


Clean Air-Cool Planet

Campus Carbon

**Calculator**



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## Introduction

This new, improved *Clean Air-Cool Planet Campus Carbon Calculator* is an upgrade of a tool used at over 500 schools across North America. There are three major tasks facilitated by the Calculator:

1. **Conducting a Greenhouse Gas Emissions Inventory:** Collecting, analyzing, and presenting data on the emissions of greenhouse gases attributable to the existence and operations of an institution. This first step provides an essential foundation for focused, effective collaboration on the issue of climate change at a college or university, and is the basis for institutional action.
2. **Projecting Emissions into the Future:** Projecting the university's "business as usual" and alternate-scenario emissions trajectories will provide a context for choosing emission reduction goals and the projects needed to meet those goals.
3. **Evaluating a Portfolio of Carbon Reduction Projects:** Developing a portfolio of proposed carbon reduction projects will put you well on your way to creating an effective climate plan that will address the specific emissions identified in your inventory.

The Campus Carbon Calculator is an Excel workbook designed to facilitate these three tasks.. It includes all six greenhouse gases specified by the Kyoto Protocol (CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, HFC and PFC, and SF<sub>6</sub>). It will enable you to calculate and project emissions for the years 1990-2060 and produce charts and graphs illustrating changes and trends in your institution's emissions over time. The spreadsheets were originally based on the workbooks provided by the Intergovernmental Panel on Climate Change (IPCC, [www.ipcc.ch](http://www.ipcc.ch)) for national-level inventories, and incorporate data from the Fourth Assessment Report of the IPCC. The Calculator has adapted this IPCC data for use at institutions like a college or university, but follows virtually the same protocols.

The Campus Carbon Calculator uses standard methodologies codified by the GHG Protocol Initiative, and employed by corporations, the state of California, The Climate Registry, and other entities to account for greenhouse gas (GHG) emissions.<sup>1</sup> These methodologies are currently the most accurate and widely accepted amongst policy makers. Inventories produced by the Calculator are compatible with current standards used to craft forthcoming cap-and-trade policy.<sup>2</sup> The Calculator is also a preferred tool for the ACUPCC (American College and University President's Climate Commitment).

This document – in addition to the Calculator – is meant to support real change on your campus. Once emissions sources are identified, feasible carbon reduction measures become more apparent. This Calculator will help you document and analyze project ideas such that your campus can begin to incorporate larger investments into its definition of "business as usual." As you may imagine, a holistic incorporation of climate-conscious sustainability is a long and ever-developing process; this Calculator will give you the tools you need to get started.

### A Four-Step Model for Campus Climate Action

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<sup>1</sup> Most Notably, WRI (World Resources Institute), and the CCAR (California Climate Action Registry).

<sup>2</sup> Disclaimer: Though methodologies remain fairly constant, the emergence of markets for RECs and carbon offsets may have a profound effect on electricity emissions attributed to institutions – especially when custom fuel mixes contain high ratios of emissions-free power like nuclear and hydropower.

As people all over the country gravitate toward taking action on climate change, more and more eyes are looking to college campuses in search of bold new solutions. Campuses are filled with young passionate minds, mentors with diverse experience, advanced research facilities—in short, many of the resources we need to address this challenge. Thus Colleges and Universities have a unique opportunity to take real action on climate change and serve as a model for the rest of the nation to follow. This section presents a general four-step plan that will help start you down the road to developing and implementing a climate action plan. Thanks for taking action! And good luck!

