

BSU Carbon Credit Market Study 1.0



This report (v. 1.0) is the first of three to be developed in concert with the transfer to Chevrolet of the carbon credits resulting from the installation and operation of the Ball State University (BSU) district-scale geothermal heat-pump chiller heating and cooling system.

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1. Executive Summary

The report describes the current standing of the voluntary carbon market in the United States, the development of new performance methodologies by which colleges and universities can qualify their carbon credits for that voluntary market, the economic complexities of the life-cycle and first-cost bases used to evaluate carbon-reduction projects, the piloting of this effort at a system-wide scale by Ball State University, and the role of the Carbon-Reduction Initiative of Chevrolet.

This report attempts to reach audiences of differing technical expertise and so provides generic descriptions of the environmental and economic context as well as detailed findings.

The Epilogue lists content to be covered in the next version (2.0) of this report which will be released on the second anniversary of carbon credit qualification resulting from the operation of the Ball State University district-scale geothermal heat-pump chiller heating and cooling system.

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2. Introduction

As part of its commitment to acquire some 8 million metric tons of carbon credits throughout North America, the Chevrolet Motor Division of General Motors contracted with the Carbon Neutral Business Network (CNBN) and the Bonneville Environmental Foundation (BEF) to facilitate development of a “qualifying” methodology that could be used by colleges and universities to enter the carbon market. These institutions can employ this methodology to garner supplemental financial support for expanding their Greenhouse Gas Emissions Reductions.

Correspondingly, CNBN turned to the Verified Carbon Standard (VCS) as a third-party evaluator to review and validate the methodology designed specifically for institutions of higher education. A broad mix of stakeholders has contributed to the evolution and refinement of this methodology. Ball State University, specifically, has worked with CNBN to pilot its application in determining the eligibility of carbon credits resulting from our installation of a district-scale geothermal heating and cooling system. As a result, we have helped to frame the approach used in the methodology and to troubleshoot the technicalities of campus-wide implementation.

This report is the first of several to be issued during the next three years as Ball State University executes its agreement with BEF for its transfer to Chevrolet of the carbon credits resulting from the installation and operation of its geothermal district-scale heating and cooling system. This market study is meant to share our experience with the broader higher education community to the benefit of all. The study provides overviews of the structure and operation of the carbon market in the United States, and uses the Ball State experience as a case-study exploration of the procedures for “qualifying” carbon market transactions.

Since the development of the methodology by CNBN has been coincident with the installation of our district-scale geothermal system, and our continuing update of Greenhouse Gas Emissions Reporting—as part of our STARS and GRI Reporting efforts—much of the content in this first version of our multi-year reporting contains in-process discoveries and realizations. In our anticipated reporting over the next two years, we will be updating the content of this Carbon Market Study with more details from our experience as a campus-wide case study.

The CNBN methodology, which is being reviewed by the VCS at the time of this writing, offers two (2) paths for qualification of carbon credit transactions. One is for campus-wide reductions tied to large-scale, district-scale intervention and the other is for building-by-building LEED-certified reductions for New Construction (NC) or Existing Buildings (EB); each offers an opportunity for carbon market participation by colleges and universities. For each of the paths presented, the CNBN methodology provides explicit applicability criteria, and guidelines for benchmarking emissions baselines and for calculating net Greenhouse Gas Reductions. It also distinguishes the importance of clarifying the project boundary, the accounting of SCOPE 1 (Stationery 1) and SCOPE 2 (Upstream) emissions interactions and the challenges of tracking (documenting) internal and external “leakage.”

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With regard to applicability criteria for qualifying campus-wide Greenhouse Gas Reduction, a spreadsheet tool is used to identify: 1) “additionality,” 2) the distinction of SCOPE 1 and SCOPE 2 inter-relationships, 3) performance benchmarks by Carnegie category, and 4) validation of the monitoring plan.

With regard to LEED-Certified buildings, the methodology describes: 1) the distinction of New Construction (NC) from Existing Buildings (EB), 2) the two differing paths for existing building qualification and 3) the use of Energy Star Indexes, and 4) a clearly-articulated monitoring plan.

Details on the establishment of the performance benchmarks are best understood by reading through the methodology itself and by conferring with Sue Hall, the CEO of CNBN who is responsible for the development of this tool.

For Ball State University, qualifying our carbon credits as a campus-scale greenhouse gas reduction has led to numerous discoveries about our own needs for reporting. For example, we learned that we needed to isolate a nearby regional hospital to which we had been selling steam because it is not within our “campus boundary” for reporting. Other insights gained include the trade-offs of SCOPE 1 and SCOPE 2 impacts under the umbrella of leakage considerations.

The narrative in this report regarding our case-study experience does not attempt to duplicate the content of the stand-alone Campus Clean Energy Efficiency Methodology submission template, available separately, nor our Clean Air-Cool Planet Greenhouse Gas Report, which is posted publicly on the ACUPCC reporting website. All these materials must be examined for the most complete understanding of our experience. The goal of this report, however, is to isolate those key findings of project qualification for Carbon Credit market entry.

2. The Carbon Market Opportunity

The Climate Context

Evidence from scientific studies of the Earth’s climate indicates overwhelmingly that the Earth’s temperature and weather patterns are changing as a result of increased greenhouse gas (GHG) emissions from human activity. In fact, measurements of CO₂ in the atmosphere over the last 100 years reveal how dramatic these changes have become. These higher concentrations of CO₂ are trapping more of the sun’s heat and changing Earth’s climate. In pre-industrial times, the measured CO₂ emissions in the atmosphere were on average 280 parts per million (ppm). Emissions from natural sources such as decaying organic materials in forests and grasslands, volcanic outgassing, and wild fires were absorbed as they were produced and remained closely balanced. Human-generated CO₂, created by burning fossil fuels and land-use changes (e.g., deforestation, urbanization, and industrial agriculture) has been increasing at an alarming rate. In 2013, CO₂ in the atmosphere was measured at 400 ppm; over 400 ppm is considered detrimental to controlling the rise in the Earth’s temperature. Climate scientists have stated that to keep the global temperature increase below 2 degrees Celsius (3.6 degrees Fahrenheit), GHG emissions need to peak below 450 ppm. As a result, reducing the generation of CO₂ is seen as the most pressing issue for maintaining a habitable planet for humans.

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The economic consequences are likely to be substantial from damages caused by changing weather patterns, which are predicted to increase the severity and frequency of storms, floods, and droughts. In 2011, U.S. Property & Casualty insurers incurred more than \$32 billion in losses from impacts of multiple, extreme weather incidents.¹ In 2012, Hurricane Sandy alone was responsible for \$20-25 billion in insured losses and an estimated total \$100 billion in total economic damages.² The potential losses from climate change will have multiple consequences given the interdependent nature of many sectors of the national economy. One such example is the insurance industry. Insurance plays a vital role in the economy because it enables all aspects of the global economy such as commercial transportation, factory operations, and construction to operate. As more loss claims are paid, insurance coverage for storm-prone areas will rise in price or disappear altogether; with increased prices or lost coverage, business profits will decline along with a rise in business failures. These declines and failures in turn will affect the insurance industry's invested capital, which is needed to meet its obligations and provide capital to the economy. In 2012, the U.S. insurance sector had an invested capital of almost \$5 trillion, which was approximately one third of the U.S. 2012 GDP.

The need for a stable climate is essential for the productivity of business, so achieving carbon reduction targets is critical. The counter argument to investing in carbon reduction initiatives is that the economy will suffer because spending resources to cut carbon is not productive. Can effective carbon reduction be done without causing national economic decline? The World Wildlife Fund (WWF) and Carbon Disclosure Project (CDP) advocate in a recent study that a 2020 science-based carbon reduction target to keep the average temperature increase below 2 degrees Celsius is not only possible, but also is profitable.³ If U.S. companies reduce carbon emissions by an average 3% per year between 2010 and 2020, they can save an estimated \$780 billion (net present value).

