CHAPTER 5: AMAZING WASTE: WHAT SUSTAINABILITY COSTS

Towards the middle of campus, south and a little to the east of the inner ring of buildings that surround the Middlebury College quad, an angular building rises from the earth. Through its glass plate casing passersby can see white utility pipes running from the walls and ceiling into a gigantic blue cylinder flanked by red utility boxes and surrounded by grey walkways and stairwells. The industrial building contrasts sharply with the homely piety of the neighboring cemetery, where many of the college's founders are buried (along with the cremated ashes of one unfortunate Egyptian mummy that fared poorly in New England's humidity), and with the stately dignity of the marble, neo-colonial McCullough Student Center across the street.

Middlebury College's $12 million biomass gasification plant moves the college closer to carbon neutrality.

This steel and glass building houses Middlebury's new Biomass Gasification Plant, a wood-fed boiler engine that produces steam to heat and power much of Middlebury's campus. Inside the glass walls, wood chips chopped to no more than two inches thick and dried to 50 percent moisture content ride a conveyer belt into the cylindrical boiler, where they smolder under extreme temperatures and emit wood gas that, when mixed with oxygen, ignites to 1100 degrees Fahrenheit. Metal tubes carrying water crisscross the interior of the cylinder, and as the water inside turns to steam, the energy—30 million BTUs per hour, 15-20 percent of the college's total electricity needs—powers campus heating units, hot water heaters, and other electrical equipment to keep Middlebury's campus warm and fed with electricity.[350] After dark, even on the most frigid days of Vermont winters, the window panes, like a nightlight, glow with activity, casting comforting fingers of light across the parking lot and the Old Chapel Road behind it.

The Gasification Plant serves as a sign of hope to Middlebury residents in another way, too. It is carbon

350 "Middlebury College's Biomass Heating and Cooling Plant Aims to Cut Carbon and Costs—in Big Ways," Biomass Energy Resource Center, Biomass Case Studies Series, 2008. http://www.biomasscenter.org/images/stories/middlebury-college.pdf

neutral, a key achievement on Middlebury's path to eradicating or offsetting 100 percent of all campus carbon emissions by the year 2016. The gasification plant relies on trees (theoretically, constantly replanted and therefore renewable) that are harvested and shipped—20,000 tons every year, up to two or three truckloads a day—to Middlebury from within a 75-mile radius. Trees absorb carbon from the air and store it inside their trunks, and when they die and decompose—whether by decay on a forest floor or combustion in an engine room—they release the carbon back into the atmosphere. The gasification plant releases no more carbon than the trees would have emitted had they rotted in the forest, and so long as the College replants what it cuts down, the local carbon levels should, in theory, remain stable. And because the wood chips smolder in low-oxygen tanks, rather than burning as in an old-fashioned stove, no smoke emanates from the plant. Middlebury filters its exhaust assiduously, with 99.7 percent accuracy in removing all particulates, so the gases pouring out of the stacks into the sky are almost entirely steam.

Going zero-carbon means a chance at admittance to an exclusive group of environmental enthusiasts whose membership, so far, includes only three: tiny, 300-student College of the Atlantic in Maine (2007),[351] Vermont's Green Mountain College (2011),[352] and Colby College, also in Maine (2013).[353] One other university had previously announced its carbon neutrality, but later had to retract that claim when it came to light that both the university and the local electricity provider had inadvertently been double-claiming the same renewable energy credits. Winning that fourth spot is a big race between the Presidents' Climate Commitment signatories, which has now grown in number to 685. All of them have pledged to eliminate their net greenhouse gas (GHG) emissions entirely, by "minimizing GHG as much as possible, and using carbon offsets or other measures to mitigate the remaining emissions."[354]

Middlebury's pledge—carbon neutral by 2016—is ambitious. Our environment is built on carbon, and the economy runs on fossil fuels. Renewable energy remains costlier than oil and gas. Targeting zero-carbon requires changing staff and student habits and instituting new training. Infusing sustainability throughout the campus culture means establishing an office of sustainability, hiring new staff, adding new degree programs and incentivizing professors to re-focus their courses. Just how costly sustainability initiatives are, though, is not often transparently analyzed within the field.

Footprints in the Earth

"Carbon neutrality" sounds benign and simple enough, as if it required nothing more than to stop doing

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351 Kenny Luna, "And the First Carbon-Neutral College Campus in the US Is…," *Treehugger*, December 21, 2007. http://www.treehugger.com/corporate-responsibility/and-the-first-carbon-neutral-college-campus-in-the-us-is.html

352 "Climate Neutrality," Sustainability at Green Mountain College. http://sustainability.greenmtn.edu/climate_neutrality.aspx

353 Ruth Jacobs, "Colby Achieves Environmental Milestone: Carbon Neutrality," Colby College News, April 4, 2013. http://www.colby.edu/news/2013/04/04/colby-achieves-environmental-milestone-carbon-neutrality/

354 Frequently Asked Questions, American College and University Presidents' Climate Commitment. http://www.presidentsclimatecommitment.org/about/faqs#10

something unnatural, or to cease swinging between extremes and to settle peaceably at an equilibrium. In fact, it's something of an economic black hole. Full elimination of carbon emissions requires an expensive overhaul of campus life. Institutions must retrofit or even reconstruct campus buildings to reflect cutting-edge efficiency technologies, and replace college vehicles with electric or hybrid biodiesel cars. They have to figure out how to cut down on administrative air travel or else purchase carbon credits to offset the emissions.

Even simple tasks such as ordering paperclips and sticky notes for the admissions office become fraught with ethically-charged factual questions: *Was the iron mined without destroying a mountainous ecosystem? Did the paper come from "sustainably" managed trees? How far did the delivery truck travel, and is there any way to order from someplace closer?* Middlebury's "Procurement Policies and Procedures" manual, for instance, authorizes college representatives to give preference to local, minority-owned businesses that "demonstrate superior long-term sustainability, energy efficiency, and pollution minimization in product production and usage life cycles."[355] Middlebury's "Recycled Paper & Purchasing Policy," adopted in 2007, specifies minimum percentages of post-consumer waste recycled product in its paper (100 percent for all College office uses), asks all employees to consider printing fewer pages, and requires that the "stock will be readily and consistently available from a local supplier."[356]

The EPA's "Environmentally Preferable Purchasing" guidelines, used by many universities[357] as a supplement to their own purchasing guidelines, go further. The guidelines recommend that solid Polyethylene (PE) plastic binders, for instance, should have at least 30-50 percent post-consumer recycled material in them, and at least 30-50 percent of the material should be recoverable for recycling again.[358] But solid Polyethylene Terephthalate (PET) should be made of 100 percent recycled material and be 100 percent recoverable, while paper-covered binders should hold 75-100 percent recycled material and be 90-100 percent recoverable. The guidelines come with detailed charts breaking down precise standards for all office supplies.

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355 "Procurement Policies and Procedures at Middlebury College," Middlebury College, Vermont, pg. 11. https://www.middlebury.edu/media/view/252745/original/ProcurementPolicy.pdf

356 "Recycled Paper and Purchasing Policy," Middlebury College, 2007. http://www.middlebury.edu/sustainability/policy-planning/policies/paper

357 For instance, "Duke University Stores Green Purchasing Policy," Duke University Office of Sustainability. https://sustainability.duke.edu/documents/Duke%20Stores%20Purchasing%20Policy.pdf

358 "Non-Paper Office Products," Environmentally Preferable Purchasing, Environmental Protection Agency. http://www.epa.gov/epawaste/conserve/tools/cpg/products/nonpaperoffice.htm

Figure 8. EPA Purchasing Guidelines[359]

EPA's Recommended Recovered Materials Content Levels for Binders, Clipboards, File Folders, Clip Portfolios, and Presentation Folders

Product	Material	Postconsumer Content (%)	Recovered Materials (%)
Binders - Plastic Covered	Plastic	- -	25–50
Binders - Paper Covered	Paper	75–100	90–100
	Pressboard	20	50
	HDPE	90	90
Binders - Solid plastic	PE	30–50	30–50
	PET	100	100
	Misc. plastics	80	80
	HDPE	90	90
Plastic clipboards	PS	50	50
	Misc. plastics	15	15–80
Plastic file folders	HDPE	90	90
Plastic clip portfolios	HDPE	90	90
Plastic presentation folders	HDPE	90	90

EPA's Recommended Recovered Materials Content Levels for Office Recylcing Containers and Office Waste Receptacles

Product	Material	Postconsumer Content (%)	Recovered Materials (%)
Waste Receptacles	Plastic	20–100	- -
	Steel[1]	16	25–30
	Paper:		
	- Corrugated	25–50	25–50
	- Solid Fiber Boxes	40	- -
	- Industrial Paperboard	40–80	100

359 *Ibid.*

Recommended Recovered Materials Content Levels			
Product	**Material**	**Postconsumer Content (%)**	**Total Recovered Materials Content (%)**
Furniture structure	Steel[1]	16	25–30
Furniture structure	Aluminum	- -	75–100
Cellulose Loose-Fill and Spray-On	Postconsumer Paper	75	75
Particleboard/Fiberboard component[2]	Wood or wood composite Agricultural fiber	Greater than 0 - -	80–100 100
Fabric	PET	100	100
Plastic furniture component	HDPE	70–75	95
Remanufactured or Refurbished Furniture	Various	25–75	25–75

Carbon neutrality quickly becomes invasive, too. In calculating an institution's net greenhouse gas emissions, the American College and University Presidents' Climate Commitment includes student, staff, and faculty commutes, obliging signatory schools either to mandate green transportation or to purchase carbon credits that off-set their students' and staff's behavior.[360] In that spirit, Middlebury asks its students to consider purchasing carbon offsets to make up for their travel when they study abroad,[361] and asks incoming students to buy $36 in carbon offsets to counteract the 3 tons of carbon that an average student will consume by living in a campus dormitory.[362]

Big Footprints

In hoping to erase carbon footprints, sustainability leaves an economic footprint of its own. Going green is pricey. Exactly how pricey, though, is hard to find out. Those economic footprints are kept carefully hidden. When one goes looking for realistic and reliable estimates of what sustainability efforts cost colleges and universities, there are few ready-made answers to be found.

This is ironic in that the movement frequently criticizes free market capitalism for its failure to account

360 The ACUPCC asks institutions to include almost everything in their assessments: "At a minimum, participating campuses should include in their inventories: (1) direct emissions produced through campus activities (known as "Scope 1 emissions"); (2) indirect emissions from purchased energy ("Scope 2"); and (3) indirect emissions from (a) student, faculty, and staff commuting; and (b) institution-funded air travel ("Scope 3"). As the inventory methodology develops and to the extent practical, participating institutions should also endeavor to evaluate embodied emissions in purchased goods and services, including food." "What emissions sources are included, and how are they calculated?" FAQs, American College and University Presidents' Climate Commitment. http://www.presidentsclimatecommitment.org/about/faqs#11

361 "Carbon Offsets," Middlebury College, Study Abroad. http://www.middlebury.edu/international/sa/sustainable/carbon_offsets

362 Tess Russell, "Offsets Figure into Carbon Neutrality Plan," *The Middlebury Campus*, February 14, 2008. http://middleburycampus.com/article/offsets-figure-into-carbon-neutrality-plan/

for the total life-cycle costs of products "from cradle to grave." A favorite talking point of sustainability advocates is that the environmental costs of extracting raw materials and disposing (or recycling) items that are no longer useful isn't adequately reflected in market-based prices. Yet when it comes to the cost of the sustainability movement itself, this love of transparency simply disappears. No one knows exactly what sustainability costs—except that the figure is very high.

It is telling that the Presidents' Climate Commitment requires its signatories to make numerous environmental impact statements available for public review and verification, but none on financial viability. Each signatory completes an initial "Implementation Profile" summarizing what tactics of greenhouse gas (GHG) elimination the school plans to use, a "Climate Action Plan" detailing these actions, periodic "GHG reports" chronicling the campus's environmental improvement (usually accompanied by a massive thousand-cell "Inventory Calculator" to gauge impact and a supplemental "Inventory Narrative" kindly interpreting the data), and finally a "Progress Report" to summarize all consequent environmental enhancement, student and faculty activism, and community outreach. Of these six documents, only the Progress Report asks schools to estimate the money spent and saved through sustainability measures. That Progress Report has five sections. One-half of one section, or one-tenth of the report, deals with finances, and the questions there are optional.

