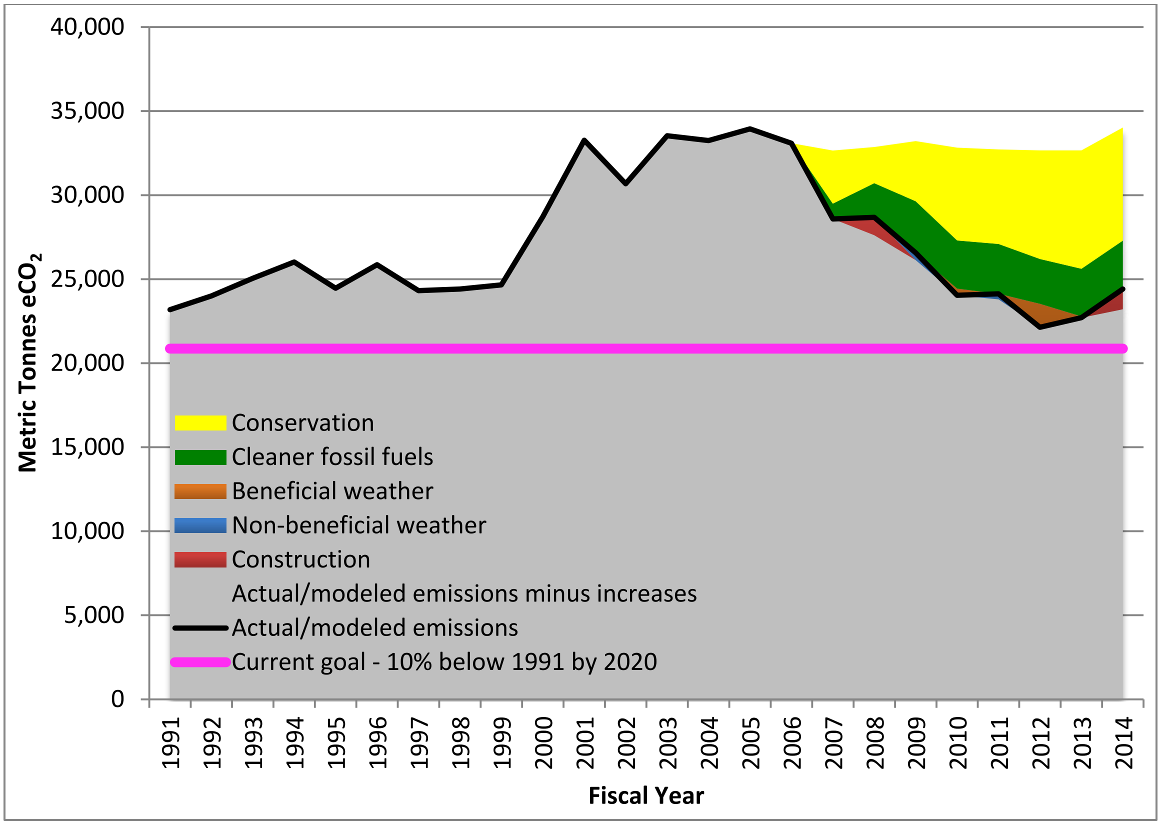

Figure 1A: Emissions from 1991 - 2014, with strategies for reduction to date

No increased emissions from construction projects

One of the clearest drivers of emissions on the Williams campus (and elsewhere) is the amount of conditioned building space. As our campus has grown, so have our emissions. Each new square foot of space requires energy for heating, cooling, lighting, and ventilation, and both our standards for comfort and the requirements for building code compliance have increased over the years. As Williams continues to maintain and upgrade its facilities, we will need to make every effort to avoid actions that will result in increased emissions. It is possible to continue to upgrade–and even modestly expand–our facilities, but we will need to prioritize renovations that dramatically decrease energy use in existing spaces while judiciously adding very high performance new spaces. The current ideas about a new science building to replace Bronfman Science Center are a good example. Bronfman is currently a highly inefficient space, using approximately 254 kBtus per square foot annually. The College is contemplating replacing it with two new energy-efficient buildings with a total of 67% more square footage. The goal for the new construction is 120 kBtu per square foot per year. Thus even with the larger area, together these two new buildings would use 21% less energy than the current building. This example illustrates how high-performance building can reduce energy use as we add desired space to the campus.