To achieve these savings, organizations will need to improve energy efficiency. This can be done through behavioral or management changes, technology improvements, and the deployment of low-carbon energy. Behavioral changes are often the "low hanging fruit" and involve things like turning off lights, tracking energy use, and plugging energy leaks in systems. Installing systematic management approaches for energy conservation has been shown to be low-cost and effective. Technological improvements come in the form of installing new energy-efficient lighting and heating systems along with upgraded heating, ventilation, and air-conditioning systems. Other examples of acquiring energy efficiency through technology include designing low-energy data centers and fuel-efficient engines along with recycling waste heat. Such recycling, or cogeneration, can be undertaken by factories, power plants, hospitals, and universities wherein the waste heat generated by electricity production can be used to heat water or provide space heating in the same facility. Both costs and carbon emissions are lowered. Low-carbon energy investments can range from installing onsite renewable energy sources such as solar panels and wind turbines to purchasing renewable energy certificates (REC). RECs and carbon offset credits established by carbon reduction projects provide opportunities for both project builders and investors in the carbon markets.

Types of Carbon Markets

The creation of carbon markets offers a market-driven mechanism for reducing the unacceptable rise in CO₂e. Carbon markets enable participants to buy and sell units of: 1)

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greenhouse gas emissions, 2) avoided emissions, or 3) sequestered carbon dioxide. A carbon credit is a tradable certificate or permit that gives the holder of the credit the right to emit one metric ton of CO₂ or mass of total GHG emissions equivalent to a metric ton of carbon dioxide (CO₂e). Typically, carbon markets consist of two types: mandatory and voluntary. Mandatory markets are regulated under legislated or mutually-consented international and national laws to reduce carbon emissions. For example, signatories to the Kyoto Protocol, an international treaty to reduce carbon emissions, committed their countries to achieve a reduction of carbon emissions at 5.2 % below 1990 levels over the first commitment period, which spanned from 2008 to 2012. To achieve those targets, which are expressed as allowed emissions units, regulatory bodies in various parts of the world established maximum emission caps or limits to emissions that organizations were to be allowed. In mandatory markets, organizations in power-and-heat generation, energy-intensive manufacturing, and commercial transportation are given (or acquire) carbon credits to comply with those set limits.

The function of a mandatory carbon credit system is to monetize carbon emissions, making them inherently costly for the emitters so they will reduce their output. Carbon emitters can capitalize operational changes in their facilities to physically reduce emissions, purchase credits (permits) to release emissions into the atmosphere, or invest in energy efficient projects in developing nations as a means of offsetting their emissions impact. Caps are established on allowable credits, and each year emitters reconcile their credits with their emissions. If their emissions exceed their allowable credits, fines are imposed on the emitters. If credits exceed emissions, they can save the credits or sell them to others who then claim a 'reduction' in their emissions with the purchased credits. The credits in the trading system are limited so that they will have an assured monetary value. Over time, the limits are systematically lowered so overall emissions will decrease. If a company buys offset credits to compensate for its own emissions, these credits must be retired. Accurate accounting of emissions is critical for the success of these markets. Organizations measure and report their emissions to designated bodies to maintain their compliance. There are measurement and verification costs associated with project registration.

The voluntary carbon market is different in many respects from the compliance schemes under the Kyoto Protocol. In particular, various industry-created standards are used to calculate and certify emission reductions rather than acquiring national approval for the project participants from the registration and verification process through the United Nations Framework Convention on Climate Change. In countries that are not bound by carbon regulatory limits, organizations can manage their carbon emissions by using the voluntary markets. Many organizations in these countries recognize the need to reduce their carbon emissions and set their own reduction targets. They can reduce their emissions by: redesigning their own operations, purchasing emission reduction credits from others, or doing both. If they do not meet their targets from their own facilities' efficiencies, they can purchase credits from projects that create renewable energy, develop energy efficiency schemes and/or implement reforestation. Their choice to make these investments is often motivated by the anticipation of carbon legislation, enhancement of their reputations, analysis of associated costs and benefits, and/or as a form of industry leadership, challenging others to engage in similar large-scale carbon reduction projects.

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Advantages of the Voluntary Mechanism

Some question whether a voluntary market system can work to reduce carbon emissions on a large scale, but the voluntary system has many advantages over a mandatory one. Mandatory carbon markets require political agreement, which involves lengthy processes; agreement is often difficult to achieve on both local and international levels. A case in point is the lack of agreement on national carbon reduction legislation in the United States, which produces almost one fifth of the world's carbon emissions from fossil fuel combustion and some industrial processes.⁴ The voluntary market avoids the prolonged political conflicts associated with setting carbon emission limits. In addition, formal markets are not necessary for transactions to occur over-the-counter between buyers and sellers or through third parties. Among the additional benefits for investors are transaction speed, project flexibility, reduced transaction costs, wider sector involvement, and enhanced-reputation opportunities.

Buying credits in the voluntary market to encourage pro-environmental behavior in others is a philanthropic approach that not only enhances an organization's reputation but also can augment its brand. For example, by launching its Carbon Reduction Initiative (CRI) in 2010, Chevrolet, a General Motors' (GM) brand, committed to invest up to \$40 million to reduce eight million tons of CO₂ throughout the United States between 2010 and 2014. In a February 2013 interview with TriplePundit, David Tulauskas, Director of Sustainability of GM and Manager of the Chevrolet Initiative, said the following about how its CRI fit within Chevrolet's sustainability strategy.⁵

Traditionally, companies have been considered great if they delivered great quarterly results. Going forward, greatness is going to depend not only on financial results, but on their environmental and social performance. That's how we're approaching it at GM. This is about top-line growth opportunities, bottom line improvements and risk mitigation that delivers long term stakeholder value in a responsible manner.

The flexibility of the voluntary market allows for investments to be directed at local communities that address *local* needs and can begin in a fairly short timeframe. Chevrolet's CRI includes investments in local, community-based carbon-reducing projects. In the first two years of the commitment, Chevrolet has signed project agreements that cover about 90% of their target carbon reductions. These projects involve "forestry, wind energy, biomass fuel-switch, landfill methane capture and use, pipeline heat recovery, prairieland conservation, truck stop electrification, naturally-occurring coal bed methane capture, and a first-of-its-kind energy efficiency, low-income housing weatherization project."⁶ The remaining 10% of its reduction targets is aimed at supporting energy efficiency and renewable energy projects in higher education facilities. The impetus is to provide institutions of higher education with opportunities for creating energy and cost efficiencies with the intent of monetizing the related carbon credits within the voluntary market.

Voluntary carbon market transactions can be executed on an individual, negotiated basis resulting in transactional cost efficiency and flexibility. For many organizations this process also can be facilitated by third parties that connect buyers and sellers. In 2010, Chevrolet selected Bonneville Environmental Foundation (BEF) as its buyer's agent and portfolio manager for the

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Chevrolet CRI. Chevrolet chose BEF, a nonprofit organization, because of its expertise in procuring, selling, and developing environmental commodities.⁷

In 2013, BEF negotiated a three year contract in which Chevrolet agreed to fund a carbon market study built around the purchase of carbon reduction credits from Ball State University (BSU), Muncie, Indiana. BSU's carbon credits are the product of a new ground-source heat pump geothermal-energy system, which when completely operational will heat and cool 47 buildings. The new system replaces four aging coal-fired boilers that consumed on average some 36,000 tons of coal annually. The system harvests geothermal energy from the Earth as water is circulated in closed-loop underground pipes. Geothermal heat pumps are used to draw heat from the Earth in the winter or sink it in the summer. Ball State's system will save the university some \$2 million net in annual operating costs and eliminate the 85,000 metric tons of CO₂e emissions generated from on-campus coal combustion. As a voluntary-market transaction, Chevrolet's purchase of 110,000 of BSU's carbon credits over three years will not involve government agencies and will not be subject to regulatory body approvals and fees.

Carbon reduction investments not only reduce emissions but also can create jobs in the local community. This is the case for BSU wherein the construction of its geothermal project brought employment for several hundred contractors and suppliers. In fact, it is estimated to have added a total of 2,300 direct and indirect jobs to the regional economy.⁸

Measurement and Verification

The voluntary carbon market is filling the void where mandatory markets have not been formed. In 2012, the voluntary market grew by 4% with the private sector securing 90% of the \$523 million commitments to acquire 101 million tons of carbon offsets.⁹ As a group, U.S. based corporations, such as Chevrolet and Disney, acquired more offsets (28.7 million tons) than those in any other country. Growth in the voluntary market underscores the need for reliable and transparent standards for establishing, measuring, and certifying GHG reduction projects.