- 1) **Bring People Together:** The easiest and most important part of gearing up to take real climate action is to make sure everyone who wants to be is included is included. A broad coalition of groups is the most effective mechanism to achieve the transformational change necessary for campus carbon reductions. Make sure you include academic departments, environmental clubs (all of them), the facilities department, and the sustainability office,. If serious carbon reduction targets are your goal, you'll need all the help you can get! Your dream team will be comprised of economists, activists, talkers, listeners, staff, faculty, and administrators. Every campus community has a few people who really want to get involved – they are a resource that must be tapped. Skill sets are just as important as the story you'll tell. The headline you're going for is something like: "Campus comes together to set bold goals for carbon reduction." You want something with a narrative powerful enough to get people excited.
- 2) **Find Data:** The GHG inventory and climate planning processes supported by the Calculator requires a lot of information to complete. The Inventory will best be performed by a small core group of people who will communicate well with the broader group of interested community members during and after the inventory process. For a student, this is a great project for a break, a summer, an on-campus job, a service learning project or an independent study. If you're not the energy manager on campus, you will definitely want to get friendly with him or her; s/he can help you come up with the right data, but also ideas for harvesting data that doesn't exist yet – like how much electricity goes where in each building. If you're a student (or group of students), you will need support from campus staff, professors, and administrators to gain access to purchasing and other relevant records in the facilities department.
- 3) **Get Creative:** Once you know exactly where your emissions come from, you can focus on how to reduce them. Campus communities are great places to access people with a broad range of ideas: freshmen, seniors, faculty, staff, administrators, community business leaders, etc. Tap the collective consciousness, and get people excited about pitching in – even if they're just supporting your goals from the sidelines. Collect as much information as you can on project ideas, but also start generating campus-wide excitement about your new low-carbon future. Host carbon-neutral events, guide tours of the co-gen plant, write articles in the paper, and be sure to get words like "offsets," and "carbon neutrality" into shared dialogue.
- 4) **Present Your Ideas:** So you've assembled a reasonable list of well-sourced carbon reduction projects and your coalition of interested parties has stirred up a little excitement on campus. Now it's time to present your ideas to your stakeholders. Armed with a thorough list of credible carbon reduction projects, you can start to chart a path toward emissions reductions that ends with a decisive target like, "carbon neutral by 2018." Your presentation includes how carbon reduction will enrich the academic lives of students on campus because it will be integrated into existing campus programs. You can also talk about the respect you'll win from the academic community and media attention for pursuing such an audacious goal when the rest of the country is having trouble even maintaining its current emissions GHG levels. In the end your proposal may lack many of the specifics needed to completely integrate carbon neutrality into master planning and the curriculum – but that's OK. The most important step here is to provide a starting

point, and unite the campus community around one common reduction goal that includes a growing portfolio of carbon reduction projects.

### Changes from Previous Versions

- Updated constants and emissions factors
- Added emissions factors for a range of alternative fuels
- Emissions projections extended out to 2060
- Added normalization of emissions by heating or cooling degree days
- Transportation and distribution losses no longer included in Scope 2 (rather, Scope 3)
- Re-formatted Input sheet for increased compatibility with World Resources Institute / California Climate Action Registry / Climate Registry / American College and University Presidents' Climate Commitment methodology
- Allows more conservative definitions of “offsets”
- Calculation for two new emissions source categories: wastewater treatment, and paper purchasing
- Biogenic carbon emissions reported tracked
- Projection Module assists planning for future energy needs and emissions reductions projects out to 2060, allowing for four methods of projection:
  - Linear
  - Normalized by number of students
  - Normalized by square footage
  - Custom annual growth rates
- Solutions Module allows cost/benefit analysis of carbon reduction measures and includes
  - A customizable input interface by which many different carbon reduction projects can be compared on a basis of financial feasibility and potential for GHG reduction.
  - Customizable fuel price projections out to 2060
  - Projected cash and emissions flows for carbon reduction projects
  - Executive summary comparing reduction measures by cost/savings and reductions
  - Graphs comparing reduction measures and showing overall progress towards meeting reduction goals
- Expanded documentation includes:
  - Explanation of new features
  - Increased user-friendliness and guidance on developing and implementing a climate action plan
  - Updated text on Users's Agreement and Introduction sheets to reflect new version
  - Updated spreadsheet map

### Using the Calculator

**BEFORE USING THE CALCULATOR, SAVE A COPY OF THE ORIGINAL FILE FOR REFERENCE.** Then, on a computer with Excel,<sup>3</sup> open the file, “Calculator\_v6.xls.” Enable the macros when prompted (if you disable the macros, the Calculator will not function properly.) The Calculator will open to a user’s agreement. Read the agreement, and then click “I understand and am willing to abide by these terms...” This will take you to an introductory sheet that summarizes the information below and explains the different sheets and how to use them. Fill in the name of your institution and your contact

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<sup>3</sup> We’ve tested the tool on Excel 2000, 2003, and 2007 for PC, and Excel 2004 for Mac.

information in the box on the introduction sheet. This will automatically update all the other sheets with your information.