The ACUPCC on its website prominently promises signers that "exerting leadership in addressing climate disruption" will not only fulfill "an integral part of the mission of higher education" and "attract excellent students and faculty," but also "stabilize and reduce their long-term energy costs" and "attract new sources of funding."[363]

Whether sustainability programs reduce operating costs remains to be seen. Some high-profile institutions, however, have indeed secured outside funding. In May 2014, California Technical Institute brought in $15 million from Lynda and Stewart Resnick in support of the Resnick Sustainability Institute. Three million dollars went to establish the Resnick Institute Innovation Fund to support clean energy research; the remaining $12 million went to a matching fund program for the Institute.[364] Also in May, Arizona State University received a $25 million grant from Julie Ann Wrigley, CEO of Wrigley Investments, to support research at ASU's Global Institute of Sustainability.[365] This, after she had already given $10 million in 2007. Then in August 2014, Columbia University scored $3.5 million from the Andrew Sabin Family Foundation

363 "The Crisis of Climate Disruption," American College and University Presidents' Climate Commitment. http://www.presidentsclimatecommitment.org/about/climate-disruption

364 "Caltech Receives $15 Million for Sustainability Research," *Philanthropy News Digest*, May 9, 2014. http://philanthropynewsdigest.org/news/caltech-receives-15-million-for-sustainability-research

365 "Julie Ann Wrigley, Facts and Figures," *Philanthropy News Digest*. http://philanthropy.com/factfile/gifts_detail?GiftDonorJoin_a_DonorID=PGDON1319

for Columbia's Center for Climate Change Law, which aims to fight land developers and other nature-despoilers in court.[366] In September 2014, the University of Arizona was given a $50 million bequest from the estate of Agnese Nelms Haury to support environmental and social justice research,[367] and the University of Dayton received a $12.5 million grant from the George and Amanda Hanley Foundation to establish a new sustainability institute.[368]

These high-dollar sustainability donations give some idea of how much money sustainability programs cost. Many Presidents' Climate Commitment signatories, however, are small regional colleges with lower profiles; likely they undertake these projects without significant grants.

Another telling data point is the proliferation of administrative sustainability jobs and their salaries. An average university sustainability director, according to a 2012 survey by the Association for the Advancement of Sustainability in Higher Education (AASHE), can expect to make approximately $82,791 per year. Energy managers scored the second-highest average salaries at $67,392, reaching as high in one case as $150,000. Sustainability managers averaged an annual wage of $62,059, assistant directors $60,345, education and outreach staff $48,658, recycling and waste staff $48,000, and sustainability coordinators $45,000.[369] An institution that hired staff for all seven positions could expect to spend upwards of $400,000 per year just on salaries alone.

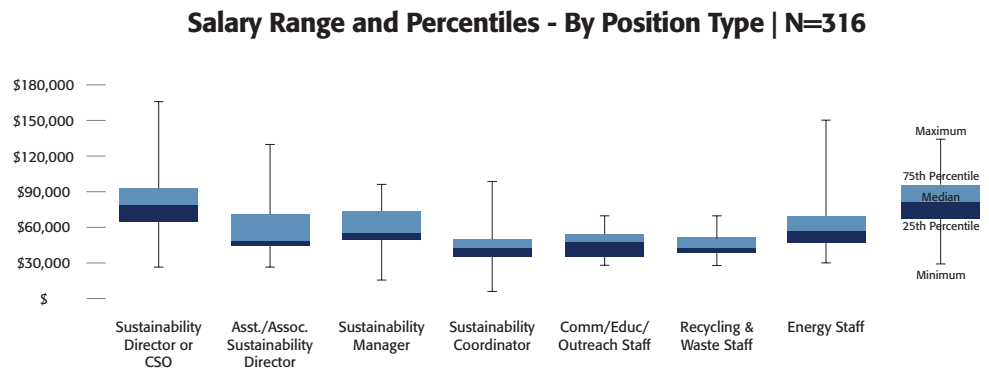
366 "Columbia Law School Receives $3.5 Million for Climate Change Center," *Philanthropy News Digest*, August 20, 2014. http://philanthropynewsdigest.org/news/columbia-law-school-receives-3.5-million-for-climate-change-center

367 "University of Arizona Receives $50 Million Bequest," *Philanthropy News Digest*, September 24, 2014. http://www.philanthropynewsdigest.org/news/university-of-arizona-receives-50-million-bequest

368 "University of Dayton Gets $12.5 Million for Sustainability Institute," *Philanthropy News Digest*, September 24, 2014. http://www.philanthropynewsdigest.org/news/university-of-dayton-gets-12.5-million-for-sustainability-institute

369 Judy Walton, "Salaries and Status of Sustainability Staff in Higher Education—2012," Association for the Advancement of Sustainability in Higher Education, 2013, pg. 27. http://www.aashe.org/files/documents/programs/2012_staffsurvey-final.pdf.

Figure 9. Annual Salaries of Sustainability Staff[370]



N	93	20	47	109	19	19	12
Average	$82,791	$60,345	$62,059	$45,000	$48,658	$48,000	$67,392
Lowest Salary	$29,120	$30,000	$19,469	$10,000	$31,788	$23,000	$33,000
25th Percentile	$66,000	$46,750	$52,000	$38,000	$39,004	$41,680	$49,825
Median	$80,000	$50,000	$57,196	$45,000	$50,000	$45,000	$60,000
75th Percentile	$95,000	$72,750	$75,450	$53,000	$57,000	$53,789	$72,250
Highest Salary	$165,000	$130,000	$97,000	$100,000	$72,000	$85,000	$150,000

In AASHE's survey, most institutions (82 percent) reported self-funding their sustainability staff salaries directly from the university's general operating fund, rather than paying the costs via gifts from external foundations and donors. AASHE also reported that "average salaries increased slightly across all regions and positions,"[371] and that 80 percent of all sustainability staff reported feeling that their positions were either "secure" or "very secure."[372] Even in times of rising student debt and shrinking college budgets, these sustainability officers were confident that their departments were high on the funding totem pole. Only 7 of the 450 surveyed (less than 1 percent) reported feeling "very insecure" about their position's funding. When AASHE asked the group about the biggest challenges facing their sustainability efforts, the most popular answer (50 percent) was lack of time to complete their goals; only 28 percent cited lack of funding.[373]

370 *Ibid*, pg. 27.

371 *Ibid*, pg. 27.

372 *Ibid*, pg. 32.

373 *Ibid*, 31.

What a complete sustainability department budget looks like is hard to say. Arizona State University in a 2013 annual report calculated that it had spent more than $5 million in a sustainability "revolving loan fund" alone.[374] These funds typically finance efficiency measures that should theoretically pay for themselves due to energy savings and utility rebates and other third-party incentives. The University of California's 2012 "Annual Report on Sustainable Practices" mentions receiving a $2 million grant to study whether renewable energy was effective at charging batteries for the university's electric cars, $66 million in energy efficiency grants, and $12 million in "incentive payments" from third parties who supported the renovation of 27 million square feet of building space to comply with energy efficiency programs sponsored by the local utility company.[375] Brown University acknowledges spending $14.6 million to reduce about 20,000 tons of carbon (saving, it says, about $3 million in energy reduction in the process).[376] But while Brown's report has plenty of statistics on the tons of pollution reduced, pounds of recyclables diverted, number of students involved, tallies of buildings retrofitted to higher efficiency standings, and the amount of electricity saved, there are no budgets, few dollar amounts, and no cost-benefit analyses.

Clashing Principles

The principle of marginal utility is a familiar concept: the more you acquire of a good, the less incremental value each unit brings to you. It works in the negative, too: reducing the first thousand tons of carbon is easier and less costly than reducing the last thousand. The purpose of a cost-benefit analysis is to determine at which point cost begins to outweigh the benefits—and to stop just before that point.

So why don't sustainability projects undergo more comprehensive public surveys of economic viability?

Sustainability operates on a different logical system—one that can fit within principles of marginal thinking, but that so reorders them as to be beyond much recognition. The main principle of decision-making within the environmental movement is something called the "precautionary principle." The term is a favorite of the EU and the UN and, given sustainability's birth in the UN's Brundtland Report, is an unsurprising kin to sustainability. The basic principle asserts that caution, rather than calculated risk-taking, should govern decision-making. If there is a chance that some action will cause harm, and no clear evidence or consensus among accepted experts as to whether it will or will not, then no action is to be preferred to

374 "SIRF: Sustainability Initiatives Revolving Fund, FY 2013 Annual Report," Arizona State University. http://www.asu.edu/pb/documents/SIRF-Annual-Report.pdf

375 "Annual Report on Sustainable Practices 2012," Budget and Capital Resources, University of California Office of the President, January 2013. http://sustainability.universityofcalifornia.edu/documents/Annual%20Report%20on%20Sustainability%202012_+formatted_for_binder_v8.pdf

376 Christopher Powell, "Sustainability Progress Report," Office of Sustainable Energy and Environmental Initiatives, Facilities Management, Brown University, Fall 2012. http://brown.edu/Facilities/Facilities_Management/docs/Sustainability_Report_2012_Final.pdf

potentially risky action. Or if there is a chance that current activity could cause harm, even if there is no sure evidence of its doing so, one ought to scale back or even cease such activity and take measures to induce others to do so as well. In other words, until we know that global warming is not happening, or that greenhouse gas emissions do not exacerbate it, we should all aim to stop emitting greenhouse gases.

The European Court of Justice outlined the principle in the first legal case in which the precautionary principle was applied: "Where there is uncertainty as to the existence or extent of risks to human health, the institutions may take protective measures without having to wait until the reality and seriousness of those risks become apparent."[377] The trouble, as international trade lawyer Lawrence Kogan explains, is that "there is always some level of uncertainty, since certainty of the absence of risk is a logical, empirical, and scientific impossibility."[378]

Applied in its strongest, most literal sense, the precautionary principle would preclude most activities. Is there risk involved in driving a car? In eating sweets? In eating vegetables? Better to hold off and wait for better evidence. And because the precautionary principle favors weight of evidence over strength of evidence—preferring quantity over quality of relevant data—it discourages careful contemplation of facts and encourages quick conclusions drawn from surveys of the "relevant experts." According to Peter Saunders, professor emeritus of mathematics at King's College London, the precautionary principle is triggered once there is "at least prima facie scientific evidence of a hazard, rather than a risk."[379] Since it is impossible to prove the absence of some hazard, the outcome invariably is that the potential hazard is regulated or stopped. Hence, zealous zero-carbon policies that ignore standard economic analysis.

Without the precautionary principle, the sustainability movement would be hard-pressed to justify many of its initiatives. There is not enough evidence to marshal in favor of radical carbon-cleanses. Only the principle of precaution, rather than careful cost-benefit risk analysis, could value carbon so highly as to make it worth exorbitant costs to remove. Measured by this principle, in an environmentalist Pascal's wager, eliminating carbon emissions makes sense. There is a slight chance—however slim—that minuscule amounts of carbon contribute to runaway global warming, which itself has a chance of harming us. Follow the logic back and the decision is clear: quit emitting, quit trashing, quit polluting. At that point, no price is too high.

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377 Cited in Lawrence Kogan and Lucas Bergkamp, "Trade, the Precautionary Principle, and Post-Modern Regulatory Process," *European Journal of Risk Regulation*, April 2014, pg. 498.

378 Kogan, pg. 498.

379 Cited in Kogan, pg. 499.

Consider Middlebury College's Carbon Neutrality Plan. The plan does not specifically name the precautionary principle as its guiding standard, but it uses the language of potential unknown hazards as justification for its carbon neutral goal. The preface praises the Pew Center on Global Climate Change for serving "as an influential forum for corporate and non-profit leaders to objectively explore the environmental and economic risks and uncertainties associated with climate change"[380] and devotes an entire section, I.2.1, to "Potential climate impacts on Vermont."[381] Here the college acknowledges that

> *Admittedly, the uncertainties associated with regional predictions of the consequences of climate change are higher than the uncertainty in global predictions.*[382]

But "despite these uncertainties," Middlebury is preparing for a host of possible detrimental outcomes predicted by the EPA. It lists a series of risks that it hopes to mitigate with its carbon neutrality plan: a 4-degree Fahrenheit temperature rise by 2100; an increase in rainfall; heat-related illnesses among the elderly; concentrations of ozone leading to eye irritations, asthma and other ailments; upticks in tick-borne diseases; shortened ski seasons; the displacement of maple trees by oak and hickory; a change in fall leaf colors; and the disruption of the maple syrup industry.[383]

Planning for possible dangers is wise of course, but so is considering possible benefits that may come from warming temperatures: longer growing seasons, greater flora fertility thanks to increased carbon, more warm-season tourism, less road salt damage, or lower heating bills. Cost-benefit analyses consider both sides of these equations; the precautionary principle considers only the potential harms.