Carbon credits in the voluntary market are not regulated in a uniform fashion as are those under the Kyoto Protocol, but carbon offset programs serve a valuable function by reporting and tracking carbon reduction projects in this market. These programs are involved in developing and applying their own — or other — established protocols (also called methodologies), which are the rules and procedures used to identify project types and their desired attributes. These programs typically have three core components: (1) accounting rules, (2) monitoring, reporting, verification, and certification rules, and (3) registration and enforcement systems.

Accounting rules establish that offsets are “real,” “additional,” and “permanent.” Real means that an actual net emissions-reduction has occurred; closing a carbon-emitting energy plant in one country while opening one in another does not create ‘real’ offsets. Additionality refers to reductions that happened because an organization voluntarily chooses to cut its emissions. In other words, if the project would have happened anyway, it is not additional. Permanent refers to reduction projects that cannot be reversed or have a mechanism that makes them functionally irreversible. Some projects such as reforestation (re-establishing previously forested land) and afforestation (planting previously non-forested land) are more prone than other carbon sequester projects to risks of reversal such as fire and disease. To mitigate these

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risks, mechanisms can be established to provide evidence of good management, insurance, incentives for long-term continuance, and contingency carbon credits. Accounting rules include definitions relating to the design and early implementation phases of a project. Additionality and baseline methodologies, definitions of accepted project types and methodologies, and standards for validating project activities also are part of the accounting rules.

Monitoring, reporting, verification and certification rules are intended to evaluate a project's actual performance. Once the project is operational, monitoring and reporting rules help to determine if the project is saving the predicted carbon emissions. In the verification and certification components, carbon offset programs specify rules for auditor qualifications and auditing standards.

Registration and enforcement systems facilitate determination of ownership, enable trading, track retirement, and prevent double counting. Included in this component is a requisite publicly-available registry that identifies each offset project and tracks its ownership. This enables carbon credits to be tracked from inception to retirement.

Carbon offset programs, known by various names such as “standard” and “registry,” include such notable programs as American Carbon Registry, Gold Standard, and Verified Carbon Standard (VCS). Thirty seven percent of projects in the over-the-counter carbon offset market in 2012 used the VCS carbon mitigation protocol, which was more than any other available program. VCS was founded in 2007 and supported by The Climate Group, International Emissions Trading Association, The World Economic Forum, and the World Business Council for Sustainable Development.¹⁰ With nearly 1000 projects in its registry, VCS assigns each project a unique serial number and requires external verification of the carbon credits. Organizations like Green-e and Carbon Footprint provide third party verification.

The Case for Carbon Offsets in Higher Education

The growth in membership of the Association for the Advancement of Sustainability in Higher Education (AASHE) and the American Colleges and Universities Presidents Climate Commitment (ACUPCC) over the last decade illustrates the importance of climate change issues to leaders in higher education. Although they are separate organizations, AASHE is a sponsor of ACUPCC. Both organizations are committed to changing the role that colleges and universities have in addressing sustainability and more specifically climate change. Each organization has a different focus, but both have commonalities, especially with regard to the reporting of greenhouse gases (GHG) inventories.

AASHE was organized in 2006 to “...empower higher education to lead the sustainability transformation.” AASHE encourages and supports its over 1,000 members by providing resources, professional development, and a peer-to-peer communication network so the members may incorporate sustainability in all dimensions — from governance and operations to education and research.¹¹ To track members' progress, AASHE developed the Sustainability Tracking Assessment and Rating System (STARS) as a voluntary reporting framework that promotes the comprehensive engagement of the economic, social, and environmental dimensions of sustainability. By using a consensus-based set of measurements created by stakeholders in the campus sustainability community, STARS is intended to enable comparisons over time and

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across institutions. The measurement of GHG emissions is among the performance indicators; it has the explicit goal of achieving measurable reductions over time.

In 2006, a network of colleges and universities formed the ACUPCC and "...made institutional commitments to eliminate net greenhouse gas emissions from specified campus operations, and to promote the research and educational efforts of higher education to equip society to re-stabilize the earth's climate." ACUPCC institutions pledged to specific actions on carbon emissions; they committed to complete an emissions inventory and within two years, and to set a target date and interim milestones for becoming climate neutral. Reporting carbon emissions inventories is becoming common practice by these institutions. As of June 2013, 671 signatories submitted 1,939 greenhouse gas inventories, 512 climate action plans, and 322 progress reports. Consistency exists in the measurement of their GHG inventories because over 90% of U.S. colleges and universities use the Clean Air-Cool Planet (CA-CP) Campus Carbon Calculator™ to generate their GHG inventories.¹² As evidenced by this activity, university leaders are not only pledging but also are acting on the challenge of achieving carbon neutrality.

With their commitment to carbon neutrality, college and university leaders should view their increasing budgetary constraints as an actual opportunity. In general, funding for public colleges and universities comes from tuition and fees, state legislature appropriations, bond issues, grants, and private donations. State legislatures across the United States have continually cut funds to higher education to reduce state budget deficits. Raising tuition to meet shortfalls is often met with strong opposition from regulatory bodies. Consequently, college and university leaders seek alternative funding sources and ways to cut costs. One potential area is energy. Annual energy costs for U. S. colleges and universities are approximately \$2 billion.¹³ If these institutions cut their energy costs generated from the burning of fossil fuels, they are likely to cut carbon emissions. Carbon reduction projects and the resulting carbon credits created are a relatively untapped but potentially fruitful market for colleges and universities; these projects can reduce costs and attract new revenue from the voluntary carbon market.

The opportunity to be rewarded for leadership in the reduction of GHG is added incentive for universities to act. In 2012, the U.S. EPA established the annual Climate Leadership Award (CLA) to recognize and provide incentives for exemplary corporate, organizational, and individual leadership in response to climate change. In the first year, awards were presented to one individual and twenty organizations from across the U.S. This award "Recognizes organizations that not only have their own comprehensive GHG inventories and aggressive emissions reduction goals, but also exemplify leadership in their internal response to climate change, through engagement of their peers, competitors, partners, and supply chain, and addressing climate risk in their enterprise strategies."¹⁴ To qualify for the award, applicants are required to publish a third-party verified GHG inventory of all GHG emissions from scope 1 and 2 sources in addition to having an established current public corporate GHG reduction goal. The GHG reduction goals must be aggressive; they need to "significantly exceed credible and transparent sector-specific, business-as-usual performance forecasts."

Investment Evaluation

Financial considerations as well as environmental ones should be evaluated when deciding to invest in carbon reduction projects. Although most colleges and universities operate

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as non-profit organizations, investment decisions should be made using the same tools used by for-profit organizations. There are several analyses that can be used to evaluate the profitability of a long-term investment. These include the net present value of cash flows (NPV), the return on investment (ROI), the internal rate of return (IRR) and the years of payback (YP).

A relevant analysis for long-term carbon reduction projects is NPV, which incorporates the time-value-of-money concept over the expected life of the project. This concept assumes that the purchasing power of a dollar declines over time. For example, a cup of coffee that can be purchased today for \$2 is likely to cost considerably more in 10 years. In calculating NPV, estimated future values of the benefits and costs of an investment are converted to the present value when multiplied by a present-value factor, which is based on compounded interest over a specified number of periods. The interest rate selected is usually an organization's target ROI, also known as the discount, hurdle, or desired minimum rate. All future cash inflows and outflows of the project are "discounted" to present values and combined to get the net present value of cash flows. The net number will be positive, negative, or zero. If it is positive, then the net present value of cash inflows are greater than the outflows, meaning that the ROI is greater than the target rate. If it is negative, then the net present value of cash inflows are less than the outflows with ROI being less than target. If discounted net cash flows are zero, the ROI is exactly equal to the target. To avoid a trial and error approach to calculating the ROI, IRR can be calculated to get the precise annual rate of return for the project.

In evaluating the financial ramifications of any project, it is important to determine what qualifies as relevant information. From an accounting perspective, relevant information refers to future benefits or costs that differ between alternatives.

Deciding when to invest in carbon reduction projects is an integral part of a financial evaluation and should be done using the NPV of cash flows. Institutions may choose to delay an investment because internal funding is unavailable immediately. An alternative is borrowing funds, but interest charges are often considered a deterrent. In fact, the costs of delaying a project are opportunity costs, which are lost savings for each year of delay. On the surface, it may seem that avoiding interest charges is a prudent approach. However, a quantitative analysis should be conducted to decide whether to delay investment and savings or to borrow for immediate investment and savings. Finally, the question is often asked, "How long will it take to get our money back?" The payback in years provides the answer. In simple terms, the cost of the investment is divided by the annual savings or revenues.