### **Updating the Campus Climate Calculator from a previous version**

The Calculator includes a macro to help update your data from previous versions of the tool. A Macro is a set of instructions programmed into the tool to automate certain tasks. Clean Air–Cool Planet released version 3.0 of the Campus Climate Calculator in the fall of 2001. Version 4.0 of the Calculator includes a macro that moves data from v3.0 to v4.0. Similarly, v5.0 includes a macro to move data from v5.0 to v6.0. To update your data from a version prior to 5.0, either use the macros in versions 4.0 and 5.0 or contact CA-CP for assistance. To update from v5.0 to v6.0, click the “Update from v5.0” button on the Introduction sheet of the Calculator v6.0 and follow the instructions.

For the update to work, you will have to enable macros. Because a macro is like a program, it is generally not advised to allow run macros you are not familiar with and Excel has security settings to prevent this. To enable macros in Excel 2007, click the developer tab, then click “macro security” and choose the setting you prefer.

Note: you will probably see differences in emissions estimates between versions (for example, you may enter the same number of kWh purchased and get a different emissions estimate). This is due to improvements in methodology and emissions factors. For example, since v5.0 emissions factors for purchased electricity are taken from the EPA’s eGRID electric emission database<sup>4</sup> which uses plant-specific emission factors for each electrical region in the United States.

### **Tips for Navigating the Calculator**

- **Tip 1:** Each worksheet has a box in the upper left corner labeled "Spreadsheet Map" - click on this to navigate to the Spreadsheet Map worksheet. This worksheet contains a diagram of all the relevant worksheets in the Calculator. To navigate to a specific worksheet simply click on its box in the Spreadsheet Map. To reach a worksheet in the Emissions Factors or Graph Modules, click on the module in the Spreadsheet Map to view a list of worksheets in that module.
- **Tip 2:** Enable the "Web" toolbar (click View -> Toolbars -> Web) and use the forward and back arrows. Note that clicking the back arrow does NOT undo any changes you have made.
- **Tip 3:** Use the worksheet tabs at the bottom of the sheets, which are color-coded on PCs using Excel 2003 or later.

### **Background Information**

Notes: Certain Calculator cells contain a note meant to assist you in understanding the function of that particular cell of worksheet. Notes are indicated by a small red triangle in the upper right corner of the cell. To view the note, simply place the mouse over the triangle and the comment will appear.

Reference Data: At the bottom of every column is a gray row that links to the external references of the data in that column.

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<sup>4</sup> Emissions and Generated Resource Integrated Database (eGRID), Data Years 1996-2000, Version 2.01. US EPA Office of Atmospheric Programs. Prepared by E.H. Pechan & Associates, Inc. 2003  
<http://www.epa.gov/cleanenergy/egrid.htm>

## **Building A Foundation: Understanding Key Greenhouse Gas Accounting Concepts**

So you want to begin to work toward reducing your carbon footprint. How do you know what to measure on campus and what not to measure? How do you differentiate between emissions the institution is responsible for versus those that are the responsibility of the individuals that make up that institution? These questions are not always easy to answer but they must be addressed in order to start setting carbon reduction goals, collecting data or formulating plans. Indeed, one of the major sticking points in evaluating claims of “carbon neutrality” is the question of how boundaries are drawn, which emissions are “neutralized,” and what energy sources count as “carbon neutral.”

Over the past decade, the World Business Council for Sustainable Development and the World Resource Institute (WBCSD/WRI) jointly established a set of accounting standards<sup>5</sup> to begin to address these questions and guide entities in their emissions-reporting. These standards provide concepts and systems to ensure transparency, accuracy and standardization for carbon management. They are primarily found in the GHG Protocol’s “Corporate Accounting and Reporting Standard” and Project Protocol, available at the GHG Protocol website ([www.ghgprotocol.org](http://www.ghgprotocol.org)). These protocols, created and maintained through multi-stakeholder input and dialogue, are the foundations upon which most national and international reporting standards rest.