The Story of Middlebury

We offer a case study of one college that has positioned itself as a sustainability icon. Middlebury College is known for its commitment to achieving carbon neutrality. Bill McKibben, probably the best-recognized environmental thinker and activist in the country, is a resident scholar there.

Middlebury College's zero-carbon goal has a long history behind it. In 1999, well before most of its peer institutions began devoting themselves to environmental causes, and seven years before Al Gore's documentary *An Inconvenient Truth* conveniently stirred up public fear of climate change, the college had identified global warming as a significant threat it pledged to fight. Two years later, in a 2001 "Environmental Peak Report," a task force of professors set forth 140 action items meant to make the pledge a reality. One of these items was a recommendation to "establish a carbon neutral campus with

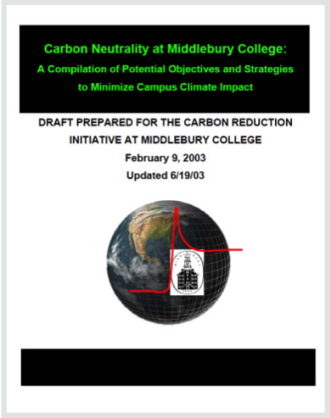
380 *Carbon Neutrality at Middlebury College*, pg 9.

381 *Ibid*.

382 *Ibid*.

383 *Ibid*, pg. 10.

zero emissions"—though no dates were set and no vows sworn just yet.[384]



Students took up the cause. One particularly dedicated group signed up for a January 2003 winter term course on the "Scientific and Institutional Challenges of Becoming Carbon Neutral." Their coursework involved researching case studies and writing a 200-page brief on strategies Middlebury might adopt to reduce its carbon emissions to a net of zero.[385] Their efforts convinced the board of trustees to vote in 2004 to reduce emissions by 8 percent below 1990 levels by the year 2012. Two years later, after more student research and outreach, including another winter term course that hosted a "MiddShift" climate change conference in January 2006, the board upped those goals to full climate neutrality by 2016. The official proclamation tied carbon neutrality to the college's deepest values, and linked the project to sustainability:

> *We believe the College should take a leadership stance on carbon neutrality and should build and expand upon the strategies it has in place to attain carbon neutrality and take further actions to develop and implement sound strategies that ultimately advance sustainability for this institution and our planet.*[386]

One year later President Ronald Liebowitz made the pledge a matter of public accountability when he joined 151 college presidents as charter signatories of the newly launched American College and University Presidents' Climate Commitment.[387]

The role of the Biomass Gasification Plant in this endeavor was to cut down Middlebury's reliance on No. 6 fuel oil, the main source of energy the college had previously used to heat and to supply electricity around campus. The students in the winter term course on carbon neutrality calculated that the oil burned in campus heating equipment constituted the single greatest source of greenhouse gas emissions on campus. By installing a 30,000-pound biomass boiler, Middlebury could cut down 1 million gallons of oil—50 percent of its annual usage—and 40 percent of its annual carbon emissions.[388] When the plant

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384 Nan Jenks-Jay and Chris McGrory Klyza, "Dear Alumni and Friends," *Environmental News*, Third Issue, Spring 2002, pg. 3. http://www.middlebury.edu/media/view/101461/original/EnvNews02.pdf.

385 *Carbon Neutrality at Middlebury College: A Compilation of Potential Objectives and Strategies to Minimize Campus Climate Impact*, February 9, 2003. https://www.middlebury.edu/media/view/262585/original/es010_report.pdf

386 "Resolution on Achieving Carbon Neutrality by 2016," Middlebury College, May 5, 2007. http://www.middlebury.edu/sustainability/policy-planning/policies/neutrality/2007

387 "Charter Signatories," American College and University Presidents' Climate Commitment, 2007. http://www2.presidentsclimatecommitment.org/html/chartersignatories.php

388 *Carbon Neutrality at Middlebury College*.

opened in frigid February 2009, Middlebury could declare itself well on its way to full carbon neutrality.

In fact, however, the plant provoked disagreement from those skeptical that biomass could truly be carbon neutral. In 2006, immediately after Middlebury announced its interest in pursuing biomass, the *Chronicle of Higher Education* published "Truth in Advertising: Middlebury College's Biomass Plant," which noted that saw mills (themselves consumers of energy) would produce the wood chips, that Middlebury's entry into the chip market would increase demand for wood, and that the net result might be a greater number of trees cut down and therefore less carbon sequestered.[389]

Middlebury faculty and students also began to dispute that biomass could truly be carbon-neutral. During the fall 2009 semester, Christopher Klyza, the Stafford Professor of Public Policy, Political Science, and Environmental Studies, taught a course on Middlebury's biomass plant in which students investigated whether biomass boilers actually released carbon emissions. "The students were interested in this question, because it didn't make sense that there is smoke coming out of the biomass plant," Klyza told the student newspaper, *The Middlebury Campus*. "It's not obviously carbon neutral. So there must be more to it."[390] Even Jon Isham, Director of the Center for Social Entrepreneurship and Professor of Economics, who in 2008 taught an environmental economics course in which students researched and first recommended the biomass plant to the college administration, had to admit in 2013, "I think we've rethought biomass and how carbon neutral it is. There were some critiques from faculty colleagues that proved to be true about overselling biomass as a carbon neutral process."[391] Middlebury, for its part, insists that it is responsible only for emissions from its own geographic property or from its private operations, not including any emissions from chopping or transporting the wood, carting off the ashes, or other third-party involvement.

(Bio)Mass Budget Destruction

Middlebury College, like most, does not publicize its sustainability budget. Indeed, it doesn't seem to have one per se. The costs of sustainability are diffused through many departmental budgets and are not broken out even within those budgets. But a great deal of document sifting and researching yields several startling conclusions: Middlebury appears to underestimate costs and overestimate benefits of sustainability endeavors, and the college appears driven more by ideology than by principles of economics in undertaking new sustainability programs.

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389 Richard Montastersky, "Truth in Advertising: Middlebury College's Biomass Plant," *Chronicle of Higher Education*, October 20, 2006. http://chronicle.com/article/Truth-in-Advertising-/27972

390 Claire Abbadi, "Carbon Neutral, or Carbon-Lite?" *The Middlebury Campus*, October 16, 2013. http://middleburycampus.com/article/carbon-neutral-or-carbon-lite/

391 Abbadi, "Carbon Neutral, or Carbon-Lite?"

We recognize that individual institutions—especially private ones—are free to allocate their budgets as they see fit. Middlebury College has a right to spend abundantly on sustainability, and it is evidently willing to do so. Our aim in producing a case study of Middlebury College's sustainability costs is solely to offer an estimate—the first we have seen to date—of what campus sustainability initiatives cost. To this end we include costs that might in themselves seem trivial but as components of overall expense are worth registering. We also recognize that the expenses that Middlebury College or any other college voluntarily assumes have to be weighed against the social good that these institutions imagine they are contributing to. In this analysis, we aggregate the costs and take account of any savings Middlebury reports, but we make no attempt to quantify the more diffuse social benefits that these expenditures are intended to bring about.

The new biomass plant at Middlebury is a good example of expensive sustainability-minded projects. According to a notice on the Planning, Design, and Construction division of Middlebury's Facilities Office, the new biomass-based heating system cost $11.9 million to construct,[392] though L.N. Consulting, Inc., the company that designed and oversaw the construction of the plant, pegged the cost at $12.5 million. [393] The college explains in a report to the Presidents' Climate Commitment that it financed that expense on the basis of student fees, outside grants and individual contributions, and money it borrowed through a bond sale.[394]

The plant is among Middlebury's pricier campus expenditures. The Planning, Design, and Construction division records that the same year that the plant opened, in 2009, Middlebury spent $5 million renovating the student center[395] and $1.7 million on a ski lift at the snow bowl.[396] Its most expensive campus construction that year was a $10.6 million upgrade on the dining hall.[397] The biomass plant cost the equivalent of what 263 students (about 11 percent of the student body) will spend on tuition for the 2014-2015 school year ($45,637 each),[398] or, for comparison, about 4 percent of the fiscal year 2013 operating budget—not too far behind the library services at 6 percent.[399]

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392 "Biomass Gasification Facility," Middlebury College. http://www.middlebury.edu/media/view/185271/original/Biomass_Project.pdf

393 "Middlebury College Biomass Project," L.N. Consulting, Inc., 2009. http://www.lnconsulting.com/portfolio/plant-systems/middlebury-college-biomass-project

394 "Progress Report for Middlebury College," ACUPCC Reporting System. http://rs.acupcc.org/progress/390/

395 "McCullough Student Center," Middlebury College. http://www.middlebury.edu/media/view/185321/original/McCullough_Project.pdf

396 "Worth Mountain Chair Lift at the Snow Bowl," Middlebury College. http://www.middlebury.edu/media/view/189061/original/Worth_Mountain_Project.pdf

397 "Proctor Dining Hall," Middlebury College. http://www.middlebury.edu/media/view/185351/original/Proctor_Project.pdf

398 Frequently Asked Questions, Middlebury Admissions. http://www.middlebury.edu/admissions/start/faq/node/172721

399 Frequently Asked Questions, Middlebury Financial Facts. http://www.middlebury.edu/media/view/464848/original/financial_faqs_17_infosheet_12.13.pdf

The boiler system, itself a $2.5 million-dollar[400] piece of equipment from Chiptec, Inc. of Bristol and Williston, Vermont,[401] is housed in an 8,000 square-foot addition to an existing service building, about 5,000 square feet of which also had to be renovated. Its operation requires a staff of six, as well as an electronic video-based control system.

To feed the boiler, the college buys wood from local farms and forests. In an experiment co-run with the State University of New York College of Environmental Science and Forestry, Middlebury Professor Timothy Volk had attempted to grow wood for the engine's consumption, planting nine acres of willow trees on the west side of Middlebury's campus to be harvested on a rotating three-year basis. Willow, a fast-growing, perennial tree that grows to sufficient height within three years, seemed ideally suited to the college's needs for quick wood that could be planted and harvested easily by machine. But seven years' testing (two harvests) determined the wood was too wet, too cold, and insufficient in quantity to supply the biomass needs of the plant, and the college would need to continue purchasing wood from outside sources.

The idea for biomass surfaced in the 2003 student report as an alternative to biodiesel fuel to replace the No. 6 fuel oil. Biodiesel, at $1.30 per gallon, was too expensive to replace the carbon-heavy fuel oil, whereas biomass—wood chips gathered from sawmills, forest floors, or chopped trees—was by comparison cheap. A consultant team with Vermont Family Forests determined that the surrounding Addison and Rutland counties had an annual supply of 269,250 green tons of suitable low-quality wood, and about 109,592 annual green tons in current demand for firewood, wood pulp, and wood chips, leaving 159,658 green tons of wood per year available for potential use, dependent on whether the landowners were interested in cutting and selling.[402]

Though the biomass chips were less expensive than biodiesel, the construction project wasn't cheap to undertake. In their initial estimate, the students guessed that the biomass gasification plant would cost $2.52 million in start-up costs: $2 million for the biomass boiler itself, $500,000 for delivery and storage equipment, and $23,000 for a storage building to house wood chips.[403] It would last for 50 years. But on the other hand, by reducing the college's need for fuel oil, it could save Middlebury $309,300 in annual

400 Michele Madia and Tadu Yimam, "How Many Wood Chips Does a Wood-Chip Burner Burn?" *Business Officer Magazine*, National Association of College and University Business officers, June 2010. http://www.nacubo.org/Business_Officer_Magazine/Magazine_Archives/June_2010/Energy_Stewards.html

401 "Chiptec Wood Energy Systems Helps Middlebury College Become Carbon Neutral," Chiptec Wood Energy Systems. http://www.chiptec.com/linked/middlebuiry%20college%20case%20study%20final.pdf

402 "Biomass Fuel Assessment for Middlebury College," Vermont Family Forests, January 31, 2004, pg. 44. http://sites.middlebury.edu/biomass/files/2009/02/mcbiomassreport.pdf

403 *Carbon Neutrality at Middlebury College*, pg. 37.

fuel costs.[404] In 7 years, they thought, it would pay for itself.