For BSU, the differential cost between an industry-standard Circulating Fluidized Bed (CFB) boiler replacement of its existing boilers and the installation of the geothermal district-scale heat-pump-chiller system was projected at \$20,400,000.; with a \$2,320,000. first year of full operational, for a simple payback of 7.9 years savings (at a projected 3% annual inflation factor). Assuming a 50-year project life, the IRR is projected at 14.3% and the ROI, based on incremental capital costs and savings, is projected to be 11.4%.

[NOTE: A copy of the economic analysis citing these details and used in making the decision to reach beyond BAU is included as an Appendix to this report.]

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Special Protocol for Carbon Offsets in Higher Education

As a complementary enterprise to this Carbon Market Study and in support of Chevy's engagement with Higher Education, Sue Hall, founder of Climate Neutral Business Network (CNBN) was contracted to develop the US College Clean Energy and Efficiency Methodology.¹⁵ This methodology, which draws upon other established performance-based methodologies (e.g., VCS), creates a performance basis, which allows for energy-based Scope 1 (stationary 1¹⁶) and Scope 2 (upstream) GHG reductions to be credited. In addition, this protocol correlates to many ACUPCC and AASHE GHG reporting requirements already in play.

3. The BSU Experience as a Case Study

Introduction

Ball State University has been a leader among universities in becoming carbon neutral. In 2006 Ball State University became a signatory to the American College and University Presidents Climate Commitment (ACUPCC). In fact, Dr. Jo Ann Gora, President of Ball State University, was one of twelve members of the leadership circle that initiated a nationwide call for counterparts in higher education administration to commit their institutions to becoming climate neutral. As part of this commitment, universities take immediate action toward climate neutrality, and within the following two-year period commission the development of a greenhouse gas emissions assessment with public reporting, and then a multi-year climate action plan by which the institution can achieve climate neutrality by a date that it selects. In the case of Ball State University, we undertook five of seven recommended¹⁷ initiatives and then in the summer of 2008 completed the first-ever campus-wide Greenhouse Gas Inventory. In pulling together this assessment, we used version 5.1 of the Clean-Air, Cool-Planet Greenhouse Gas Calculator and, with that benchmark assessment, began preparation of our Climate Action Plan.

That Climate Action Plan sets 2050 as the final deadline for achieving climate neutrality. The plan is organized in nine strata of activity for greenhouse gas reduction beginning with the installation of a campus-wide geothermal district-scale heating and cooling system. It eliminates the combustion of coal on campus and leverages the impact of ongoing campus-wide energy conservation as having significant upstream (Scope 2) environmental impact on overall GHG reduction. The Climate Action Plan also advocates for transparency of information sharing so as to engage all members of the academic and near-surround communities. The plan provides specific measurable reductions in 5-year cycles so as to coordinate such climate action planning with that of the more academically-rooted strategic planning. To illustrate our expected reductions, we developed a Greenhouse Gas Impact Reduction Chart (Figure 1.0), which incorporates at the close of the plan timeline the contingency of purchasing a modest number of renewable energy credits through the carbon market to meet our final carbon neutrality goal.

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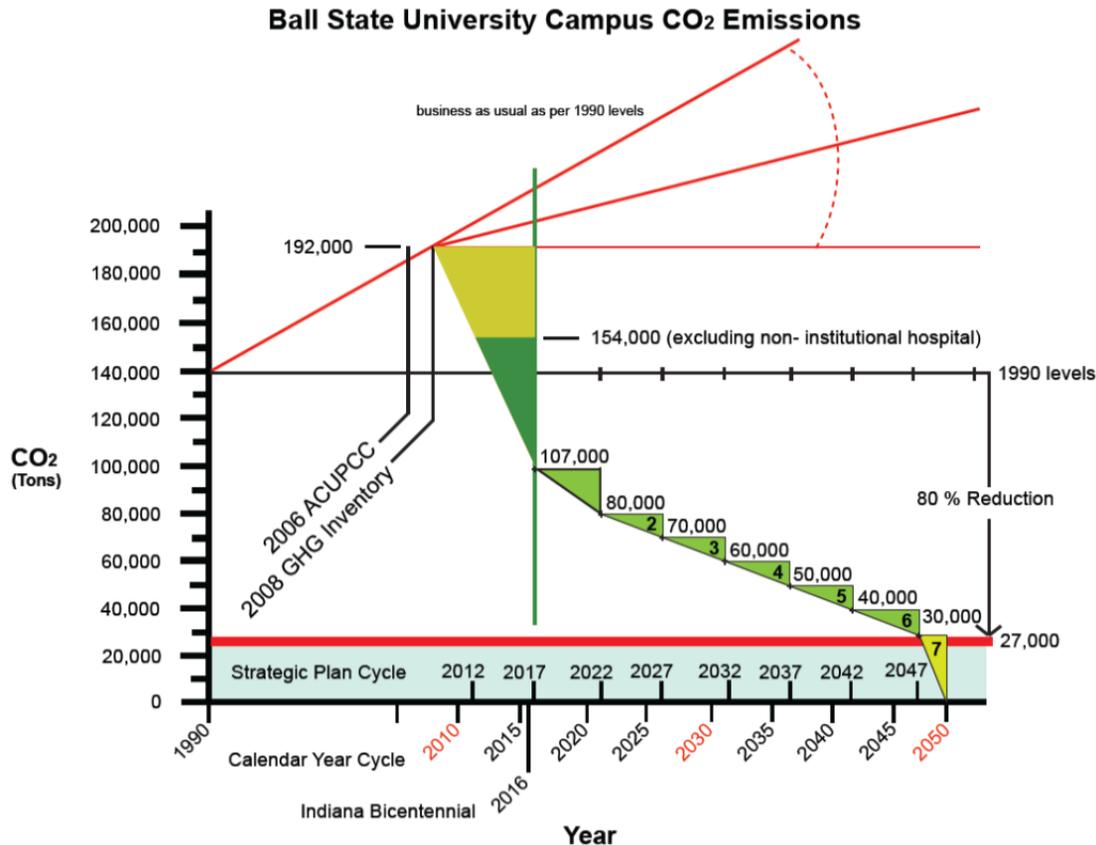


Figure 1.0 The BSU Plans for GHG Reduction in Five-year Increments

More recently we refined our carbon emissions calculations and institutional boundary for emissions. In the process of using the Clean-Air Cool-Planet Campus Carbon Calculator™ to prepare annual reports on progress to date, we discovered more completely the complexities of our fossil fuel consumption and the boundary-setting of our institution. Specifically, we are able with a ten-year tracking of fuel usage and greenhouse gas emissions, to identify that portion of the total combustible on-site resource that is strictly attributable to an adjacent regional hospital for which we provide contracted heating and cooling. Thus we have modified our original Greenhouse Gas Reduction Profile to reflect this piece of on-site fossil fuel combustion that sits “outside the boundary” of the university’s 47-building campus fabric. Nonetheless, with the switch from coal-fired boilers to the district-scale geothermal system, we will completely eliminate coal-combustion; the hospital portion of our contracted energy delivery will be shifted to natural gas. In the longer term, it is likely that the provision of heating and cooling to the hospital will be provided by our district-scale geothermal system.

At present, we’re working to complete the campus-wide installation and the connection of all 47 buildings; this completion includes eliminating coal-combustion on campus by March 2014 with completion of the full geothermal system installation as soon as possible thereafter. As of this date, all 47 buildings on campus are receiving chilled water supply (for air conditioning) from the district-scale system and some 22 buildings in the northern half of campus have been heated this past winter using the geothermal district-scale network. With the recent approval by the state legislature of \$33 million in remaining funding, we will be able to

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complete the campus distribution loops for hot water service to the southern half of campus and the connection to those remaining 25 buildings; bringing them on-line for heating within the next 1-2 years. As of this writing, the south bore field is on track for completion, construction of the south energy station is underway, and the design and engineering of the proposed placement of trunk-loops for servicing of the 25 buildings are being refined.

Electricity

Once the district-scale heating and cooling system is complete, the university will turn its attention more fully to the upstream sourcing of electrical energy as a target of opportunity for reducing its Scope 2 emissions. In doing that, the university will expand its focus on demand-side reduction in: 1) the upgrade of the efficiency of building shells (insulation levels, window systems, natural ventilation strategies), 2) the introduction of more efficient equipment (LED lighting and variable-speed drives on all pumps and fans), and 3) the use of modulated controls (for building sub-zones with attention to building-use scheduling).