One of the most important topics for which these documents provide guidance is that of setting boundaries to guide your carbon management process, from your inventory to your climate action plan to implementation and institutionalization. There are three types of boundaries to consider: organizational, operational and temporal.

### **Organizational Boundaries**

Organizational boundaries are generally the highest-level, most straightforward boundaries drawn. Organizational boundaries tell you where you are measuring and reporting carbon emissions – for one department or school, or the entire campus? For one state university campus, or the entire university system? What facilities or property will be included in your analysis?

The GHG Protocol suggests choosing one of two approaches to setting organizational boundaries: the control approach, or equity share approach. The control approach suggests you measure emissions for any operations over which you have practical control; whether at facilities that are owned or leased. The equity share approach suggests you measure emissions from facilities where you have some degree of ownership. The basic guidance is to choose and then consistently apply the approach that is going to be the most comprehensive. For example, Clean Air-Cool Planet operates out of four different offices across the Northeast; these offices are essentially leased suites of rooms that occupy a portion of larger office space. In order to create a comprehensive inventory, it makes the most sense for CA-CP to apply a control-based rather than ownership (equity share)-based boundaries. On the other hand, many colleges and universities own real estate associated with college operations but not under the direct control of the institution—such as student or faculty housing. When faced with the question of whether to include these facilities -- owned by the college but managed by the tenants -- into its inventory, the college must decide whether it will get a more comprehensive picture of its climate impact by applying organizational boundaries based on the control approach, or equity share approach, consistently across the institution.

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<sup>5</sup> WBCSD/WRI, <http://www.wbcds.org/web/publications/ghg-protocol.pdf>

## Operational Boundaries

Once you've identified *where* you will be managing carbon emissions, you next have to decide *which* emissions sources to measure. Since there are greenhouse gas emissions associated at some point with nearly every action we take and every product we use, this counting could go on for ever. Selecting operational boundaries is a key aspect of carbon management because it really dictates how ambitious, and how comprehensive, your carbon management efforts will be.

One problem commonly identified when people first start considering carbon management commitments and strategies is the potential for the "double counting" of GHG sources or sinks in multiple entity-level greenhouse gas emissions. Given the nature of our market-driven society, it's hard to definitively place responsibility for many types of greenhouse gas emissions solely with one entity. Carbon management initiatives typically have to balance two competing desires: the college or university's need to be a responsible citizen, thoughtfully and thoroughly accountable for its "true" impact, and, its need to make commitments that it can keep and that make sense from a pragmatic, operational perspective.

The GHG Protocol presents a useful accounting concept, called scopes, that can help entities understand and structure decisions about operational boundaries, and can simultaneously help address the potential for "double counting." This approach defines three levels of responsibility for emissions, and basically posits that an entity's responsibility for emissions is directly related to its control over, or ownership of, the sources of those emissions. For example, I am more responsible for the emissions from gasoline used in my car than the emissions from diesel in a bus I ride. It was my decision to buy a gas-guzzler rather than a fuel-efficient vehicle, and only I determine how far or frequently I drive. By contrast, I have no control over the fuel efficiency of another entity's busses, yet it was still my choice to outsource my transportation needs to them.

The scopes laid out by the GHG Protocol are as follows:

**Scope 1** – Direct emissions from sources that are owned and/or controlled by your institution.

This includes combustion of fossil fuels in college-owned facilities or vehicles, fugitive emissions from refrigeration, and emissions from on-campus agriculture or livestock husbandry. Your institution has complete control over these emissions, and they are no-one else's responsibility. Examples of these generally include the following:

- On-Campus Stationary Sources  
Emissions from all on-campus fuel combustion, excluding vehicle fuels
- Direct Transportation Sources  
Emissions from all fuel used in the institution's fleet (the vehicles it owns)
- Refrigeration and other Chemicals  
Fugitive emissions from refrigerants and other sources
- Agriculture  
N<sub>2</sub>O emissions from fertilizer use and CH<sub>4</sub> emissions from animals (cattle, horses, etc.)