There were ancillary expenses, though: an estimated $250,000 in annual operating costs (which they thought would match the current operating costs for the fuel oil boiler), $5,500 per year to landfill the resulting ash (unless Middlebury expanded its compost site, or succeeded in selling the ash as fertilizer), plus about $25 per ton of wood chips (at 20,000 tons, about $500,000 per year).[405]

The actual cost of construction, when it began four years later, turned out to be almost five times as expensive, and the cost of woodchips rose to $37 per ton. (Meanwhile, the cost of No. 6 fuel oil also rose, from $0.80 to $1.50 per gallon.)[406] The expected life of the plant was not actually 50 years, but much lower, somewhere in the range of 25 to 30. And, while the college expects to save $840,000 in annual fuel costs, the anticipated payback period is now 12 years, introducing more risk.[407]

"Pay for itself" is a misleading phrase, though. In its angst to save carbon and label the project budget-viable, Middlebury appears to have omitted various costs. Does the savings of $840,000 per year in the cost of biomass relative to the cost of No. 6 fuel oil factor in the costs of operating the plant? The students in 2003 estimated $250,000 to staff and maintain the plant (about $323,709 in 2014 dollars, according to the Bureau of Labor Statistics), which it thought would match previous years' expenditures on operating the No. 6 fuel oil boiler. But an analysis of Middlebury documents show that merely paying the plant's operating staff easily tops that $250,000 figure.

A 2014 document from Middlebury's Human Resources Department listing all staff positions shows that Middlebury has hired five "Heating Plant Operators" to run the biomass plant, and one "Manager of the Central Heating Plant." Kelly Boe, the heating plant manager, told us in an interview that there are actually six, not five plant operators. The exact salaries of these staff members are private, but the document does list the "salary band levels" of all staff, which refer to specific salary ranges.[408] Another document from July 2014 lists the average pay ranges from the lower, middle, and upper thirds of the staff members within these bands, with slight differences within bands based on seniority, performance, and other individual factors.[409] Cross-checking the documents and averaging the salary data yield a reasonably

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404 *Carbon Neutrality at Middlebury College*, pg. 38

405 *Carbon Neutrality at Middlebury College*, pp. 37-38.

406 *Carbon Neutrality at Middlebury College*, and FAQs, Biomass at Middlebury. http://sites.middlebury.edu/biomass/about/faqs/

407 FAQs, Biomass at Middlebury.

408 "Staff Positions," Middlebury College, Department of Human Resources, January 20, 2014. http://www.middlebury.edu/media/view/355943/original/staff_positions_by_bandlevel.pdf

409 "Middlebury College Staff Pay Ranges," Middlebury College, Department of Human Resources, July 1, 2014. http://www.

accurate portrayal of what Middlebury actually pays these six staff for the biomass gasification plant: approximately $87,000 annually for the manager, and approximately $42,000 per year for each of the six operators, for a total of just over $338,000.

Figure 10. Estimated Annual Salaries of Staff for Middlebury's Biomass Gasification Plant

Position	Salary Band	Lowest Salary in Band	Highest Salary in Band	Average Salary in Band
Manager of the Central Heating Plant	Management 3	$63,170	$110,543	$86,857
Heating Plant Operator	Specialist 1	$31,595	$52,128	$41,862
Heating Plant Operator	Specialist 1	$31,595	$52,128	$41,862
Heating Plant Operator	Specialist 1	$31,595	$52,128	$41,862
Heating Plant Operator	Specialist 1	$31,595	$52,128	$41,862
Heating Plant Operator	Specialist 1	$31,595	$52,128	$41,862
Heating Plant Operator	Specialist 1	$31,595	$52,128	$41,862
Total		$252,740	$423,311	**$338,029**

Another 2014 document summarizing the health, dental, and vision insurance, and retirement contributions that Middlebury offers also gives some indication of the benefits these seven staff likely receive.[410] Middlebury pays a variable percentage of health insurance based upon salary level (the higher the salary, the lower the percentage), but a fixed portion of dental and vision insurance. Assuming that each staff member has opted for a two-person insurance coverage plan (rather than single, family, or none at all), and basing the percentages on the estimated salary ranges, we estimate that Middlebury spends approximately $83,000 on these seven staff members' health insurance, $5,700 on dental insurance, and $470 on vision insurance, for a total of about $89,000 in insurance benefits.

middlebury.edu/media/view/476423/original/2014_middlebury_staff_pay_ranges.pdf

410 "Middlebury College Benefits Summary 2014," Middlebury College, 2014. http://www.middlebury.edu/media/view/468704/original/midd_-_benefits_summary_2014.pdf

Figure 11. Estimated Annual Insurance Benefits of Staff for Middlebury's Biomass Gasification Plant

Position	Health Insurance	Dental Insurance	Vision Insurance	Total Cost of Insurance
Manager of the Central Heating Plant	$11,142	$814	$67	$12,023
Heating Plant Operator	$12,007	$814	$67	$12,888
Heating Plant Operator	$12,007	$814	$67	$12,888
Heating Plant Operator	$12,007	$814	$67	$12,888
Heating Plant Operator	$12,007	$814	$67	$12,888
Heating Plant Operator	$12,007	$814	$67	$12,888
Heating Plant Operator	$12,007	$814	$67	$12,888
Totals	$83,184	$5,698	$470	**$89,351**

Middlebury's retirement plan requires that all employees over the age of 21 set up and contribute towards an account, so it is reasonable to assume that all seven biomass plant staff have such an account. The college has a progressive retirement account that rewards longer tenures with greater contributions and that also gives larger contributions towards older staff members' accounts. Middlebury contributes 3 percent of each staff member's salary for those who have worked for the College 0-2 years, 9 percent for those who have worked there 2 or more years and are between the ages of 21 and 44, and 15 percent for those who have worked for Middlebury at least 2 years and who are 45 years or older.[411] Taking the middle estimate, 9 percent, yields retirement contributions of about $7,800 for the plant manager and $3,800 for each of the six operators, for a total of approximately $30,000 in retirement contributions.

Figure 12. Estimated Annual Retirement Benefits of Staff for Middlebury's Biomass Gasification Plant

Position	Average Salary in Band	Retirement
Manager of the Central Heating Plant	$86,857	$7,817
Heating Plant Operator	$41,862	$3,768
Heating Plant Operator	$41,862	$3,768
Heating Plant Operator	$41,862	$3,768
Heating Plant Operator	$41,862	$3,768
Heating Plant Operator	$41,862	$3,768
Heating Plant Operator	$41,862	$3,768
Totals	$338,029	**$30,425**

411 "Middlebury College Benefits Summary 2014."

Counting salaries and benefits, we estimate that Middlebury spends approximately $457,000 compensating its biomass plant workers—about $133,000 above the $323,709 inflation-adjusted figure that the students had estimated as the annual total cost of operating the old fuel oil boiler and had projected as the new annual cost of operating the biomass boiler. (The students' estimate came without a breakdown of component costs, calculations, or sources of information.) This increase in costs is in keeping with other case studies. When the University of Minnesota-Morris in 2008 installed a biomass gasification plant a little less than half the capacity of Middlebury's (it requires 9,000 tons[412] of biomass per year, relative to Middlebury's 20,000), the university estimated that it spent an additional $132,600 in labor costs, beyond what it had spent previously to man its gas-based boiler.[413]

Figure 13. Estimated Annual Compensation of Staff for Middlebury's Biomass Gasification Plant

Position	Salary Band	Average Salary in Band	Estimated Benefits	Estimated Total Compensation
Manager of the Central Heating Plant	Management 3	$86,857	$19,840	$106,697
Heating Plant Operator	Specialist 1	$41,862	$16,656	$58,518
Heating Plant Operator	Specialist 1	$41,862	$16,656	$58,518
Heating Plant Operator	Specialist 1	$41,862	$16,656	$58,518
Heating Plant Operator	Specialist 1	$41,862	$16,656	$58,518
Heating Plant Operator	Specialist 1	$41,862	$16,656	$58,518
Heating Plant Operator	Specialist 1	$41,862	$16,656	$58,518
Total		$338,029	$119,776	**$457,805**

The $457,000 gross figure does not include any maintenance, repairs, or other operational costs of actually running the boiler. These are non-trivial costs for which Middlebury supplies no information. Additional annual operating expenses include ash removal. Boe, the plant manager, told us that Middlebury stores its ash in an underground bunker, and four times each year pays a private company to remove the ash and turn it into fertilizer for local farms. Boe did not know the cost of the ash removal, while Middlebury's website merely notes that "Ash is collected and used by a local fertilizer company in their products."[414]

Maintenance constitutes another major cost. Most biomass systems require constant observation, and

412 Judy Riley, "Public Dedication of Biomass Gasification Facility," Morris Campus News and Events, October 3, 2008. http://www.morris.umn.edu/newsevents/view.php?itemID=6547

413 Joel Tallaksen, Arne Kildegaard, "Chapter 4: Financial and Economic Analysis," *Final Report to the USDA Rural Development Grant 68-3A75-5-232*. University of Minnesota-Morris, pg 18, Table II. http://renewables.morris.umn.edu/biomass/documents/USDA_Report/SII_Finance.pdf

414 "What Happens to the Ash?" FAQs, Biomass at Middlebury, Middlebury College. http://sites.middlebury.edu/biomass/about/faqs/

periodically equipment such as fans, motors, conveyers, pressure parts, water wall tubes, super heaters, and other parts need replacement.[415] In 2011, the baghouse filter system, which purifies the air emitted through the smokestack of any particulates, caught fire spontaneously and needed to be completely replaced.[416] Biomass plants at nearby Green Mountain College and the town of Poultney had also faced malfunctioning filtering systems.

And every couple of months, the system must be shut down, cooled off, and thoroughly cleaned of ash, charcoal, mineral residue, and any debris that gets carried along with the wood.[417] The process takes several days. Ideally that cleaning should take place every few months, says plant manager Kelly Boe, but during October 2013, the biomass team pushed the plant to run for a record 16 weeks without cleaning.[418] Eventually, the college would like to run the plant for a year straight, Boe told us, but for now they're working towards the intermediate goal of only four planned shut-downs per year. The reason for delaying the scheduled cleaning is to avoid additional carbon emissions. When the biomass plant shuts down, the campus runs on fuel oil instead. "It is painful for us to use oil," Boe commented to Middlebury's student newspaper, *The Middlebury Campus*. "No one wants to be the guy that breaks the streak" of going oil-free.[419] "The really significant part of [running for a consecutive 16 weeks] is that it means we burn that much more biomass and that much less fuel oil," commented Jack Byrne, the Director of Sustainability Integration.[420]

Middlebury does not reveal its annual maintenance costs, but a representative from Chiptec Inc., the manufacturer of Middlebury's biomass plant, told us in an interview that it often recommends that customers plan to spend about 2 percent of the cost of their initial infrastructure investment on annual maintenance. In Middlebury's case, 2 percent of the upfront $2.5 million to purchase the boiler system comes to $50,000 per year.