One of the biggest factors in demand-side management of course is behavioral change; this reaches beyond the careful attention to scheduling and system controls. In the last couple academic years, we've hosted on-campus residence-hall-complex energy contests and this past academic year expanded that to include competition among academic buildings. We have made strides in supporting a culture of conservation, but more work is needed. On our list of priorities is a fully-operational and readily-accessible campus-wide dashboard system by which real-time energy use rates and total quantities are readable by members of the academic community.

Leveraging that demand-side reduction will have significant impact on the upstream demand for electrical supply. The examination of on-campus electrical conversion from solar energy, and perhaps the installation of a near-campus wind turbine are slated as additional measures by which we can reduce the amount of electrical power needed from the grid. Following these kinds of intervention, the next order of strategy is to consider negotiated arrangements for off-site wind farm and PV farm electrical production, with access to such green power over the regional/national distribution network.

Clean-Air Cool-Planet Campus Carbon Calculator™

University signatories to the ACUPCC are encouraged to use the Clean-Air Cool-Planet Campus Carbon Calculator™ for assessing Scope 1, 2 & 3 emissions impact. As noted in website materials, the Clean-Air Cool-Planet Campus Carbon Calculator™ was

“...originally developed with the University of New Hampshire in 2001 and released to the public in 2004. Due, almost entirely, to popular demand—its market share has grown steadily in the years since...as of today, thousands of institutions, in the US and abroad, use the Calculator. More than 90% of the US colleges and universities that publicly report their Greenhouse Gas Emissions use this calculator.”

This excel-spreadsheet-based tool is a robust, highly refined and proven instrument for assessing environmental impact.¹⁸ It also is important to note that the Clean-Air Cool-Planet Campus Carbon Calculator™ is available in two versions: one for the continental United States and one for Canada. As shown in the following graphic, the Clean-Air Cool-Planet Campus Carbon Calculator™ is very well indexed and easy to use—primarily because of a spreadsheet mapping page that allows for quick jumps from one content area to another.

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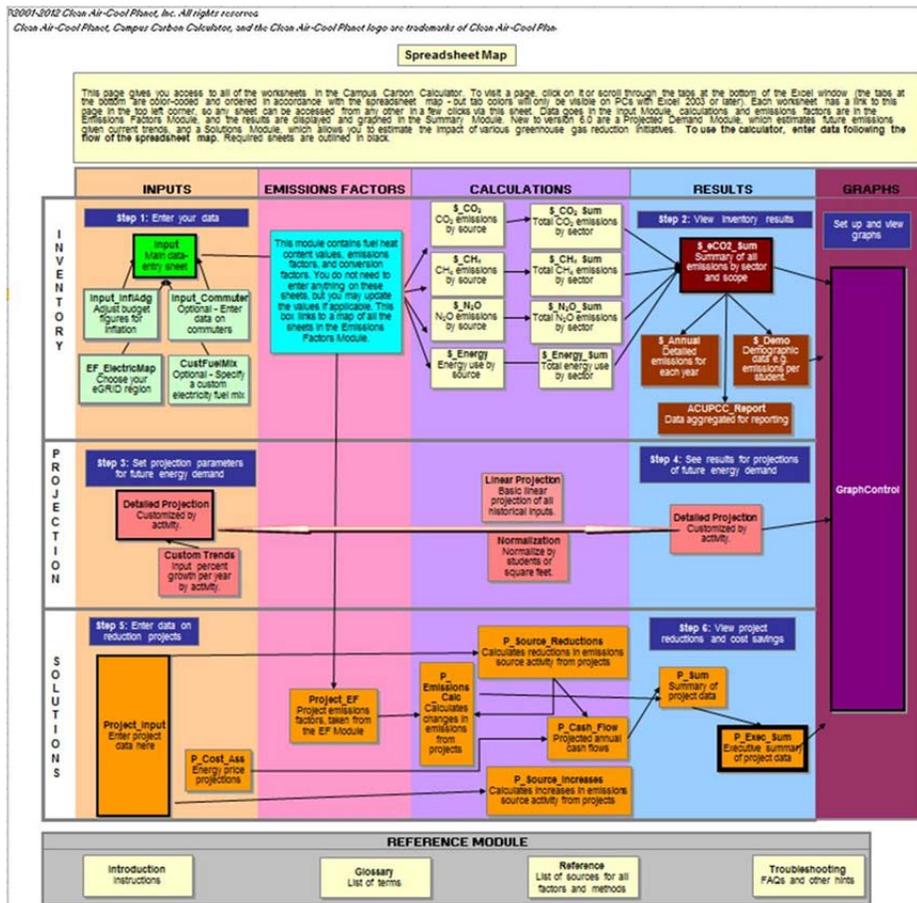


Figure 2.0 Architecture of the Clean-Air Cool-Planet Campus Carbon Calculator™

A series of analyses dealing with: 1) the inventory; 2) the projections; and 3) the “solutions.”

These are cross-referenced against 5 columns of content: 1) inputs, 2) emissions factors, 3) calculations, 4) results and 5) graphs.

The input data are easily loaded; the default emission factors are pre-configured based on regional locations within the electric utility grid. The calculations include the full range of greenhouse gases to arrive at the total CO₂ equivalent (CO₂e). The inventorying of results enables examination of emissions by sector, scope, and year, by demographic data indexes (e.g., emissions per student, per square foot, etc.) and has been linked to the ACUPCC reporting requirements so that these data can be extracted from the ACUPCC report tabs within the spreadsheet organization.

The setting-up of graphs is quite helpful given that the user can control the boundary of years to be graphed, and then can target the type of data to be presented; ranging from emissions summaries, to emissions demographics, to energy use summaries, to energy use demographics. The ‘solutions’ module graphs are equally user-friendly enabling the bounding of target years, reduction goals, and offset pricing by which to graph comparisons of individual projects and emissions timelines. The hot key buttons enable users to jump from any sector of the spreadsheet display back to the input worksheet and/or to the spreadsheet map. Once familiar with the architecture of the spreadsheet system, data entry and use are very convenient.

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Climate Neutral Business Network (CNBN) VCS¹⁹ Carbon Market Qualifications Methodology

Working from this tool, the Climate Neutral Business Network (CNBN) has developed a complimentary methodology for “qualifying” greenhouse gas reductions for positioning within the Carbon Credit Market using VCS-certified reporting protocols. In the case of the Ball State University geothermal project, our negotiated 3-year agreement with the Chevrolet Motor Division of General Motors includes our annual examination and assessment of the carbon market—using our project as a test case of application of the CNBN methodology for reporting annual CO₂e emissions (and reduction complexities).

The CNBN/VCS methodology involves six layers of documentation/reporting. Project details are provided covering everything from a narrative description to a bounding of the crediting period, to the scaling and estimation of greenhouse gas emission reductions, to project location, ownership, right-of-use and additional factual information. The actual application of the methodology involves establishing a baseline scenario, clarifying the certifiable ‘additionality’ of a GHG reduction effort, and annotating any methodological deviations in meeting the qualifications of the protocol. The actual quantification of greenhouse gas emissions reductions with attention to potential vectors of leakage is then described and finally the data and parameters available to validate and assure the sound monitoring of the activity are presented. The methodology ends with a review of environmental impact and an invitation for stakeholder comments.

Quite separate from this narrative presentation, however, one must first use a rather detailed Excel spreadsheet built around the VCS protocols. A ten-year time window is considered desirable for measuring and projecting the categorization of the intervention by type, impact of the intervention and the following:

- Behavior change campaign/communications
- Co-gen and fuel switch
- Lighting retrofits
- On-site renewables
- Boiler retrofits/central heating/cooling upgrades
- Retro commissioning, Upgrades and Automation
- Weatherization improvements
- LEED certification
- Green Building
- Innovative strategies

4. Second Order Opportunity Space

Power purchase agreements

Power purchase agreements (PPA) have become an increasingly popular way for both energy customers and providers to benefit from the installation of renewable energy systems. The customer avoids the large capital investment required for such systems, and the energy provider can take advantage of investment tax incentives. For example, Sunrun, Inc., a provider of residential solar electricity, operates in 11 states using a PPA business model. Under this model, Sunrun owns and maintains the equipment; in return, customers lease the equipment and purchase energy from the provider at a fixed rate for a 20 year period. These agreements are particularly favorable to energy providers because of the associated federal and state tax incentives. The U.S. federal tax code allows a 30% investment tax credit on residential and commercial solar, fuel cells, small wind and production tax credit-eligible technologies. For commercial companies, these investments can be depreciated and used as a tax deduction from

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revenues over a 5 year period with an accelerated 50% deduction in the first year of service. For an energy provider that uses the PPA business model, the benefits include a long-term contract with predictable lease and energy service revenue along with tax investment credits and tax deductions for the first 5 years. For the customer, their electricity bills will not be subject to price hikes over that period.