**Scope 2** – Indirect emissions from sources that are neither owned nor operated by your institution but whose products are directly linked to on-campus energy consumption. This includes purchased energy: electricity, steam, and chilled water. Although your institution is not directly responsible for these emissions, it is strongly implicated. These emissions come from converting energy sources that release greenhouse gas emissions when used (fossil fuels) to energy sources that do not (electricity, steam, or chilled water). Although your



institution did not burn the coal to make the electricity you use, someone had to, and although the electricity producer emitted the gasses, they did not use any of the energy produced.<sup>6</sup>

- Purchased Electricity  
Emissions from the production of any electricity the institution purchases
- Purchased Steam  
Emissions from the production of steam purchased from off-campus
- Purchased Chilled Water  
Emissions from the production of chilled water purchased from off-campus

**Scope 3** – Other emissions attributed to your institution, deemed “optional” emissions by corporate inventories. This includes emissions from sources that are neither owned nor operated by your institution but are either directly financed (i.e. commercial air travel paid for by the institution) or are otherwise linked to the campus via influence or encouragement (i.e. air travel for study abroad programs, regular faculty, staff, and student commuting). Many Scope 3 emissions are considered “upstream” like the emissions associated with making and transporting plastic silverware. To prevent institutions from accounting for too many upstream emissions, most campuses define distinct financial or control boundaries to distinguish which Scope 3 emissions they are indeed responsible for.

- Solid Waste  
Emissions from managing the institution’s waste (incineration, landfilling, etc.)
- Directly Financed Outsourced Transportation  
Emissions from travel that is paid for by the institution, but does not occur in fleet vehicles (business trips in commercial aircraft, staff travel in personal vehicles where mileage is reimbursed, etc.)
- Commuting  
Emissions from regular commuting by faculty, staff, or students (does NOT include student travel to and from home over breaks) (note – student commuting is generally considered to be under a greater degree of institutional control than staff/faculty commuting)
- Study Abroad Air Travel  
Emissions from students flying to their study abroad location
- Transportation and Distribution Losses from Purchased Energy  
Energy lost while transporting purchased electricity, steam, or chilled water to campus
- Upstream Emissions from Directly Financed Purchases  
Emissions associated with paper production, food production, fuel extraction, etc.

**Offsets** – Your footprint is what it is, regardless of what happens outside of your campus. However, if you use your financial control over outside entities in a way that creates a net reduction in worldwide carbon emissions that otherwise would not have occurred, you can justly declare that you have “offset” another entity’s carbon. Usually, offset transactions are managed by firms that specialize in such complex transactions, but institutions can claim their own offsets if they oversee their own off-campus carbon reduction projects.

One of the primary goals of a scoped approach is to encourage the creation of more emissions inventories. Comprehensive inventories can be costly, but cursory inventories can be useless; the scope system allows all inventories done within the scoped model to be useful. If an institution just wants to measure its most direct (yet limited) footprint, it could conduct a 1-year snapshot

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<sup>6</sup> The electricity producer IS responsible for energy losses due to inefficiency of production (i.e. if burning 1000 MMBtu of coal only generated 300 MMBtu of electricity). And the owner of the power lines is responsible for any electricity that is lost during transmission and distribution from power plants to end users (usually about 9%).

inventory of Scopes 1 and 2. This inventory would be comparable to the Scope 1 and 2 section of any other institution's inventory, and none of the emissions from Scope 1 or 2 would be included in the same scope in any other institution's inventory.