As a corollary, consider the University of Minnesota-Morris case study once again. UMM estimated that it needed to purchase new equipment (a telehandler, semi-truck with walking floor trailer, conveyer, and

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415 Anna Austin, "Planned Outage Protocol," *Biomass Magazine*, January 7, 2013. http://biomassmagazine.com/articles/8491/planned-outage-protocol

416 Susie, Steimle, "Middlebury Biomass Fire Still a Mystery," *WCAX News*, May 20, 2011. http://www.wcax.com/story/14687547/middlebury-biomass-fire-still-a-mystery

417 Joe Flaherty, "Round the Clock, Selleck Runs Biomass Plant," *The Middlebury Campus*, October 16, 2013. http://middleburycampus.com/article/round-the-clock-selleck-runs-biomass-plant/

418 Joe Flaherty, "Carbon Cleanup," *The Middlebury Campus*, October 10, 2013. http://middleburycampus.com/article/carbon-cleanup-an-inside-look-at-what-happens-when-the-biomass-plant-shuts-down/

419 Mitch Perry, "Biomass Plant Cuts Oil Use By 600,000 Gallons," *The Middlebury Campus*, October 9, 2013. http://middleburycampus.com/article/biomass-plant-cuts-oil-use-by-600000-gallons/

420 *Ibid*.

tractor with a bucket loader) approximately every ten years at a total cost of $180,000, or about $18,000 per year. The additional cost of operating this equipment was estimated at $8,000. Other maintenance costs included cleaning, repairing, and replacing various parts (sensor, filters, the boiler, the refractory lining of the gasifier) at about $27,000 per year. And the biomass plant required additional supplies: $15,000 in sodium hydroxide (NaOH) and $5,000 in additional water. Per year, these maintenance costs totaled $73,000, in addition to the extra labor involved.[421]

Figure 14. Estimated Annual Maintenance Costs for the Biomass Plant at the University of Minnesota-Morris[422]

Table III- Operations and Maintenance For Biomass Plant

Predicted Annualized Auxiliary Equipment Costs

(Equipment for biomass handling logistics)

Telehandler	50,000		
Semi-Truck with walking floor trailer	70,000		
Conveyer	10,000		
Tractor With Bucket Loader	50,000		
(purchase price for used equipment- 10 yr life)	$ 180,000.00		
		Equipment Capital	$ 18,000
		Equipment Operational	$ 8,000
		Sub-Total	**$ 26,000**

Predicted Additional Maintenance

(Not including Plant staff labor)

Estimated Total Expenses			$ 15,000
Parts	Boiler Cleaning		
Sensors	Filters		
Refractory Maintenance			$ 12,000
		Sub-Total	**$ 27,000**

Additional supplies

NaOH			$ 15,000
Water			$ 5,000
Electricity			
		Sub-Total	**$ 20,000**

Total Yearly $ 73,000

Another expense Middlebury pays is for the wood to feed the plant. Boe estimates that the plant requires 25,000 tons of wood chips each year, but declined to name a wood chip budget. Elsewhere, the college estimates a price of $37 per ton, which by our calculation makes for a total of $925,000 per year.[423]

421 Tallaksen and Kildegaard, "Chapter 4: Financial and Economic Analysis." Table III, pg. 19.

422 *Ibid*.

423 "How Much Did the Biomass Project Cost and What Is the Payback?" FAQs, Biomass at Middlebury, Middlebury College.

Middlebury estimates slightly lower and puts a positive spin on this expense: "The project will also pump $800,000 annually into the local economy through the purchase of woodchips."[424] (Relative to the cost of No. 6 fuel oil, Middlebury believes this saves $840,000 in fuel costs.)[425]

There are other questions left unanswered. Did the college price the research and time required to find the proper wood and to determine that willow didn't work? Do the projected savings assume peak operating efficiency, which presumably will decline over time, and already has declined due to less-than-ideal wood supplies?

What about the staff time required to research and vet the proposal, and the hours of work to calculate how many tons of carbon the plant would save, and whether those savings would suffice to advance Middlebury's crusade towards carbon neutrality? At various points, the preparation costs for the biomass system were kept artificially low by turning biomass research—that might have required a consultant or staff time at the Office of Sustainability—into student homework assignments. Not only was the 200-page carbon neutral strategy that recommended biomass boilers written by students in a 2003 winter term, but Middlebury's first emissions inventory that laid the groundwork for climate neutrality by tracking all of the college's sources and volumes of greenhouse gas emissions was conducted as part of a student internship and senior thesis in 2001.

And the 2008 Climate Action Plan in which Middlebury laid out its official strategy to achieve carbon neutrality, submitted for review to the Presidents' Climate Commitment, drew on the senior theses and independent studies of six different undergraduate students. Additionally, for answers to key questions—such as *What is the availability of biomass fuel to replace 1 million gallons of No.6 fuel oil? What is the local, regional, and global economic impact of Middlebury College procuring 1.2 million gallons per year of a B100 biodiesel fuel source?*—the Climate Action Plan cited student work in Professor Jon Isham's Spring 2008 Environmental Economics course.[426]

In other cases, the numbers appear evasive. The estimated cost savings of $840,000 per year, divided into the upfront costs of $11.9 million, equals more than 14 years to recover the initial investment—not 12, as Middlebury's documents claim. This indicates that third parties are covering substantial costs that do not figure into Middlebury's internal calculations. Indeed, Middlebury's 2012 Progress Report

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http://sites.middlebury.edu/biomass/about/faqs/

424 *Ibid*.

425 *Ibid*.

426 MiddShift Implementation Working Group, "Climate Action Implementation Plan," Middlebury College, August 28, 2008, pp 27-28. http://www.middlebury.edu/media/view/243071/original/Middlebury_CAP.pdf

to the American College and University Presidents' Climate Commitment discloses that it had received $1,476,893 in outside grants and gifts to be used for sustainability. The report does not detail what Middlebury spent these gifts on, but if the sum went towards the biomass plant, the remaining cost to Middlebury ($10,423,107) is equal to just over 12 years' savings at $840,000 per year.

Private donations and grants are normal parts of university initiatives, and undoubtedly the donors' intentions are good. But whereas they make a biomass gasification plant more affordable to Middlebury, they do not make the plant more economically viable overall. That is, Middlebury might (and one must emphasize the speculative nature of that "might") privately gain from its subsidized construction of a biomass plant, but the broader society and economy as a whole might experience a loss in the form of an inefficient use of funds.

One has to wonder as well whether the biomass boiler will remain in use for the full duration of its expected 25-year lifetime. If a new carbon-neutral system less reliant on trees is invented, will the college switch in an attempt to update its environmental profile?

The Wages of Sustainability

Middlebury's sustainability efforts go far beyond its biomass plant. An entire team of staff works on carbon-reduction projects and other environmental initiatives. Middlebury has a Dean of Environmental Affairs, a Director of the School of Environment, a Director of the Sustainability Integration Office, a Sustainability Communications/Outreach Coordinator, a School of Environment Language School Personnel and Budget Coordinator, another School of Environment staff member, an Assistant Director of the Franklin Environmental Center, a Food and Farm Educator to run the campus organic farm, an Environmental Health and Safety Coordinator, a Coordinator for Community Environmental Studies, and one Ecologist on staff—in addition to the biomass plant staff.

Using the same documents used to estimate the salaries of the biomass plant staff, we estimated the salaries of these positions. Four positions—the Dean of Environmental Affairs, the Director of the School of Environment, the School of Environment staff, and an ecologist— did not include a salary band level. We estimated these salaries using other sources documented below.

Figure 15. Estimated Annual Salaries of Sustainability Staff at Middlebury College

Position	Salary Band	Lowest Salary in Band	Highest Salary in Band	Average Salary in Band
Dean of Environmental Affairs	not graded			$197,475*
Director of Sustainability Integration Office	Administrator 1	$75,341	$139,357	$107,349
Sustainability Communications/Outreach Coordinator	Specialist 1	$31,595	$52,128	$41,862
Assistant Director of the Franklin Environmental Center	Specialist 3	$46,305	$76,409	$61,357
Food and Farm Educator	Specialist 3	$46,305	$76,409	$61,357
Environmental Health and Safety Coordinator	Specialist 4	$57,851	$95,471	$76,661
Director of the School of Environment	not graded			$118,670**
School of Environment Staff	not graded	$30,668†	$49,065†	$39,867†
School of Environment Language School Per Budget Coordinator	Operations 4	$39,353	$62,969	$51,161
Coordinator Community Environmental Studies	Specialist 3	$46,305	$76,409	$61,357
Ecologist	not graded	$57,851‡	$95,470‡	$76,661‡
Total				**$893,777**

** The dean's salary was estimated based on the average salary of a dean of Forestry and Environmental Studies, according to the 2012-2013 Administrators in Higher Education Salary Survey.*[427]

*** The salary for the director of the school of the environment was estimated based on the average salary of an assistant dean of Forestry and Environmental Studies, the closest match in the College and University Professional Association for Human Resources, 2012-2013 study of higher education administrators' salaries.*

† These numbers for the School of Environment Staff member were calculated on the assumption that the position, though not assigned to a salary band, might resemble a level-3 operations position, as other jobs in this band include various secretarial and programmatic work.

‡ These numbers for the Ecologist were calculated assuming that the position is paid at the same rate as a specialist level 4 (the highest level of specialists). Because faculty are not included on this staff list, we assume that the Ecologist, though likely holding a Ph.D., is not paid at the rate of Middlebury professors.

Adding in insurance and retirement benefits brings the total compensation to over $1.1 million.

427 *Administrators in Higher Education Salary Survey*, College and University Professional Association for Human Resources, 2012-2013, pg 20. http://www.cupahr.org/surveys/files/salary2013/AHE13-Executive-Summary.pdf

Figure 16. Estimated Total Annual Compensation of Sustainability Staff at Middlebury College

Position	Average Salary in Band	Health Insurance	Dental Insurance	Vision Insurance	Retirement	Total Compensation
Dean of Environmental Affairs	$197,475	$10,085	$814	$67	$17,773	$226,214
Director of Sustainability Integration Office	$107,349	$10,680	$814	$67	$9,661	$128,571
Sustainability Communications/ Outreach Coordinator	$41,862	$12,007	$814	$67	$3,768	$58,518
Assistant Director of the Franklin Environmental Center	$61,357	$11,574	$814	$67	$5,522	$79,334
Food and Farm Educator	$61,357	$11,574	$814	$67	$5,522	$79,334
Environmental Health and Safety Coordinator	$76,661	$11,574	$814	$67	$6,899	$96,015
Director of the School of Environment	$118,670	$10,680	$814	$67	$10,680	$140,911
School of Environment Staff	$39,867	$12,440	$814	$67	$3,588	$56,776
School of Environment Language School Per Budget Coordinator	$51,161	$12,007	$814	$67	$4,604	$68,653
Coordinator for Community-Based Environmental Studies	$61,357	$11,574	$814	$67	$5,522	$79,334
Ecologist	$76,661	$11,574	$814	$67	$6,133	$95,249
Total	$893,777	$125,769	$8,954	$737	$79,672	**$1,108,909**

There are also three Waste & Recycling Handlers (each paid approximately $31,625, plus benefits), and one Waste & Recycling Hauler (approximately $39,867 plus benefits) whose jobs presumably would be needed with or without sustainability initiatives. We did not include these jobs in our tally.

This list of administrative and operational positions does not include the staff for the biomass gasification plant.

Nor does it include any of the environmental and sustainability faculty members: 1 instructor, 2 lecturers, 2 assistant professors, 1 associate professor, 2 full professors, plus 7 other professors of psychology, economics, English, and various other disciplines who spend part of their teaching assignments on environmental courses, and 10 senior fellows with Middlebury's summer program, the School of the Environment. An internal study comparing Middlebury's average faculty salaries with those of other institutions in 2012-2013 shows that an average Middlebury assistant professor ranked seventh among 12 elite liberal arts college, receiving about $101,409 each year (including benefits). An average Middlebury associate professor receives $119,429 (ranking eighth among the 12 colleges). And a full professor at Middlebury can expect to receive approximately $172,322—seventh on the list.[428]

Middlebury itself doesn't make known to the public what it pays its instructors and lecturers, but information on college data websites indicates that an average instructor at Middlebury receives $68,997[429] and an average lecturer receives $69,103[430]—both before any potential benefits. Their inclusion brings Middlebury's academic spending on environmental sustainability education to nearly $875,000, apart from the dean's salary, the salaries of affiliated faculty whose primary academic assignment is not with the environmental department, senior fellows, any support staff, teacher assistants, building costs, or other associated costs of running an academic department.