In addition to federal tax incentives, many states have legislated incentives and mandatory renewable energy targets for electricity companies. In 30 states and the District of Columbia, mandated renewable portfolio standards (RPS) require electricity providers to acquire a specific amount of their power delivery from renewable sources by a specific date.²⁰ For example, the California RPS stipulates that California utilities must produce 33% of their retail sales from renewable resources by 2020 with interim goals of 20% and 25% by the years-ending in 2013 and 2016, respectively.²¹ States vary widely in their definitions, targets and timeframes; federal RPS requirements do not exist. To provide evidence of compliance, many state RPS programs have instituted a renewable electricity (or energy) credit (REC) trading system. An electricity supplier with insufficient credits for compliance could purchase RECs from a supplier with a surplus. Only the generator of the REC or the holder may claim it; but not both.

Ownership of a REC has relevance for colleges and universities looking to reduce their carbon emissions by installing renewable energy sources on their campuses. A PPA is an attractive option to shift upfront costs and risks of ownership to another entity. The downside is that the college or university may not own the REC to count as a reduction in their carbon emissions. For example, Smith College entered into a PPA for a solar energy system but was not able to claim the credit because the energy provider by conventions of practice held the REC.²²

RECs should not be equated with carbon offsets for several reasons.²³ Carbon offsets are the avoided release of carbon emissions into the atmosphere. At a basic level, a REC is a certificate that states that one megawatt-hour of renewable-source electricity was created and delivered to the electrical grid. Since the 1990s, RECs have been acquiring the reputation of having the same environmental benefits as carbon offsets. The issuance of a REC is not a guarantee that the subject renewable energy replaced any carbon emissions; rather it demonstrates only that a renewable energy unit was generated. Without a consistent regulatory framework providing specific requirements for attributes such as the qualification of sources — their quantification, verification, and ownership — RECs create confusion in the carbon markets.

Credible carbon offset programs require qualifying emission reductions to meet both rigorous additionality and ownership criteria. The additionality condition is achieved if the carbon emissions reduction occurred above and beyond a legal requirement or that would not have occurred otherwise. Ownership of the credit must be clearly documented and clearly transparent to avoid double counting. As in the example of Smith College, the college initially counted their RECs as carbon offsets but thereafter discovered that, they did not ‘own’ the RECs and had to adjust their carbon emissions data as a result. The absence of well-documented RECs and a system to track ownership could result in inaccurate counts of carbon reduction. The methodology developed by CNBN and utilized in the creation of this carbon study offer a means to that end.

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Engaged Offsets

Engaged Offsets, as an alternative financial mechanism for funding carbon reduction projects, have the potential to expand the availability of renewable technology investments to a wider group of organizations.²⁴ Because renewable energy investment tax incentives are not directly available for nonprofit organizations such as universities, public schools, and low-income housing developments, these investments are often difficult to finance and, consequently, delayed. Engaged Offsets remediate the financing difficulties by detaching renewable energy tax credits and bundling them for corporate investors in a manner similar to the federal low-income housing tax credit. Investors providing funds for the project can take advantage of the associated tax credits and can purchase the carbon offsets generated. This mechanism in turn can enable a university to fund an otherwise unaffordable investment, which provides energy cost savings, employment opportunities, and reduced carbon emissions. One of the goals of this investment vehicle is to provide local investors with local investment opportunities.

The Engaged Offsets mechanism is being implemented by CTG Energetics (nonprofit consultancy), Terrapin Bright Green (environmental consultancy), Enterprise Community Partners (nonprofit affordable housing consultants), and JP Morgan Chase (largest U.S. bank). In establishing transparency and verifiability of the credits for this mechanism, these groups have enlisted the expertise of Nixon Peabody, the law firm that crafted the federal tax investment credits for low-income housing.

5. Conclusions

Leveraging Carbon Credit Transactions

The intent of Chevrolet has been to seed transformation in higher education by providing funds to enable colleges and universities to “pay forward” current Greenhouse Gas Reductions toward additional capital improvement or repairs and renovations needed to bring down the CO₂ equivalent of Greenhouse Gases Reported. In some instances, the funding can be used as to kick-start a capitalization fund (Green Revolving Fund). In other cases, it can be used as a temporary sourcing of monies to transition capital projects already underway to deeper levels of impact; through more sophisticated development/refinement of whole-system performance.

In the case of Ball State University, we are using the funding to underwrite this very Carbon Market Study as well as additional on campus research and education associated with our geothermal installation — as elements of overall longer-term reductions through our Climate Action Plan implementation. During the time that a college or university chooses to submit its carbon credits for transaction in the carbon market, those credits cannot be counted toward the college or university reduction of greenhouse gases. The institution is literally transferring the ownership of those credits for a given fiscal year to a third-party funder so as to make monies available for additional greenhouse gas reductions. Thus, when entering the carbon market, colleges and universities can use the transaction of carbon credits as a temporary year-by-year means of leveraging additional longer-term carbon reduction, thereby enhancing their goal of overall net reduction against the requirements of the ACUPCC commitment.

For Ball State University, the 3-year contract with Chevrolet will enable us to extend our pilot testing and evaluation of this carbon credit methodology, to enable additional research and

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educational enterprise and to seed future intervention which will add to our carbon reduction. At the close of the 3-year contract with Chevrolet, the annual carbon credits will remand to our ownership and we in turn will be positioned to “claim” them against our overall carbon reduction goals. Thus it is important for colleges and universities to understand that while the overall “public good” is served by removing carbon from the atmosphere, the temporary transaction can facilitate the funding of even larger interventions and reductions, so that in the longer term the continuing net common good can be expanded as a net positive impact on the environment.

On-line/Off-line

One discovery in this process is the complexity resulting from the management of a multi-building campus undergoing numerous coincident repairs and rehabilitations of campus buildings at the same time that the district-scale system is being installed, the reporting of data is being compiled, and the qualifications using the new CNBN methodology are being developed. In short, the experience remains complex and dynamic. One of the big discoveries is the importance of logging/tracking the online/offline impact of building renovation.

As of this writing, we have 2 major residence hall facilities that have been stripped to their structural bones and are in the process of being totally re-shelled and fitted out. These square footages of occupy-able space, of course, are currently “off-line” and impact to a measurable degree the demand for energy and the resulting use of onsite geothermal sourcing and sinking for the campus as a whole. Going back over the last several years, this same factor applies. We have had a number of major renovations to buildings in which, for periods of time, they were offline and so had some influence on our demand for heating and cooling energies and associated electrical consumption. Our goal is to map these patterns in the next iteration of report on our case study experience. For this first reporting, however, we focus strictly on the initial use of the methodology to qualify our carbon reductions for the voluntary market.

In addition to the year-to-year reality of buildings going off-line and coming back on-line, we also have been adding square footage, over these years. This is accounted for in the ACUPCC and Clean-Air Cool-Planet reporting but also is germane to the reporting using the CNBN methodology. Fortuitously, in our case, our maximal square footage and peak demand for heating and cooling occurred during the year in which our initial Greenhouse Gas Report was compiled. Thus, we are able to trace our reductions from that peak time to now. We anticipate continuing decline as additional existing buildings are brought on-line — as the geothermal project is completed. Nonetheless, it is important to account for those time periods when significant square footages are taken offline during building renovation.

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6. Epilogue: Coverage Slated for the Next Report

A key interest in this longitudinal Market Study is to determine how standards and methodologies support continued reductions and future sustainability initiatives.

We anticipate reporting more detail on this in the next report.