The scoped approach categorizes emissions by level of responsibility, but does not in itself dictate what boundaries an entity should adopt. This is left at the discretion of the institution. However, the GHG Protocol Initiative ([www.ghgprotocol.org](http://www.ghgprotocol.org)) as developed consensus-based protocols to help guide operational boundary decisions, as has the American College and University Presidents Climate Commitment (ACUPCC). To ensure consistency and compatibility across inventories, we strongly recommend that you choose one of the following institutional boundaries:

- **All Scope 1 and Scope 2:** This is the bare minimum for most inventories. The WRI Corporate Accounting and Reporting Standard requires the reporting of all Scope 1 and Scope 2 emissions, but considers all Scope 3 emissions optional. This reporting protocol is the basis of the reporting guidelines for The Climate Registry and the California Climate Action Registry, among others. The **American College and University Presidents' Climate Commitment (ACUPCC)** protocol requires that signatories inventory all Scope 1 and 2 emissions and report Scope 3 emissions from commuting and directly financed air travel "to the extent that data is available." Institutions are also encouraged to report any other Scope 3 emissions, especially those that are large or "can be meaningfully influenced."
- **All Directly Financed Emissions:** This includes all of Scopes 1 and 2, as well as any Scope 3 emissions that are directly financed by the institution such as emissions from directly financed outsourced travel and solid waste management. The rationale here is that although an institution has no control over the fuel efficiency of individual airplanes or the waste management practices of a landfill, the institution finances air travel and waste management and is thus partially responsible. Also, including these emissions in an inventory provides an incentive to find ways to avoid or reduce them.
- **All Directly Financed Emissions, Plus Selected Directly Encouraged Emissions:** This includes all of Scopes 1 and 2, plus any directly financed Scope 3 emissions, plus any emissions the institution feels it strongly encourages. For example, some universities require students to study abroad to complete their major. Although the university does not pay for the plane ticket, its policy is directly responsible for this air travel. Similarly, some universities consider themselves responsible for the emissions produced by faculty, staff, and students commuting on a regular basis. Although the university does explicitly require or pay for this travel, it would not occur were it not for the existence of the university. Especially in areas with few public transit alternatives, it is hard to see how faculty, staff, and students living off campus could do anything but commute by personal vehicle.
- **All Directly Financed or Significantly Encouraged Emissions, Plus Selected Upstream Emissions:** This includes all of Scopes 1 and 2, plus any directly financed or strongly encouraged Scope 3, plus selected Scope 3 upstream emissions. Some universities opt to include certain Scope 3 upstream emissions in their inventories, generally for the sake of allocating reductions to these sources. For example, a university might choose to include in its inventory the Scope 3 upstream emissions from producing and transporting purchased paper. If the university then instituted a policy that reduced paper use, its emissions would be proportionately reduced. It is also possible to track selected Scope 3 upstream emissions but not include them in the institution's footprint.

### **Temporal Boundaries**

The Calculator is capable of collecting emissions data from 1990 onward, but that does not mean schools are required to track or report their emissions back that far. In fact, it is best to only go as far back in your data collection as you can find reasonably solid numbers. It is not considered best practice to try to extrapolate past years' data based on more recent trends.

Another question related to setting temporal boundaries is that of whether you are collecting data based on calendar years or fiscal years. Most schools choose fiscal years, and that Calculator is designed with that convention in mind. More specifically, we name the fiscal year after the end date year, so FY06/07 = 2007 on the input sheet. Fiscal Year 2006 - 2007 (FY06/07) will typically begin on July 1 2006, and end June 30, 2007 (but referred to as "2007" in the Calculator). Being mindful of this convention will be especially significant in the Solutions Module when inputting the timing of proposed projects.

### **GHG Accounting Concept: "De Minimus" Emissions**

The "Corporate Accounting and Reporting Standard," on which our methods are based, considers material emissions to be 95-100% of an institution's footprint. Sources that add up to less than 5%, are considered "de minimus" and need not be inventoried. To assess these relatively insignificant sources, (e.g., students commuting to class on a residential campus from their dorms), the conventional method is to use assumptions that produce high-bound emissions estimates. Rather than invest resources in precise calculations each year, institutions assume high bound emissions estimates, and then have the option of choosing to reject them from their inventories as immaterial

We strongly recommend that your inventory estimate carbon as accurately as possible – even de minimus emissions. Understandably, investing time and effort in precise data collection for minute emissions sources is not always the most effective allocation of resources. However, we recommend that all high-bound estimates of "de minimus" emissions not calculated regularly be included in your inventories, despite the fact that corporate inventories reserve the right to dismiss them from the inventory. Basically, if you find a de minimus source on campus, take fertilizer use for example, and your preliminary data indicates that it represents no more than 0.5% of your total footprint, there is no need to collect data for that emissions source on a regular basis. Instead, simply add the same upper-bound emissions estimate to your footprint each year. That way, footprint estimates are as precise as possible – erring on the conservative side, if at all – without causing undue stress during data collection.