428 "2012-13 Comparative Average Salaries and Total Compensation," Middlebury College, Data About Middlebury, 2012-2013. http://www.middlebury.edu/media/view/448182/original/fac_salaries_2012.pdf

429 "Middlebury College-Instructor," Faculty Salaries, *Find the Best*. http://faculty-salaries.findthebest.com/l/12944/Middlebury-College

430 *Ibid*

Figure 17. Estimated Annual Compensation for All Environmental/Sustainability Faculty at Middlebury College

Position	Average Salary	Average Benefits	Total Average Compensation
Instructor	$68,997	n/a	$68,997
Lecturer	$69,103	n/a	$69,103
Lecturer	$69,103	n/a	$69,103
Assistant Professor	$78,775	$22,634	$101,409
Assistant Professor	$78,775	$22,634	$101,409
Associate Professor	$90,888	$28,541	$119,429
Full Professor	$129,315	$43,007	$172,322
Full Professor	$129,315	$43,007	$172,322
Total		$338,029	**$119,776**

Add to that the cost of Middlebury's sustainability student interns (four of them during summer 2013[431]), farm interns (four during the summer, two during each semester[432]) and five or six residential sustainability coordinators per each of the five "commons," the living-learning communities to which each student is assigned for the duration of his time at the college.[433]

Middlebury classifies and pays these student workers by the skill level required for the job (general, skilled, specialist) and by academic standing.

Figure 18. 2014 Student Hourly Wage Scale at Middlebury College[434]

Category	1st Year	2nd Year	3rd Year	4th Year
Level A General	$ 8.75	$ 8.95	$ 9.15	$ 9.35
Level B Skilled	$ 9.35	$ 9.55	$ 9.75	$ 9.95
Level C Specialist	$ 9.95	$ 10.15	$10.35	$10.55

Students are also eligible for merit raises if they return to the same job for additional years. They are not

431 "Meet Middlebury Summer Interns," Middlebury College, July 11, 2013. http://www.middlebury.edu/sustainability/news-events/news/2013/node/452517

432 "About Us," Organic Farm, Middlebury College. http://www.middlebury.edu/sustainability/food/mcog/about

433 "Getting to Know the Residential Sustainability Coordinators," *The Middlebury Campus*, October 13, 2010. http://middleburycampus.com/article/getting-to-know-the-residential-sustainability-coordinators/

434 "2014 Student Wage Scale," Middlebury College, January 1, 2014. http://www.middlebury.edu/offices/business/seo/paid/wagescale

allowed to work more than 20 hours per week.[435]

It is likely that at least one of the sustainability interns was classified as "specialist," since Middlebury has in the past tasked interns with gathering data and filling out annual greenhouse gas audits.[436] It is likely that the other 3 interns, as well as the 2 farm interns, were classified as "skilled," though it is possible that others may also have been classified as "specialist."[437] Assuming, then, that there was 1 specialist intern, 3 skilled interns, 2 skilled farm interns, and assuming on the conservative side that there were 25 residential sustainability coordinators (5, rather than 6, per each of the 5 commons) also classified as "skilled," and that each was paid, estimating conservatively, at the "Sophomore" level, and each worked an average of 12 hours per week (again, a conservative estimate) for approximately 14 weeks over the semester (excluding finals and midterms), that adds up to nearly $50,000 per semester, nearly $100,000 per academic year.

Figure 19. Estimated Annual Compensation of Sustainability Student Workers at Middlebury College

Position	Pay Level	Number at this Level	Sophomore Pay Rate	Hours per Week	Weeks per Semester	Total Pay per Semester	Total Pay per Year
Sustainability Intern	Specialist	1	$10.15	12	14	$1,705	$3,410
Sustainability Intern	Skilled	3	$9.55	12	14	$4,813	$9,626
Farm Intern	Skilled	2	$9.55	12	14	$3,209	$6,418
Residential Sustainability Coordinator	Skilled	25	$9.55	12	14	$40,110	$80,220
Total						$49,837	**$99,674**

In all, counting sustainability staff and administrators, faculty, student workers and interns, and the biomass gasification plant staff, this brings Middlebury's annual sustainability-related salary costs, as far as we can

435 "Working on Campus," Middlebury College. http://www.middlebury.edu/offices/business/seo/workingoncampus

436 "Each summer a student intern is hired to gather the data for the inventory, enter it, and provide an initial quality/accuracy check. This draft is then reviewed by the Sustainability Integration Office and any questions, errors, or omissions are addressed before sending a final draft for review and acceptance." See "GHG Report for Middlebury College," American College and University Presidents' Climate Commitment, May 14, 2014. http://rs.acupcc.org/ghg/3077/

437 Middlebury defines "skilled" jobs as those that "require a higher level of responsibility and some previous training or experience. Positions offer extensive on-the-job training or require certification. Students may be responsible for an aspect of a program, and/or supervising other students. Examples of Skilled Level positions include: Web assistants, Lab assistants, Lifeguards, Research assistants, Tutors, Teaching assistants, Athletic Trainers, Graders, Library or Office Associates." See "2014 Student Wage Scale," Middlebury College, January 1, 2014. http://www.middlebury.edu/offices/business/seo/paid/wagescale

estimate, to more than $2.5 million.

Figure 20. Total Estimated Annual Compensation of Sustainability Staff and Faculty at Middlebury College

Position	Number of Staff	Estimated Salaries	Estimated Benefits	Total Compensation
Dean of Environmental Affairs	1	$197,475	$28,739	$226,214
Director of Sustainability Integration Office	1	$107,349	$21,222	$128,571
Sustainability Communications/ Outreach Coordinator	1	$41,862	$16,656	$58,518
Assistant Director of the Franklin Environmental Center	1	$61,357	$17,977	$79,334
Food and Farm Educator	1	$61,357	$17,977	$79,334
Environmental Health and Safety Coordinator	1	$76,661	$19,354	$96,015
Director of the School of Environment	1	$118,670	$22,241	$140,911
School of Environment Staff	1	$39,867	$16,909	$56,776
School of Environment Language School Per Budget Coordinator	1	$51,161	$17,492	$68,653
Coordinator for Community-Based Environmental Studies	1	$61,357	$17,977	$79,334
Ecologist	1	$76,661	$18,588	$95,249
Instructor	1	$68,997	n/a	$68,997
Lecturer	2	$138,206	n/a	$138,206
Assistant Professor	2	$157,550	$45,268	$202,818
Associate Professor	1	$90,888	$28,541	$119,429
Full Professor	2	$258,630	$86,014	$344,644

Position	Number of Staff	Estimated Salaries	Estimated Benefits	Total Compensation
Sustainability Intern (specialist)	1	$3,410	n/a	$3,410
Sustainability Intern (skilled)	3	$9,626	n/a	$9,626
Farm Intern	2	$6,418	n/a	$6,418
Residential Sustainability Coordinator	25	$80,220	n/a	$80,220
Manager of the Central Heating Plant	1	$86,857	$19,840	$106,697
Heating Plant Operator	6	$251,172	$99,936	$351,108
Total		$2,045,751	$494,731	**$2,540,482**

Adding it Up

In all, Middlebury has spent millions of dollars on sustainability. According to its most recent Progress Report on file with the Presidents' Climate Commitment, Middlebury estimates that it has dispensed a total of $10-$20 million for its sustainability endeavors.[438]

The Presidents' Climate Commitment rubric operates in broad $10-million ranges. Clearly Middlebury's numbers are north of the $10 million base level, since it spent nearly $12 million on the biomass plant, but how far north is kept guarded. We undertook the task of estimating more closely what sustainability costs Middlebury.

We already estimated that the biomass plant staff cost about $457,000 per year, that maintaining the biomass plant costs approximately $50,000 (by the manufacturer's guideline of 2 percent of the cost of infrastructure), and that wood chips to feed the plant cost about $800,000 (though Middlebury calculates saving $840,000 compared to fuel costs). And sustainability staff, professors, and researchers cost about $2.5 million each year in salaries and benefits.

Other costs include keeping the environmentalist, pro-divestment Bill McKibben on staff as a distinguished scholar in residence. McKibben has occasionally taught classes at Middlebury since 2001, and when he founded 350.org in 2007, he did so with four Middlebury students. In 2010 he was announced as the Schumann Distinguished Scholar at Middlebury,[439] his position named for the Schumann Center

438 "Progress Report for Middlebury College," ACUPCC Reporting System, January 6, 2012. http://rs.acupcc.org/progress/390/

439 "Author and Environmentalist Bill McKibben Appointed Schumann Distinguished Scholar at Middlebury College," Middlebury College, November 9, 2010. http://www.middlebury.edu/newsroom/archive/2010/node/269059

for Media and Democracy, which is a major contributor to 350.org and to 350.org's predecessor, the 1Sky Network.[440] In 2010, the year McKibben was appointed, the Schumann center made two gifts to Middlebury: one for $1 million, and another for $200,000, according to tax documents submitted to the IRS. It did not make any further contributions to Middlebury in the years since, though it did award $100,000 to 1Sky and $211,300 to 350.org in 2011. It is likely that the Center's $1 million gift established an endowment for McKibben's position at Middlebury, and that the $200,000 constituted McKibben's salary during his first year in this new position. The return on a $1 million endowment, estimated using the 5-year average return from the S&P 500 of 15.90 percent, is $159,000.[441] This means that if McKibben continues to draw $200,000, then Middlebury is picking up a tab of $41,000. (The college was also, prior to the Schumann Center's sponsoring of McKibben, paying for McKibben's affiliation with the college since 2001, at an undisclosed amount.)

There are other costs. Middlebury prides itself on purchasing as much locally grown organic food as it can, purchasing 20 percent of its food from within Vermont State.[442] In all, it spends 32 percent[443] of a $4.2 million annual dining hall food budget,[444] for a total of $1,344,000 each year, on organic, local food.

A host of smaller programs add up to more bills, as well. Middlebury operates a campus composting facility that annually churns out 300 tons of fertilizer.[445] Every day collection trucks gather waste (about 10,000 pounds per week) from 85 campus collections bins, mix it with three parts wood chips (the same kind that go into the biomass boiler) and one part horse manure from a local horse farm, and let it ferment before spreading it on the soil around campus landscaping.[446] Middlebury does not reveal the costs of this program, but a case study from Harvard Law School's composting experiment calculated that each ton of compost cost approximately $28 above the cost of sending that ton to a landfill.[447] If Middlebury's costs are comparable, at 300 tons per year this costs $8,400.

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440 Anne Journeyman, "What's Behind the Money Behind McKibben?" *Inside Philanthropy*, October 12, 2013. http://www.insidephilanthropy.com/climate-change/2013/10/12/whats-behind-the-money-behind-mckibben.html

441 S&P 500 Index SPX 5-Year Average, Quick Take Morningstar. http://quicktake.morningstar.com/index/IndexCharts.aspx?Symbol=SPX

442 "Dining at Middlebury."

443 "Local Food at Middlebury," Student Life, Dining, Local, Middlebury College. http://www.middlebury.edu/studentlife/dining/Local

444 "Dining at Middlebury," Food, Sustainability, Middlebury College. http://www.middlebury.edu/sustainability/food

445 "Composting at Middlebury," Middlebury College. http://www.middlebury.edu/offices/business/recycle/compost

446 Robert Keren, "Mining Black Gold," *Middlebury Magazine*. http://sites.middlebury.edu/middmag/2010/07/22/mining-black-gold/

447 Kate Cosgrove, "Post-Consumer Composting at Harvard Law School," Association for the Advancement of Sustainability in Higher Education, October 2011. http://www.aashe.org/files/aashe2011-materials/aashe_-_harvard_law_school_post_consumer_composting.pdf

Then there's the annual professional development conference that Middlebury sponsors, at which professors receive training on how to incorporate sustainability into their (usually non-environmental) courses. In exchange for their efforts, participating professors receive stipends and other incentives. Similar programs, such as the Piedmont Program at Emory University, pay stipends of $1,000 per professor, in addition to providing for the speakers, material, venues, and other conference costs.[448] Middlebury estimates that since its program began in 2009, 30 professors have participated, an average of 6 each year.[449] Assuming stipends are on par with Emory's, this means a cost of $6,000 per year in stipends.

Students wishing to study sustainability-related topics abroad are also eligible for $500 in sustainability study abroad fellowships. Lists of previous awardees indicate that often three students per year receive these fellowships, at a cumulative cost of $1,500 per year.[450]

Middlebury also relies on carbon offsets (550 metric tons, bought for an undisclosed price, according to Middlebury's 2014 GHG report to the Presidents' Climate Commitment) and renewable energy credits (10) that are meant to counteract some of Middlebury's remaining emissions.[451] According to 3 Degrees, an offset-selling company, 550 carbon offsets range in price from $1.75 to $12 per metric ton, for an average of $6.88 per metric ton; this indicates that Middlebury spends approximately $3,784 on carbon offsets. Ten renewable energy credits sell for a total of about $55. We estimate that Middlebury spends about $3,839 on its offsets and energy credits.