A primary challenge in capturing accurate carbon-reduction values is the to account for the differing valuations that occur when using:

- (1) the Cool Air Clean Planet GHG reporting tool (using non-normalized/non-regionalized carbon conversion factors from national averaging); or
- (2) the real-time metered data as permitted in the Sustainability Tracking Assessment Rating System (STARS) using real-time accounting of purchased energy and regionally-specific coefficients of conversion from named suppliers; or
- (3) the Energy Star Portfolio Manager reporting protocol; and/or
- (4) the simplified spreadsheet accounting of purchased energy records cross-referenced against local heating-degree day/cooling-degree day weather files.

We anticipate reporting more detail on this in the next report.

In every case, the unaccounted complexities can include variability in:

- (1) day-to-day solar loads;
- (2) humidity loads;
- (3) patterns of facility use;
- (4) population count loads by space type (labs vs. classrooms); and
- (5) maintained square-footages within the accounting boundary (e.g., parking garages vs. classrooms vs. administrative buildings vs. off-peak hour-spaces such as libraries, laboratories and performance halls).

\We anticipate reporting more detail on this in the next report.

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7. Endnotes

- ¹ Leuring, S. and Dlugolecki, A (2013, March). Insurer Climate Risk Disclosure Survey: 2012 Findings & Recommendations. CERES. Retrieved from <https://www.ceres.org/resources/reports/naic-report/view>
- ² Leuring, S. and Dlugolecki, A (2013, March). Insurer Climate Risk Disclosure Survey: 2012 Findings & Recommendations. CERES. Retrieved from <https://www.ceres.org/resources/reports/naic-report/view>
- ³ The 3% Solution
- ⁴ U.S. Environmental Protection Agency. Global Greenhouse Gas Emissions Data. Retrieved from <http://www.epa.gov/climatechange/ghgemissions/global.html#four>
- ⁵ Siegel, RP (2013, February). Talking Carbon Reduction with GM's Sustainability Chief *TriplePundit*. Retrieved from <http://www.triplepundit.com/2013/02/talking-carbon-reduction-gms-sustainability-chief/>
- ⁶ Chevrolet Carbon Reduction Initiative. Retrieved from <http://www.b-e-f.org/partner/chevy-carbon-reduction-initiative/>
- ⁷ Bonneville Environmental Foundation. Retrieved from <http://www.b-e-f.org/our-solutions/carbon/carbon-supply-buyers-agent/>
- ⁸ Going Geothermal. Retrieved from <http://cms.bsu.edu/about/geothermal>
- ⁹ Peters-Stanley, M. and Yin, Daphne (2013, May). Maneuvering the Mosaic: State of the Voluntary Carbon Markets 2013 Executive Summary. Retrieved from <http://www.forest-trends.org/publications.php>
- ¹⁰ Verified Carbon Standard. Retrieved from <http://v-c-s.org/who-we-are>
- ¹¹ AASHE Mission, Vision, and Goals. Retrieved from <http://www.aashe.org/about/aashe-mission-vision-goals>
- ¹² Clean Air-Cool Planet Campus Carbon Calculator™. Retrieved from <http://cleanair-coolplanet.org/campus-carbon-calculator/>
- ¹³ Energy Star. Retrieved from http://www.energystar.gov/index.cfm?c=higher_ed.bus_highereducation
- ¹⁴ Organizational Leadership Award, U.S. EPA. Retrieved from <http://www.epa.gov/climateleadership/awards/orgleadership.html>
- ¹⁵ Sue Hall, CEO of Carbon Neutral Business network (CNBN) Retrieved from http://www.climateneutral.com/recognition_sh.html
- ¹⁶ Stationary 1 emissions represent the on-site energy-generation based GHG emissions; these exclude scope 1 mobile emissions (such as from campus transportation fleets). This definition will be consistent with those used by ACUPCC and other GHG reporting/regulatory systems.
- ¹⁷ As noted in the ACUPCC Guidelines, a university must pick at least two of the following:
- 1. Establish a policy that all new campus construction will be built to at least the U.S. Green Building Council's LEED Silver standard or equivalent.**
Yes: In the 2007-2012 University Strategic Plan, Goal IVE mandated that all new construction on campus will be LEED Silver certified at minimum and that all existing building renovation on campus will be considered for LEED EB certification at minimum. We now have eight buildings undergoing LEED Silver Certification.
 - 2. Adopt an energy-efficient appliance purchasing policy requiring purchase of ENERGY STAR certified products in all areas for which such ratings exist.**
Yes: Computing purchases on campus are Energy Star Certified and recommendations are made to all incoming and returning students that reside on campus to acquire Energy Star-rated appliances for their residence hall living.

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3. Establish a policy of offsetting all greenhouse gas emissions generated by air travel paid for by our institution.

Yes: Unit-level strategic planning for sustainability has been completed as per Goal IVF of the 2007-12 university strategic plan and by January 2008 all units addressed a policy for off-setting greenhouse gas emissions generated by air travel.

4. Encourage use of and provide access to public transportation for all faculty, staff, students and visitors at our institution.

Yes: Through an agreement with the local Muncie Independent Transit System (MITS), free ridership is provided for students, staff and faculty. Moreover, this academic year at the request of the university, a new east-west bus route was implemented to enable students living in the respective neighborhoods to have more direct access to MITS for commuting to campus.

5. Within one year of signing this document, begin purchasing or producing at least 15% of our institution's electricity consumption from renewable sources.

No: No information provided.

6. Establish a policy or a committee that supports climate and sustainability shareholder proposals at companies where our institution's endowment is invested.

No: No information provided.

7. Participate in the Waste Minimization component of the national RecycleMania competition, and adopt 3 or more associated measures to reduce waste.

Yes: Students have participated in the Recyclemania competition and campus-wide waste recycling is achieved through our contract with an independent waste hauler. Monthly reports are provided to the university identifying the proportion of the solid waste stream that has been recycled.

¹⁸ A more current movement by Clean-Air Cool-Planet is to migrate the excel calculations to a web-based version of the Campus Carbon Calculator™ which in 2013 was released for Beta testing under the title Carbon Map. The goal ultimately is to replace the stand-alone spreadsheet as the calculating engine.

¹⁹ The Verified Carbon Standard (VCS) was founded by a collection of business and environmental leaders who saw a need for greater quality assurance in voluntary carbon markets. It has become one of the world's most widely used carbon accounting standards. VCS has revolutionized the market developing trusted and innovative tools, as well as pioneering efforts to develop standardized methods that will streamline the project approval process, reduce transaction costs and enhance transparency.

²⁰ <http://www.eia.gov/todayinenergy/detail.cfm?id=4850>

²¹ <http://www.dsireusa.org/incentives/?State=US>

²² Weisbord, D. (2010). Power Purchase Agreement: Can I Develop Renewable Energy and Keep the Carbon, Too?

<http://www2.presidentsclimatecommitment.org/pcc/newsletter/021.html>

²³ Offset Quality Institute June 2009 "Maintaining Carbon Market Integrity: Why Renewable Energy Certificates Are Not Offsets," <http://www.offsetqualityinitiative.org/briefings.html>

²⁴ Engaged Offsets

<http://www.terrapinbrightgreen.com/ideas/ideaindepth.php?ideaid=heL75pM0daDsBDq3LhJL>

Additional useful links:

<http://www.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2012-ES.pdf>

<http://co2offsetresearch.org/policy/StandardsPrograms.html>

http://www.forest-trends.org/documents/files/sovcm_2013_exec_sum.pdf

http://www.terrestrialcarbon.org/Terrestrial_Carbon_Group_soil_%26_vegetation_in_climate_solutions/Background_Reports_files/TCG%20Background%20Analysis%20of%20REDD%20Regulatory%20Frameworks%20090501.pdf/

APPENDIX

PROJECT ECONOMICS

Overview

In 2001, Ball State University (“the University”) retained an independent consultant to conduct a condition analysis of its existing heat plant and district system. The heat plant produces steam that is used to heat buildings and to heat water for domestic use for the entire campus. The study concluded that the four coal-burning stoker boilers (ranging in age from 51 to 68 years), although well maintained, had outlived their rated lives by many years and warranted replacement within the next ten years (i.e. by 2011). The condition of the coal boilers, along with the increased environmental regulations regarding emissions, led to the University’s decision to replace all four boilers.

In 2005, the Indiana General Assembly granted bonding authority to the University for the purpose of replacing the existing boilers. In January 2007, the University sold bonds in the amount of \$44,900,000, with debt service to be provided by the State of Indiana on a fee replacement basis.