Some examples of de minimus emissions could be: wastewater, student commuting, methane and nitrous oxide from biogenic sources, propane, off-road diesel, emissions from buildings that are marginal to campus operations or have outdated energy monitoring systems.

### **GHG Accounting Concept: Biogenic Carbon**

Following the GHG Protocol guidelines, the Campus Carbon Calculator separates out biogenic emissions of carbon. Biogenic CO<sub>2</sub> refers to carbon in wood, paper, grass trimmings, etc. that was originally removed from the atmosphere by photosynthesis and, under natural conditions, would eventually cycle back to the atmosphere as CO<sub>2</sub> due to degradation processes. The quantity of carbon that these natural processes cycle through the earth's atmosphere, waters, soils, and biota is much greater than the quantity added by anthropogenic GHG sources. Examples of anthropogenic (human-caused) emissions of biogenic CO<sub>2</sub> include landfill gas, incinerator emissions, and biodiesel, ethanol, or biomass combustion.

The main driver of global climate change is the net increase in the amount of CO<sub>2</sub> in the atmosphere due to anthropogenic – resulting from human activities and subject to human control – emissions of fossil carbon. These emissions result in a net increase in the amount of carbon in the carbon cycle, because the carbon that was previously locked away in fossil fuels is now available. By contrast, anthropogenic

processes that emit biogenic CO<sub>2</sub> can be thought of as simply "closing the loop" in the carbon cycle - they return CO<sub>2</sub> to the atmosphere that was originally removed from the atmosphere by photosynthesis, but they do not increase the total amount of carbon in the carbon cycle.

Anthropogenic emissions of biogenic carbon do not generally increase the total amount of carbon in the carbon cycle, though they may increase the speed at which the carbon is returned to the atmosphere. For that reason, past versions of the Calculator suggested that, in keeping with IPCC guidance, biogenic emissions essentially be ignored or counted as "0." Current protocols for GHG accounting actually suggest a new best practice, however—that is to track biogenic emissions accurately, but report them separately from the rest of your carbon footprint. Thus, the summary sheets in version six do include a total for biogenic carbon, tracked and reported separately from all other campus emissions, outside of the scoped categories (i.e., CO<sub>2</sub> emitted as the result of combustion in an on-campus stationary source is not counted as "0," but neither as it counted with the rest of your Scope 1 emissions or your total emissions.)

This approach, as in the past, ultimately assumes that anthropogenic emissions of biogenic CO<sub>2</sub> do not result in any long-term changes in the amount of carbon in the atmosphere. Such changes could occur if demand for biogenic carbon sources leads to long-term changes in land-use or land-cover. For example, burning wood from a sustainably harvested forest should not result in a net increase in atmospheric carbon, but burning wood from forest that is clear-cut to build parking lots probably will result in a net increase in atmospheric carbon. In the latter case the emissions could be reported as Scope 3 upstream emissions associated with fuel production.

Although few people bother to calculate or report Scope 3 upstream fuel production emissions for conventional fuels, when calculating biofuels it is common to consider how significant these emissions are. For example, corn-based ethanol is widely disparaged within the environmental movement because lifecycle analyses suggest that its use results in few or no net atmospheric carbon reductions and could lead to far-reaching market effects on many goods and services due to increased corn prices. If you are considering using any source of biogenic carbon, we recommend that you carefully evaluate whether your actions might lead to long-term changes in land-use, land-cover, or significant upstream emissions associated with fuel production.

While emissions of biogenic carbon may be discounted under some circumstances, emissions of other greenhouse gasses from biogenic sources should be included in your inventory. They are included in the Calculator as part of your total institutional emissions. For example, CH<sub>4</sub> emissions from landfilled waste or N<sub>2</sub>O emissions from burning biomass should be included in your inventory because these emissions are the result of human activity (creating anaerobic conditions by landfilling waste or releasing N<sub>2</sub>O through incomplete combustion) and so would not have occurred under natural circumstances.