To this there are additional costs that simply are unknown. There's the bike-sharing program, the organic farm on campus, the Environmental Council Grants awarded in undisclosed amounts to student projects, the annual sustainability fair, the sustainability new student orientation, and a host of other sustainability events on campus—not to mention less tangential costs such as the cost of maintaining the office space and building used for the Office of Sustainability.

To the best of our ability, we estimate Middlebury's annual sustainability costs to be $4,920,221.

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448 Arri Eisen and Peggy Barlett, "The Piedmont Project: Fostering Faculty Development toward Sustainability," *Journal of Environmental Education* 2006 (Vol. 38, No. 1) pp. 25-38. http://piedmont.emory.edu/documents/Articles1/Eisen26Barlett06.pdf

449 "Sustainability in the Curriculum Workshops," Sustainability, Middlebury College. http://www.middlebury.edu/sustainability/tools/courses

450 "Sustainable Study Abroad Grants," Study Abroad, Middlebury College. http://www.middlebury.edu/international/sa/sustainable/grants

451 "GHG Report for Middlebury College," ACUPCC Reporting System, May 14, 2014. http://rs.acupcc.org/ghg/3077/

Figure 21. Estimated Annual Gross Cost of Sustainability at Middlebury College

Category	Cost
Wood chips for biomass plant	$925,000
Maintenance of biomass plant	$50,000
Compensation for biomass plant staff	$457,805
Compensation for sustainability staff and faculty	$2,082,677
Bill McKibben	$41,000
Organic food for dining hall	$1,344,000
Composting	$8,400
Carbon offsets	$3,839
Professional development for faculty	$6,000
Sustainability study abroad grants	$1,500
Total	**$4,920,221**

These are, of course, gross costs. Even if we remove the $840,000 in fuel oil costs that Middlebury expects to save annually and the $323,709 ($250,000 inflation adjusted 2006 money) that the students estimated as the annual operations cost of running the old fuel oil plant, Middlebury's net expenditures on sustainability still total approximately $3,756,516 per year.

Figure 22. Estimated Net Cost of Sustainability at Middlebury College

Category	Cost
Estimated gross costs	$4,920,225
Fuel oil savings	-$840,000
Operation of old oil heater	-$323,709
Net costs	**$3,756,516**

Compared with Middlebury's complete operating budget of $292 million in fiscal year 2014, sustainability initiatives are modest.[452] They comprise about 1.2 percent of the budget. But neither are they budget-neutral (as many activists hope sustainability initiatives are), nor are they necessarily directed to the most effective, efficient ways to help the environment.

There are another 684 signatories of the American College and University Presidents' Climate Commitment who have committed themselves to similar carbon purges. Some smaller colleges, and others less advanced on their paths to carbon neutrality, surely spend less per year. But many others no doubt spend much more. Middlebury is a small college with about 2,500 students; Arizona State University, another

452 "General Financial Information," Middlebury College, 2014. http://www.middlebury.edu/offices/business/budget/gen_finance_info

sustainability champion, has more than 76,000, and Ohio State University has more than 57,000. These, and other large state schools, surely spend far more than Middlebury does.

Assuming, though, that Middlebury's annual $4,920,221 cost of sustainability efforts is in range of the average cost, we estimate the total annual cost of all 685 signatories endeavoring to fulfill the Presidents' Climate Commitment is nearly $3.4 billion.

There are also a host of one-time costs, such as the $11.9 million dollar biomass plant, and the additional $1.7 million that the board recently approved to modify the four non-biomass fueled heating plants to be able to run on bio-methane gas, natural gas, No. 2 fuel oil, biodiesel fuel and other types of renewable fuel rather than the more carbon-intense No. 6 fuel oil.[453] Middlebury also operates a revolving loan fund with $300,000 set aside to be used for cost-effective sustainability projects, with the goal of growing this fund to $1 million.[454] This comes to $13,900,000.

Figure 23. Estimated Fixed Costs of Sustainability at Middlebury College

Category	Cost
Biomass Gasification Plant	$11,900,000
Heating plant upgrade	$1,700,000
Green revolving loan fund	$300,000
Total	**$13,900,000**

Granted, Middlebury estimates in its report to the Presidents' Climate Commitment a projected $20-$30 million return on these investments, banking on "the amount of money saved annually on fuel costs for the expected lifespan of the biomass facility plus planned and likely future energy efficiency projects."[455] Whether the biomass plant will actually save money remains to be seen.

But the fixed costs, plus a mere two years' worth of annual costs, equals $23,740,442—far above the upper bound of $20 million that Middlebury reported in spending to the Presidents' Climate Commitment. Adding a third and fourth years' operations drives the cost to $33,580,884—more than $3 million above the $30 million that

Beyond the direct costs, Middlebury also faces forgone economic opportunities.

453 "Middlebury Trustees Approve 2013-2014 Budget, Sign off on new Environmental School and Hebrew Language Institute," Middlebury College, May 17, 2013. http://www.middlebury.edu/newsroom/archive/524638/node/451019

454 "Green Revolving Loan Fund," Sustainability, Middlebury College. http://www.middlebury.edu/sustainability/tools/RLF

455 "Progress Report for Middlebury College," ACUPCC Reporting System, January 6, 2012. http://rs.acupcc.org/progress/390/

Middlebury hopes its biomass plant will save. This indicates that Middlebury is disclaiming significant costs in its own cost-benefit analyses and that the return on sustainability investments is significantly lower—even negative.

And beyond the direct costs, Middlebury also faces forgone economic opportunities, sidestream effects of supplying green energy, and the impediments to human health in chopping lumber for the biomass plant, erecting windmills, and installing solar panels—costs that it never reckons at all. For instance, Middlebury could choose to sell carbon credits from its own carbon reduction by means of the biomass plant–12,500 metric tons per year–probably for a total of $86,000, using the $6.88 average from the company 3 Degrees.

Diminishing Marginal Utility

Eliminating 100 percent of all greenhouse gas emissions is a gargantuan task requiring a princely sum, and it's not clear the rewards are proportionally sized. What if that money had been invested into faculty research, student programs, scholarships, or community engagement programs? What if the student courses and homework time, staff attention, and faculty research devoted to carbon neutrality had been redirected towards more timeless pursuits? At least one Middlebury student is beginning to agree. "Too many people take a fundamentalist approach to saving the environment while ignoring the fact that all actions have costs and benefits, and, sometimes, the benefits of burning carbon may indeed outweigh the costs," wrote a student, Max Kagan in a *Middlebury Campus* op-ed in February 2014.[456] Kagan contended that Middlebury rightly recruited students from diverse geographic locations, even though transporting a global student body to Vermont was far from carbon neutral: "I happen to think that a pound of carbon spent furthering the educational mission of Middlebury College is a pound we are justified in spending. Judging from the fact that most students willfully emit thousands of pounds of carbon each year in their journeys to and from campus, it appears that nearly all my peers already agree with me."[457]

Even if Middlebury were set on spending its sustainability budget on only sustainability endeavors, chasing carbon-zero is not the most effective way to cool the planet. Middlebury's initial $10-20 million investment cut down 27,618 metric tons of carbon dioxide, down from 29,882 in 2007,[458] to a net of 2,264 in 2014.[459] (That includes 12,729 metric tons of gross emissions, minus 550 in carbon offsets,

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456 Max Kagan, "An Inconvenient Truth About Carbon Neutrality," *The Middlebury Campus*, February 26, 2014. http://middleburycampus.com/article/an-inconvenient-truth-about-carbon-neutrality/

457 Middlebury avers in its policies that it is responsible only for the emissions from its own geographic property and its private operations, not from student or other third-party use. But, since 2006, it does ask students travelling internationally to consider purchasing carbon offsets to account for their transportation. "Carbon Offsets," Middlebury College, Middlebury International. http://www.middlebury.edu/international/sa/sustainable/carbon_offsets

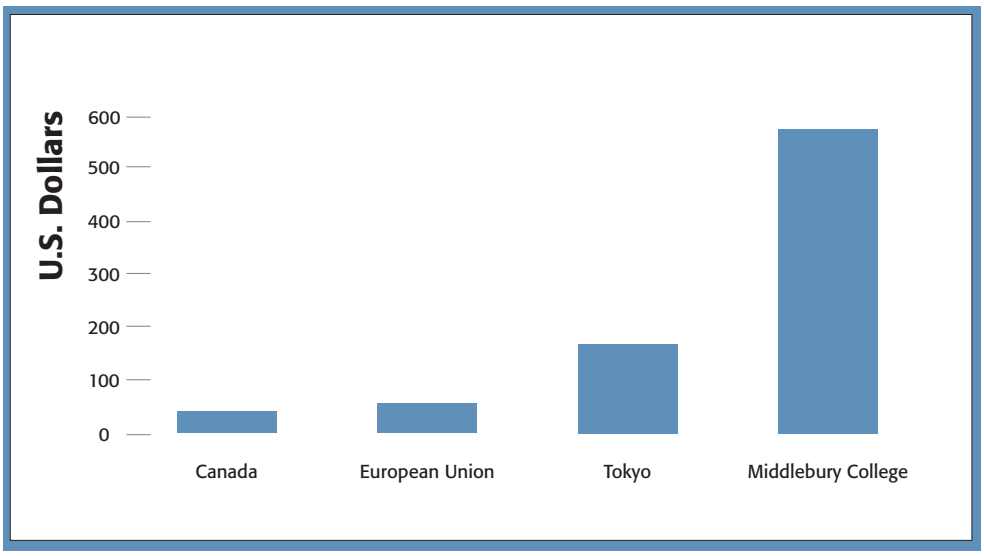
458 "GHG Report for Middlebury College," ACUPCC Reporting System, November 26, 2008. http://rs.acupcc.org/ghg/441/

459 "GHG Report for Middlebury College," ACUPCC Reporting System, May 14, 2014. http://rs.acupcc.org/ghg/3077/

10 in Renewable Energy Certificates, and 9,905 in sequestration credits for the forests that Middlebury maintains on its property.) That's a price ranging from $362 to $724 (an average of $543) per metric ton of carbon that Middlebury refrained from emitting. If that price remains constant for the last 2,264 metric tons that Middlebury has yet to eradicate, the college will spend somewhere between another $800,000 to $1.6 million achieving carbon neutrality. More likely, though, those last emissions will be more difficult and more expensive to eliminate.

By comparison, the Environmental and Energy Studies Institute estimates that the EU under a cap and trade program launched in 2005 has spent €10 to €30, or $12 to $36, per metric ton eliminated, and Pigouvian carbon taxes in Canada reduced emissions at a cost of $15 per metric ton.[460] The most expensive program profiled in the EES study was Tokyo's, which cost $142 per metric ton.

Figure 24. Cost Per Metric Ton of Greenhouse Gas Reduction



Perhaps it sounds unfashionably frugal to expect a good bang for your buck, but the reality is that Middlebury might improve the environment several hundred-fold if it invested its sustainability-slotted funds not into its own, already eco-friendly campus, but into easier, cheaper solutions elsewhere.

Middlebury's multi-million dollar effort to achieve zero-carbon is just a drop in the bucket of sustainability spending. Hundreds of other colleges, universities, nonprofits, cities, counties, and other local governments have set similar targets and spent similar amounts. Meanwhile international delegations to the September

460 "Carbon Pricing Around the World," Environmental and Energy Study Institute, October 2012. http://www.eesi.org/files/FactSheet_Carbon_Pricing_101712.pdf

2014 UN climate summit in New York City recently began the process (to be concluded in Paris in 2015) of preparing carbon cuts, not quite to zero carbon, but still sizeable, pricey carbon diets with enormous repercussions on international economics.