Thus, energy and emissions goals must play a role from the very first stages of any deliberations involving changes to our physical plant, including development efforts, budgeting, and building study and design. Unfortunately, quantifying the cost of this element of GHG reductions involves some uncertainty, as the marginal increase in cost for high-performance construction varies a great deal depending on the type of building and the approach taken.

Strategies to Reduce Emissions Further

Figure 1b illustrates the emissions impacts from implementing additional reduction strategies. For comparison, the figure shows our current goal (pink line) and Option #1 (pale green line). We discuss each of the additional strategies in turn.

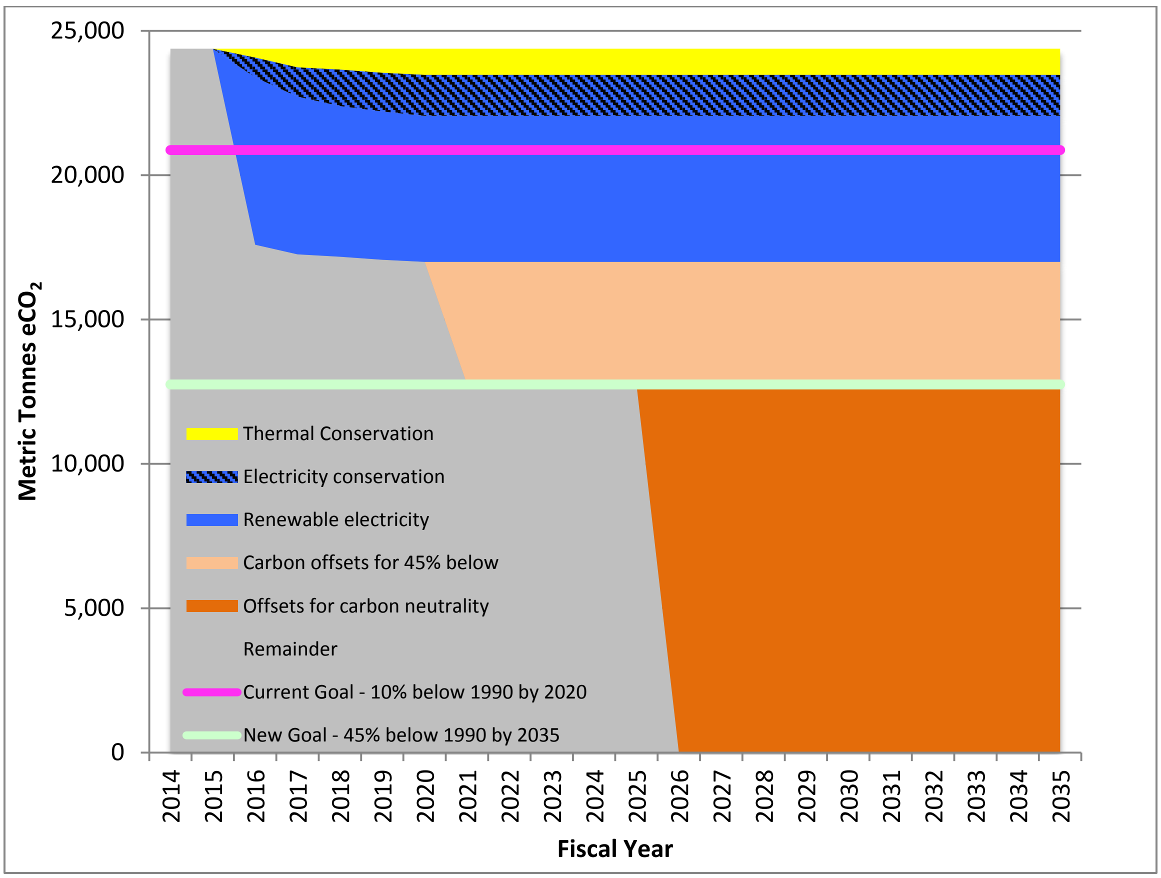

Figure 1B: Emissions Reduction Goals and Strategies

Increasing investment in energy conservation and efficiency

As noted above, Williams has invested over $2,000,000 in energy conservation and efficiency projects over the past five years. Those projects have prevented an estimated 3200 metric tons annually of carbon emissions and saved an estimated $600,000 per year in utility costs. There are energy conservation projects currently outlined in the five-year renewal plan for the College's facilities, but a more ambitious emissions goal necessitates finding additional projects beyond those already proposed. In December 2014 the College engaged GreenerU, an engineering consulting firm specializing in campus sustainability for educational institutions, to provide a high level assessment of the energy conservation potential in thirty representative buildings on campus. GreenerU provided rough estimates of potential energy and emissions savings in each building, the upfront cost of each project, and likely annual cost savings. Their estimates of annual cost savings and GHG emissions reductions did not extend beyond 2020. We will almost certainly not have exhausted the conservation possibilities on campus at that point, but technology is changing rapidly enough that trying to predict potential projects any further in the future was a challenge not worth undertaking. The contribution of conservation to overall emissions reduction we are presenting should thus be considered conservative, and we want to stress that the College should continue to seek additional conservation opportunities beyond the five-year window for which we were able to obtain information. To the extent such opportunities can be found, the contribution represented by the blue wedges in Figure 1b would be enlarged.

GreenerU estimates that if Williams were to invest $5.5 million over the next five years, we could achieve an additional 2300 metric tons in annual GHG emission reduction. Some of the initiatives would both save money and reduce GHG emissions. Others offer low cost ways of reducing emissions. Still others are more costly. Assuming a 7 percent discount rate in the net present value (NPV) calculations, the individual projects included in that $5.5 million total range in NPV from $400,000 to -$60,000. It is important to note that if Williams does purchase 100 percent renewable electricity (a strategy that we discuss below), then the electricity portion of emissions reductions from conservation projects deriving from decreased electricity use will not decrease our net emissions; this is because emissions from any given source cannot go below zero. However, projects with a positive NPV would still provide financial savings.