The University had planned to replace the existing boilers with the industry standard at that time, a coal-fired circulating fluidized bed (CFB) boiler. This option was chosen based in part on cost estimates provided by boiler manufacturers. This type of boiler, when compared to the stoker boilers, would provide modest improvements in efficiency and reductions in certain emissions such as nitrous oxide, sulfur oxide, and particulate matter. However, a CFB boiler would not reduce the emission of carbon dioxide.

During the early stages of procurement, it became apparent that the purchase of a CFB boiler was cost prohibitive. Due to the cost of raw materials, availability of suppliers, and market demand, the estimated cost of a CFB boiler and related improvements had increased to the point that the expenditure was not justified.

As a result of the increased cost of a CFB boiler, the University explored other options, analyzing up-front capital costs, future operating costs, environmental impact, and other criteria. Through discussions with the National Renewable Energy Laboratory (NREL), the Oak Ridge National Laboratory, and some of the top geothermal experts in the country, it was determined that a geothermal-based district energy system, despite high initial costs, would yield dramatic energy efficiency improvements, leading to future operational savings and an enormous reduction in carbon dioxide and other pollutants.

The following economic analysis is based on the conclusion that the existing system must be replaced. Therefore, the analysis compares the financial projections of installing a CFB boiler to the existing district system combined with the current electric centrifugal chiller operation versus converting the existing system to a geothermal-based district system.

Capital Costs

Initial cost estimates for a CFB boiler were provided in 2006 by one of the largest vendors in the United States. This estimate was the basis, in part, for the University’s decision to pursue a CFB purchase. In late 2007, the University invited the known vendors to submit bids to provide the University with a CFB

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boiler. Each vendor declined to submit a bid. However, the University was contacted by one of the vendors regarding a proposal for a sole-source agreement. This was the same vendor that had prepared the earlier estimate. The resulting proposal was for a boiler package that represented a 60% increase over the earlier estimate. This increase was primarily due to increases in the price of steel and high demand for boilers in emerging economies (e.g. China and India).

Cost estimates for the geothermal-based system have been prepared by consultants retained by the University. These consultants specialize in the development of geothermal-based systems.

Regardless of the direction taken, the University would have also had to invest in other improvements to its district system. These improvements include, among other items, upgrades to the campus electrical distribution system that will ensure reliability throughout campus. Also, the existing stoker boilers would be decommissioned regardless of the option pursued.

The costs for each system, on a comparative basis, are shown below:

	CFB Boiler	Geothermal System	Difference
Base cost	\$63,000,000	\$83,400,000	\$20,400,000
High voltage distribution improvements	3,900,000	3,900,000	-
Emergency generator	4,000,000	4,000,000	-
Decommissioning of existing boilers	2,000,000	2,000,000	-
Total Capital Investment	\$72,900,000	\$93,300,000	\$20,400,000

The base cost of the geothermal system is comprised of the following:

Component	Cost Estimate
Borehole fields	\$28,600,000
Energy stations	16,200,000
Building conversions	14,700,000
Hot water loop	12,600,000
Chilled water loop	4,400,000
Engineering & design fees	3,400,000
Sitework	2,000,000
Inspection costs	1,000,000
Project management	500,000
Total base cost	\$83,400,000

Operating Costs

The primary costs to the University of operating a district heating and cooling system are Labor & Benefits, Utilities, and Maintenance. The labor costs to operate a CFB combined with an electric centrifugal chiller operation versus the proposed geothermal system that produces both hot water and chilled water are estimated to be essentially the same. The same number of workers would be required regardless of the system employed.

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Utility costs vary greatly depending on the type of system installed. A CFB boiler, while 16% more efficient than the stoker boilers, still consumes a large amount of coal. A geothermal-based system, on the other hand, would not be dependent on the University purchasing coal, thereby resulting in approximately \$3.0 million in annual savings. However, the electrical requirements of operating the geothermal system, due primarily to the pumping requirements, would increase electrical costs by approximately \$1.0 million. The net savings in utility costs would be \$2.0 million annually.

Coal boilers, whether they be stoker or CFB, are expensive to maintain due to wear and tear on feeder chains, sprockets, tubes, etc. It is estimate that conversion to a geothermal system which uses heat pump chiller technology would have annual operating costs similar to the existing electric centrifugal chillers. Therefore, the University would save the annual maintenance cost attributable to the CFB operation, estimated to be an additional \$0.3 million per year.

The comparison of operating costs and the related savings between a CFB boiler and geothermal-based system are shown in the table below:

Operating Costs	CFB Boiler	Geothermal System	Savings
Labor & Benefits	\$840,000	\$840,000	\$ -
Utilities, net	4,465,000	2,465,000	2,000,000
Maintenance	653,000	333,000	320,000
Total Capital Investment	\$5,958,000	\$3,638,000	\$2,320,000

**Represents full year costs and savings upon completion of the entire system.*

Financial Analysis

Based on the independent study showing that replacement of the existing system must occur, any analysis of payback and other financial measures for the geothermal-based system should be based on not the stand-alone costs, but on the incremental cost compared to the alternative CFB boiler. In essence, these projects are mutually exclusive – only one need be done. This is a common problem in capital budgeting when managers must choose between two or more mutually exclusive projects. Looking at each individual project’s payback period or internal rate of return does not provide definitive guidance as to which project offers the best return to the company or its investors. Fortunately, there is a simple and widely accepted approach that consistently shows the value of one project over another. This solution involves looking at various return metrics for an incremental project – where the cash flows of the incremental project are found by subtracting the year-to-year cash flows of the less expensive project from the more expensive project. Therefore, the measures below are calculated for the incremental cash flows associated between the CFB boiler and geothermal-based project.

Data

Initial Cash Flow = $C_0 = -\$20,400,000$

Annual Cash Flow = $C_i = \$2,320,000$ for year 1 and inflated at 3% each year thereafter.

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Payback Period The simple payback for the University’s geothermal-based system (versus a CFB boiler) would be 7.9 years.¹

Internal Rate of Return (IRR)

The Internal Rate of Return, assuming a 50-year project, for the University’s geothermal-based system (versus a CFB boiler) would be 14.3%.²

Return on Investment (ROI)

The expected Return on Investment, based on the incremental capital costs and savings, would be 11.4%.³

Recipient Cost Share – Source of Funding

As mentioned in the Overview of this appendix, the University sold bonds in 2007 for the replacement of the boiler plant. Of the initial \$44,900,000 in bond proceeds, approximately \$41,000,000 is available to commit to the conversion to a geothermal-based district system. These proceeds are invested in liquid securities. An additional \$6,000,000 has been appropriated by the Indiana General Assembly from a future bond issuance. Debt service on both of these amounts is being provided entirely by the State of Indiana. None of these funds are provided by federal sources.

Cash Flow

Based on the information presented above, the projected cash flows for the first five years, including the construction period, are as follows:

Sources and Uses of Cash:	Year 1	Year 2	Year 3	Year 4	Year 5
Reduction in Operating Costs*	\$ -	\$ -	\$ 1,160,000	\$ 1,160,000	\$ 2,320,000
Investment in PPE	(28,150,000)	(29,600,000)	(31,380,000)	(4,170,000)	-
Proceeds from DOE Cost Share	14,075,000	14,800,000	15,690,000	2,085,000	-
Proceeds from issuance of debt	-	6,000,000	-	-	-
Change in Cash	(14,075,000)	(8,800,000)	(14,530,000)	(925,000)	2,320,000
Cash at Beginning of Year	41,000,000	26,925,000	18,125,000	3,595,000	2,670,000
Cash at End of Year	\$ 26,925,000	\$ 18,125,000	\$ 3,595,000	\$ 2,670,000	\$ 4,990,000

The reduction in operating costs will not be realized until the first phase of the conversion is completed and two stoker boilers are decommissioned. This is estimated to occur after two years. When the second phase of the conversion is complete and the two remaining stoker boilers are decommissioned, the full amount of operating savings will be realized each year.

¹ The number of years it would take to recapture the incremental capital costs of \$20,400,000 using annual operating savings of \$2,320,000 in year one and increasing at 3% annually.

² 14.3% is the interest rate that causes the Net Present Value of an initial cash outflow of \$20,400,000 and then 50 annual cash inflows starting at \$2,320,000 (and increasing at 3% annually) to equal zero.

³ Annual savings of \$2,320,000 from an investment of \$20,400,000.