And sustainability generates other costs across the national economy. There are enormous failed investments by the Federal government in companies such as Solyndra ($535 million), Abound Solar ($400 million), Beacon Power ($43 million), and A123 ($249 million), to name a few of the "sustainable" energy companies that went bankrupt when their product failed to provide efficient, reliable services at market price, despite millions of dollars of federal money to prop them up.[461]

EPA regulations drive up energy prices and impede industrial development. The U.S. Chamber of Commerce's Institute for 21st Century Energy found in a May 2014 study that by 2030, EPA-proposed carbon regulations could result in an annual loss of $51 billion in GDP, lower disposable household income by $586 billion, increase electricity costs by $289 billion, and put approximately 224,000 Americans out of work each year.[462]

Then there are tax incentives and federal grants for green construction. At the heart of the American Recovery and Reinvestment Act of 2009 (the "stimulus") was $5 billion set aside for green retrofits on buildings—much of which got misdirected, as in Delaware, where contractors authorized to perform simple repairs (insulating attics, sealing gaps) instead opted to entirely replace utilities and building infrastructure.[463]

Meanwhile the mandating of ethanol as a component of fuel for automobiles under the Renewal Fuel Standard (created in 2005 with the Energy Policy Act, strengthened in 2007 by the Energy Independence and Security Act) has inflated corn prices. The Congressional Budget Office found that compliance with the mandate "would increase total spending on food in 2017 by $3.5 billion."[464]

And switching from coal and oil to wind and solar is an unrealistically expensive change. Germany, the most aggressively pro-renewable energy country in the world, has reluctantly backed away from its ambitious goals to cut its emissions to 40 percent of 1990 levels by the year 2020, after the costs

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461 Steve Hargreaves, "Obama's Alternative Energy Bankruptcies," *CNN*, October 22, 2012. http://money.cnn.com/2012/10/22/news/economy/obama-energy-bankruptcies/

462 *Assessing the Impact of Proposed New Carbon Regulations in the United States*, Institute for 21st Century Energy, U.S. Chamber of Commerce, 2014. http://www.energyxxi.org/epa-regs#

463 Stephen Clark, "Obama's $5 Billion Weatherizing Program Wastes Stimulus Funds, Auditors Find," *Fox News*, April 14, 2011. http://www.foxnews.com/politics/2011/04/14/obamas-5-billion-weatherizing-program-wastes-stimulus-funds-auditors/

464 "The Renewable Fuel Standard: Issues for 2014 and Beyond," Congressional Budget Office, June 2014, pg. 15 http://www.cbo.gov/sites/default/files/cbofiles/attachments/45477-Biofuels2.pdf

associated with renewable energy became prohibitive. Vice Chancellor Sigmund Gabriel announced his plans in November, remarking, "It's clear that the [2020 CO2] target is no longer viable."[465] The renewable energy transition policies, called Energiewende, phased out nuclear energy and attempted to increase solar and wind substitutes. But costs skyrocketed. German residents now pay the second highest energy rates in Europe, as well as 106 billion Euros in tax subsidies to renewable energy companies over the course of 2010-2013. Increasingly, customers and power generators turned to coal instead.[466]

The unreliable nature of renewable energy sources (the wind doesn't always blow, or the sun always shine) combined with their exorbitant costs have led some to argue in favor of fossil fuels not just as a matter of economics, but of ethics. Societies need reliable access to energy. Scholars such as Alex Epstein (*The Moral Case for Fossil Fuels*) and Robert Bryce (*Power Hungry: The Myths of "Green" Energy and the Real Fuels of the Future*) note the rising quality of healthcare, life expectancy, standards of living, and educational attainment that correspond with cheap, abundant, reliable energy. Bryce has cast coal as a "social justice" issue, writing in *National Review Online*, "Coal is an essential fuel for combating energy poverty." His research showed that

> *between 1990 and 2010, about 1.7 billion people gained access to electricity. Of that number, some 830 million people gained access owing to coal. Natural gas came in second, with about 380 million, and hydro came in third with about 290 million. Put another way, over that two-decade period, for every one person who gained access owing to solar and wind energy, four gained access owing to hydro; six gained access owing to natural gas; and 13 gained access owing to coal.*[467]

Middlebury students, however, fighting hard for carbon neutrality and fossil fuel divestment, have stubbornly marked out their opposition to fossil fuels as a pro-social justice position.

Sustainability as Business

As government policies have pressured institutions to submit to environmental regulations, and environmental activists have pressured other institutions to voluntarily adopt stricter standards, hundreds of businesses have set about manufacturing ways to get them from carbon-dependent to carbon-zero. We recognize the value of many protective measures and technological innovations that keep our air and water clean and preserve our natural terrains. But we also notice an accelerating movement pushing society to accept and prefer all things green, regardless of cost. In response, the economy has shifted, and not always in a healthy way. Sustainability is big business.

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465 "Germany Plans To Withdraw From Binding 2020 Climate Targets," *Spiegel*, reprinted by the Global Warming Policy Foundation, November 16, 2014. http://www.thegwpf.com/germany-announces-withdrawal-from-binding-2020-climate-targets/

466 "Germany's Renewable Energy Transition Misses Carbon Reduction Goals," Institute for Energy Research, September 30, 2014. http://instituteforenergyresearch.org/analysis/germanys-renewable-energy-transition-misses-carbon-reduction-goals/

467 Robert Bryce, "The Social Justice of Coal," *National Review Online*, November 6, 2014. http://www.nationalreview.com/article/392167/social-justice-coal-robert-bryce

In the cleft of radical activism and regulatory activism, a new branch of industry has sprung up, feeding off of fears of tighter regulations and fears of climate change. With an inelastic demand for products and services designed for zero waste, zero carbon, and zero "impact," companies needn't compete on price, only on effectiveness at curbing perceived environmental hazards.

That isn't necessarily a strike against the eco-entrepreneurs, of course. Engineering better ways to clean up trash or responsibly extract and use resources is wise—and in large part, they're simply responding to a change in consumer tastes and preferences. As a market opens up for these new services and products, it only makes sense for enterprising businessmen to serve this niche clientele. What is more astounding, though, is consumers' ardent demand and their willingness to pay for such services.

One such industry is the new market for inventive recycling techniques. Dozens of colleges and universities partner with Terracycle, a self-billed "trash alchemist" company that finds ways to repurpose hard-to-recycle items. Terracycle specializes in "upcycling," the process of using trash to create a new product, ideally worth more than its ingredients. The idea is to use waste products whole—gluing together Oreo packaging wrappers into a kite or sewing Clif Bar wrappers into the body of a backpack—without melting, smashing, or otherwise demolishing the waste.

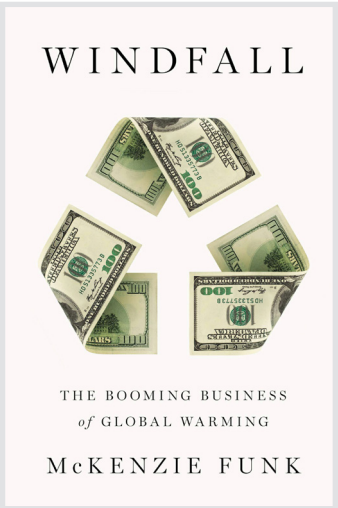
This trash to treasure program means a boon for Terracycle. It started in 2001 when Tom Szaky, then a Princeton freshman, got the idea of feeding leftovers from the Princeton cafeteria to worms, collecting their excrement, and selling it in used soda bottles as fertilizer. The business grew to such success that Szaky left school to run his business, but after a 2007 altercation with Scotts Miracle-Gro, he switched gears, giving up the fertilizer business and repurposing (perhaps upcycling?) his branding into a recycling company with an entrepreneurial twist.

Unlike some recycling organizations spurred by philanthropy, Terracycle is driven by profit. Szaky found a market niche catering to the needs of the environmentally-conscientious who felt guilty throwing things away. Many cities already provided recycling services for certain metal, plastic, paper, and glass items. But Terracycle came up with ways to repurpose hard-to-recycle items such as Cheetos bags and Capri Sun pouches by cleaning the wrappers, unwrapping them, laying them flat, and sewing them back together. Szaky started "brigades" for food wrappers, plastic gloves, bottle corks, even cigarette butts. From these sprang the Oreo package kites and Clif Bar wrapper

backpacks—along with coasters made from computer circuit boards, Doritos pencil boxes, Lays potato chip messenger bags, and Sun Chips placemats. Terracycle also offers more conventional recycling options: plastic fence posts, benches, spray bottles, flower pots, and (ironically) trash cans made from melted plastic and other waste.

Terracycle is a godsend for institutions such as Middlebury intent on reducing their waste-lines. They can send to Terracycle their Oreo packaging and Clif Bar wrappers and soothe their consciences with the knowledge that the plastic, once opened, laid flat, and sewn together, will turn into a lightweight plastic kite or a child's backpack—no trash involved. Middlebury's relief at finding a way to clear its trash conscience is evident in the name it bestowed upon its Terracycle partnership: the plastic tubs where students can deposit their upcycling-bound trash are called "Terracycle Sin Bins."[468]

These trash indulgences prove economically inefficient. Terracycle's business plan relies on what Szaky calls "sponsored waste," wherein institutions pay for the privilege of declaring their products "zero waste." It's free market economics meets environmental zealotry at its worst. Product brands pay Terracycle engineers to find ways to repurpose the unreusable parts of their products, typically the packaging. The brands then advertise themselves as especially eco-friendly, and benefit from the patronage of zero-wasters like Middlebury College, who can save up their wrappers and mail them to Terracycle, in exchange for mini donations that Terracycle gives to various charities they choose from. Terracycle then manufactures upcycled products and sells them as eco-friendly alternatives to mainline carbon-based department store offerings. It's a clever intrusion into the free market. Terracycle benefits from free inputs (trash) and monetary sponsorships from brand names. The zero-wasters earn a claim to being diligent recyclers and a feeling of easy philanthropy. And the purchasers of the upcycled products get to feel good about their environmentally-thoughtful purchases and get to wear their commitments, if not on their sleeves, at least on their handbags and backpacks.



There are big opportunities for those who would profit from others' carbon phobias. McKenzie Funk, a journalist from Seattle, chronicles some opportunistic climate change entrepreneurs in his book *Windfall: The Booming Business of Global Warming* (Penguin Press, 2014). Funk spent six years traveling the globe to document Israeli desalinization plants—originally invented to freeze, melt out the salt,

468 "Terracycle Sin Bins," Environmental Council Grants 2011-2012, Middlebury College. http://www.middlebury.edu/sustainability/fech/ec/grants/2011-12

and make water from the Dead Sea drinkable—doubling as fake snow producers for melting ski slopes in the Alps, Canadian troops defending the Northwest Passage (thawing and passable for foreign trade for the first time in centuries), and Africa's proposed Great Green Wall, a 4,700-mile-long, 10-mile-wide strip of trees meant to hold back the expansion of the Sahara Desert.

Some of the institutions Funk profiles fill real needs that existed before climate change loomed large in the public mind—the Great Green Wall was first proposed in 1952 by Richard St. Barbe Baker, an English forester who saw the tree-band as a way to reduce land mismanagement, over-grazing, and over-harvesting. Funk also spends time in the Netherlands, where Dutch engineers trained in building dikes for the lowland country design sea walls for flood zones in island nations.

But others prey off people's fears: private firefighting squads in Los Angeles for expensive, high-insurance homes, or investment companies constructing "climate change funds" that invest in windmills and solar panels and all the other markets expected to rise in value once climate change hits: biotech plants re-engineering agriculture for warmer temperatures, dredging rigs that rebuild flooded islands, reinsurance companies expected to jack up insurance rates, even grocery stores presumed to profit from the predicted food scarcity. These funds bank not only on what they expect to become intrinsically valuable, but on what quavering markets will begin to prize as they come to fear global warming and its accompanying regulations. "There's another possible response to melting ice caps and rising sea levels" besides regulating and nudging consumers towards carbon cuts, Funk writes, "a response that is tribal, primal, profit-driven, short-term, and not at all idealistic. Every man for himself. Every business for itself."[469]

Saving Carbon

What exactly does sustainability cost? No one knows exactly, and that silence is telling. Cost-benefit analyses seem to have gone with the wind. Perhaps they were blown there by precautionary principle-fanned sustainability-driven wind turbines. The extravagant costs of sustainability paired with the economic inefficiencies suggest that as much as colleges like to talk about saving money through high-efficiency light bulbs and Energy STAR-certified appliances—or, in the case of Middlebury, its supposedly cost-neutral Biomass Gasification Plant—the real goal is to save carbon. Colleges' eager assent to expensive reforms in a time of shrinking budgets indicates the power of the sustainability movement on college campuses.

469 McKenzie Funk, *Windfall: The Booming Business of Global Warming*, New York: Penguin Press, 2014, pg. 8.