In Table 1 below, we provide information (based on the estimates done by GreenerU) on installed cost, annual savings, annual GHG emissions reductions, and internal rate of return (IRR) and NPV, all on the basis of a 15-year time horizon, for the seven energy conservation building renovation projects with the highest IRR. (In the Appendix we provide similar data for all of the projects identified by GreenerU.)

As is apparent in Table 1, some building retrofit projects both reduce GHG emissions and yield significant net savings for the College over reasonable planning horizons. Other projects reduce GHG emissions but only provide modest net savings. Still others, which we list in the Appendix, reduce GHG emissions but never "pay for themselves" through their energy savings. Consistent with our earlier comment, we note that if the College is able to obtain its electricity from a GHG-neutral source, some of the projects would contribute less to GHG emissions reductions than shown because any GHG emissions reductions in the projects that derive from reduced electricity use would already have been accounted for.

Table 1: Installed Cost, Annual Savings, Internal Rate of Return, Net Present Value, and Annual GHG Reduction, Seven Highest IRR projects

Building	Installed cost	Annual Savings	IRR over 15 year horizon	NPV over 15 years @ 7% discount rate	Annual GHG emission reduction
Schow Library	$462,686	$141,529	30%	$772,288	450
Tyler House	$100,884	$24,500	23%	$114,262	84
Morley Science Laboratories	$1,133,123	$265,942	22%	$1,204,723	850
Driscoll Dining Hall	$79,822	$18,104	21%	$79,503	61
Gladden House	$116,171	$24,546	20%	$100,366	83
Paresky Center	$524,250	$93,952	16%	$309,773	309
Chandler Athletic Center	$648,407	$115,044	16%	$373,275	382

Purchase 100 percent renewable electricity

Williams has been actively pursuing opportunities to provide renewable electricity to the campus. There are several small solar electric systems installed, and several more will be installed over the spring semester. We have entered into a power purchase agreement (see below) with a solar developer who will install solar panels on the new library, the Weston Field Team Support building, and the Class of 1966 Environmental Center. In addition, the developer has installed a much larger system at the offsite shelving facility on Route 7. These arrays are concrete steps in the right direction, but together account for less than 5 percent of the College's total annual electricity use.

Several solar developers have examined the Williams campus for locations to install solar panels and have found that many roofs are too old, or not designed to support an additional load, or are too shaded. As buildings are renovated and roofs are replaced, more opportunities will arise for on-campus solar projects. For example, the renovated Log will include solar panels that will provide approximately 20 percent of that building's energy needs.

While we will continue to pursue on-campus renewable electricity projects, we will need to reduce the emissions from the campus's electricity use to zero to meet further emissions goals. There are several possible ways for Williams to invest in 100 percent renewable electricity. One is through a power-purchase agreement (PPA). Williams would commit to purchasing electricity from a particular project (most likely a New England wind project) for a particular period of time (generally 15 or 20 years) at either a fixed rate per kilowatt-hour or at a rate that includes a contracted rate of escalation. These agreements are usually negotiated with the renewable electricity developer, and Williams has been pursuing agreements of this sort.

The environmental attributes of renewable electricity – including the emissions reductions – are separated from the electricity itself and included in a separate commodity called a Renewable Energy Certificate (REC). In order to claim emissions reductions from a renewable electricity purchase, Williams will need also to purchase the RECs. This can be done as part of a bundled electricity and REC purchase from a single project, or the RECs can be purchased separately from the electricity.

The rate for electricity varies a great deal depending on timing, the type and length of contract, and the state of the market. Recent power purchase agreements for wind power that include the environmental attributes have priced the power roughly $.03-$.04/kilowatt hour above our current cost. Given such prices and our current electricity use, an investment in 100 percent wind power with environmental attributes would cost an additional $680,000 per year over our current electricity costs.

Current pricing for national wind RECs alone, without the accompanying electricity, is approximately $.01 per kilowatt hour. The future of the REC market is hard to predict, but prices have stabilized over the past several years (see Appendix 2 for a figure showing price trends over the past 6 years). At current REC pricing and our current electricity use, purchasing RECs for our entire electricity use (but without purchasing the renewable electricity itself) would cost approximately $25,000 per year over our current electricity costs. In addition, Williams will need to purchase RECs for the electricity generated at our cogeneration plant. Cogeneration reduces emissions a small amount by utilizing heat that would otherwise be wasted, but the electricity is still generated through the burning of fossil fuels and has emissions associated with it. To reduce those emissions to zero, Williams would need to purchase corresponding RECs.

Purchase carbon offsets

Carbon offsets represent the reduction of greenhouse gasses elsewhere to compensate for the pollution caused by the purchaser. Each carbon offset counts for 1 metric ton of reduction in CO_2 or CO_2e (carbon dioxide equivalents). This allows for reduction in net carbon emissions from sources like heating, air travel, and other forms of transportation where there are few alternatives to fossil fuels. Purchase of a carbon offset finances an emission reduction project elsewhere in the world. In theory, they are a mechanism for encouraging the most globally efficient investment in GHG emissions reduction: funding methane capture from a landfill in some other part of Massachusetts or cleaning the emissions from a smokestack in China could potentially be a better use of Williams' available emissions reduction funds than a higher cost project on campus. Unlike RECs, carbon offsets are not restricted by any type of GHG (greenhouse gas) source and can be used to reduce any amount of emissions. This makes them a very versatile way to reduce GHG emissions.

Legitimate carbon offset projects are typically evaluated by third parties to ensure that the project is doing what its implementers claim. These third parties evaluate two key aspects of a project: (1) the amount of CO2e emissions reduced and (2) whether that reduction would have taken place if the project was not undertaken (called "additionality"). If the project is deemed only to have achieved a reduction that would already have happened, then there is no net reduction after all. The reduction from the carbon offsets comes from the difference between the amount of predicted emissions and the actual amount of emissions released, so additionality is a critical factor in determining the value of a carbon offset project. While the actual impact of carbon offsets can be difficult to verify, the verification concern can largely be solved (at a cost) by purchasing only high-quality third-party-verified offsets.

There are two main disadvantages of the purchased carbon offset approach. The first is that while the costs of verified offsets are at present quite low (between $1.40 and $1.60 per metric ton depending on volume), it is not at all clear that this situation will persist. In part this is because as the "low hanging fruit" is picked, legitimate emissions reduction opportunities will become more costly, and in part this is because the demand for such offsets may very well increase in the future. The second disadvantage is that achieving carbon neutrality through purchased offsets, as opposed to as actual energy conservation or carbon neutral energy production, does not have the same demonstration effect for our students and the wider College community. We see an important educational impact of demonstrating to our students that living in a sustainable fashion requires deliberate, and sometimes tough, choices.

Summary and Conclusions

There is widespread consensus on campus (and unanimity on this committee) that our existing GHG emissions goal must be strengthened for Williams to do its part in combating climate change. Business as usual is not an option. We have presented two alternative goals for the College to adopt along with strategies the College might use to achieve these goals and the best estimates we were able to obtain of the costs of these strategies.

Option #1, setting a goal to reduce greenhouse gas emissions to 45 percent below 1990 levels by 2035, has advantages and disadvantages. It does put the College on a trajectory to meet

Massachusetts' goal of a reduction in GHG emissions of 80 percent from 1990 levels by 2050. Further, it depends less on the purchase of carbon offsets, so the College can be more certain that the reductions in GHG emissions are real reductions and are not vulnerable to claims that they are based on possibly spurious reductions in GHG emissions achieved elsewhere. However, Option #1 does not put the College in a leadership position relative to other colleges and universities in GHG emissions reduction. We will look better than we do at present, but we are likely still to be seen as lagging behind our peers.

Option #2 involves doing all of the strategies discussed, including purchasing verified carbon offsets. The advantages of Option #2, that is, supplementing Option #1 with carbon offsets, are that it would allow us to legitimately achieve carbon neutrality at an earlier date than would be possible under Option #1. It would also allow Williams to assert that it is among the leaders in GHG emissions reductions. Further, and not unimportant, at least at present the costs associated with purchasing the number of carbon offsets we would require are surprisingly low. Purchasing the carbon offsets necessary to achieve carbon neutrality would cost approximately $18,000 annually. It is important to note, however, that for the reasons we outlined above, we do not support a policy of achieving carbon neutrality solely or primarily through purchase of carbon offsets because of the disadvantages we outlined previously.

After researching and discussing the options and strategies extensively over the past year and a half, the members of this committee are in agreement that the *minimum* action the College should take would be the adoption of Option #1. Such a goal would require the commitment of additional resources as discussed above, but at least some of the actions that would be taken to meet this goal would pay for themselves over reasonable time horizons. Moreover, this goal would put Williams on track to meet the Massachusetts state goal. However, the members of the committee also agree that in order to make a real difference in our carbon footprint and to reclaim our leadership position, it is necessary for Williams to adopt a goal of net carbon neutrality by 2035.

Members of the Campus Environmental Advisory Committee GHG Subcommittee:
Ralph Bradburd, Chair of CES and David A. Wells Professor of Political Economy
Rita Coppola-Wallace, Executive Director, Design and Construction, Facilities
Mike Evans, Assistant Director, Zilkha Center for Environmental Initiatives
Sarah Gardner, Associate Director of CES
Amy Johns, Director, Zilkha Center for Environmental Initiatives
Roxana Rodriguez '17
Lara Shore-Sheppard, Professor of Economics, Committee Chair
Jefferson Strait, Professor of Physics
Claire Swingle '16
Bob Wright, Executive Director, Facilities Management

Appendix 1

Installed Cost, Annual Savings, Internal Rate of Return, Net Present Value, and Annual GHG Reduction, All buildings covered in GreenerU report

Building	Installed cost	Annual Savings	IRR over 15 year horizon	NPV over 15 years @ 7% discount rate	Annual GHG emission reduction (metric tons)
Schow Library	$462,686	$141,529	30%	$772,288	450
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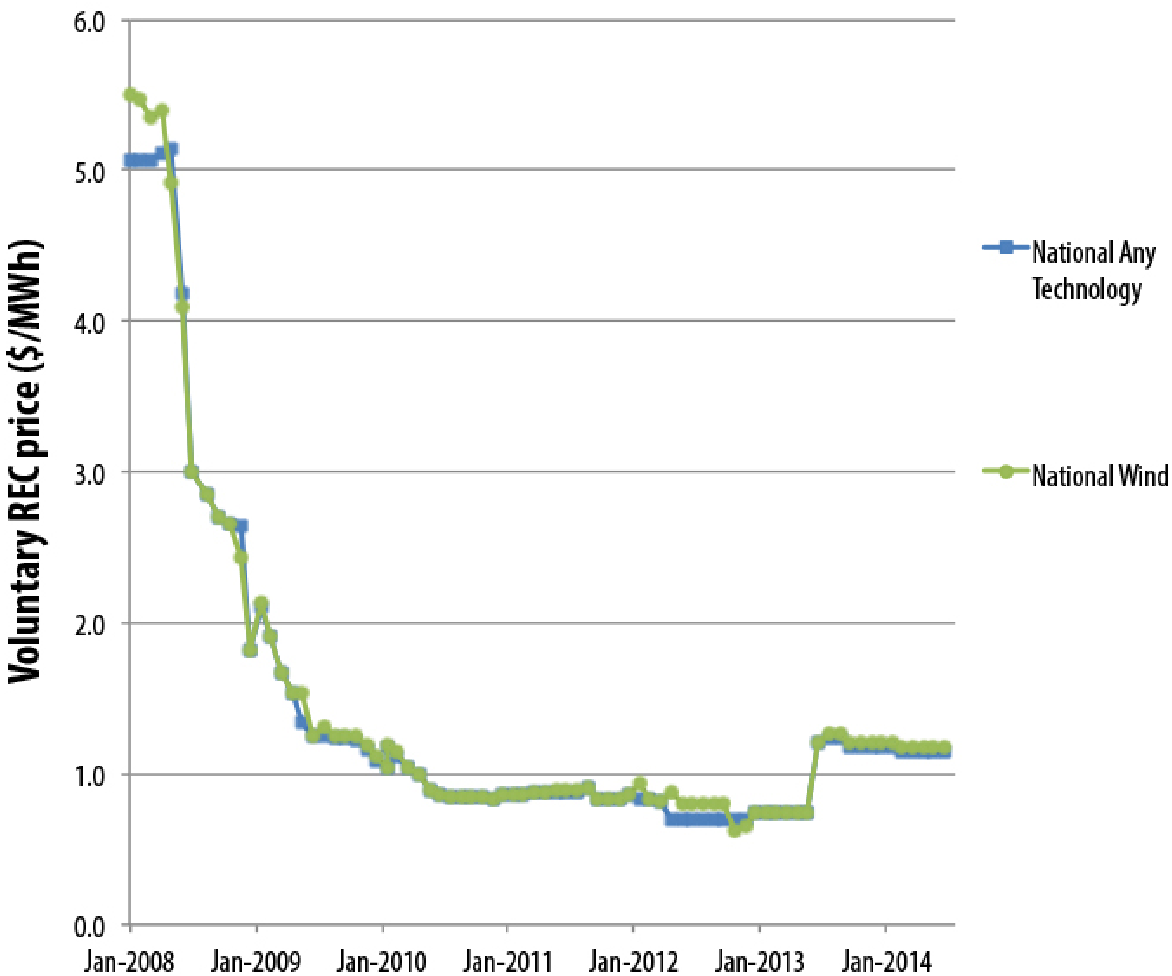
Paresky Center	$524,250	$93,952	16%	$309,773	309
Chandler Athletic Center	$648,407	$115,044	16%	$373,275	382
Spencer Art Studio	$173,450	$29,274	15%	$87,080	95
Center for Theatre and Dance	$505,500	$75,908	12%	$173,704	240
Thompson Memorial Chapel	$71,237	$10,675	12%	$24,290	36
Thompson Chemistry Lab	$218,935	$31,488	12%	$63,416	101
Brooks House	$55,657	$7,358	10%	$10,616	25
Griffin Hall	$66,158	$8,647	10%	$11,774	29
Lasell Gymnasium	$234,138	$30,258	10%	$38,738	99
Bernhard Music Center	$157,672	$20,333	10%	$25,719	66
Goodrich Hall	$81,415	$9,835	9%	$7,627	33
Fitch House	$62,921	$7,481	8%	$4,874	24
Thompson Hall	$72,906	$8,651	8%	$5,501	29
Faculty House	$128,511	$14,787	8%	$5,764	48
Goodrich House	$36,446	$4,064	7%	$531	14
Rice House	$20,253	$2,175	7%	($414)	8
Dodd House	$145,964	$15,327	6%	($5,950)	53
Thompson Biology Lab	$136,352	$14,039	6%	($7,931)	46
Thompson Physics Lab	$143,321	$14,324	6%	($12,018)	47
Bascom/Admissions	$56,270	$5,563	5%	($5,236)	18
Jenness House	$25,172	$2,287	4%	($4,058)	8
Sewall House	$31,550	$2,573	3%	($7,584)	9
Mission Park	$2,406,450	$174,785	1%	($761,237)	529
Droppers House	$17,270	$1,206	1%	($5,875)	4

Appendix 2:

REC prices by year: 2008-2014



Voluntary REC pricing from January 2008 to January 2014