## **Tracking your Greenhouse Gas Emissions: The Inventory Module**

Once you've created your team and set boundaries, you're ready to embark upon the GHG inventory process. This involves three basic steps:

- 1) Collecting data**
- 2) Calculating emissions**
- 3) Analyzing and summarizing the results.**

The Calculator makes steps 2 and 3 listed above much easier. Once your data is entered into the appropriate cells of the spreadsheet, and a few other parameters are specified (such as the regional

electricity pool from which the institution purchases), calculations are made through a series of cell references. All formulas, conversion factors, and emission factors are already built-in and are constantly updated with the latest information available. The formulas and factors *can* be altered – they can all be viewed and examined by anyone who is reasonably proficient with MS Excel – but they should ordinarily **not** be. The beauty of this Calculator is that you do not have to get into the fairly complex math, science, and economics involved in estimating greenhouse gas emissions from the many activities associated with the operations of a college/university – simply enter the data required in the proper units into the ‘Inputs’ worksheets, and the Calculator will do the rest.

### ***Collecting Data***

As you may suspect, data collection will probably be the most challenging step of the inventory process. Good places to start looking for the data you need are the Physical Plant or Facilities Office, the Campus Planning Office, local Utilities, the Farm Manager (if applicable) and related offices (see Appendix 1 for outline). It is critical that you maintain a detailed journal of every telephone call, inquiry, and successful data request throughout the data collection process. Keeping a detailed journal provides a resource to consult if questions arise about emissions and data down the road, especially when another person assumes responsibility for data collection, such as updating the inventory in subsequent years. Keeping the inventory up-to-date is a long-term project, so staff changes are inevitable. This journal should be backed up in a central location, such as the office or department or office that is taking the lead on the initiative. Box 2 describes a real-world experience in tracking down data, illustrating why detailed journal keeping is a critical component of the data collection and analysis process.

In some cases, data may simply not be available for given source. If all of the information is not available, or the resources needed to gather it are not available, gather complete data for as far back as possible. It is better to have solid numbers for back to 1995 than weak estimates back to 1990. In these cases, make note of the data gaps in the final report. The need to improve record keeping of a campus’s energy usage could well be illuminated by a project like this, so noting significant gaps could help support making this a recommended action step.

#### **Sample Data Collection Experience: A true record of a search for University Fleet Fuel Consumption**

- 12/14/00** - Contacted the Director of Transportation - was told the supervisor of garage maintenance would have the information. Contacted the supervisor of garage maintenance - was told that he forwards all of that information to the facilities business office.
- 12/20/00** - Contacted the facilities business office - was told that they could prepare the data in a few days.
- 1/11/01** - Was contacted by the facilities business office - was told they did not have that information and that the State Department of Transportation handles the fuel distribution and should have the data. Contacted the DOT - was told they keep no historical records but University Dep. of Transportation should.
- 1/18/01** - Contacted the University Controllers Office, was told they didn't have the information and forwarded my message to the Director of Facilities. Did not hear back.
- 1/25/01** - Contacted the Director of Facilities and was told he would get back to me. Did not hear back.
- 1/31/01** - Contacted the Dir. of Facilities; was told my message had been forwarded to the Dir. of Transportation.
- 2/7/01** - Received email from Dir. of Transportation suggesting I contact a specific person at the State DOT. Contacted the State DOT and was sent a file containing data from each vehicle fueling event (about 400 pages long) for the year 2000. Also learned that there used to be a University position that was charged with summarizing the vehicle data and reporting it to the state, but that this position had been eliminated in 1998.
- 2/21/01** - Contacted the supervisor of garage maintenance; was told he would look around for the old reports.
- 3/1/01** - Received a message from the supervisor of garage maintenance that he had found the reports in an old file cabinet. Photocopied reports. Discovered that they estimated fuel use at about half the amount estimated by the annual report received from the State DOT. The Dir. of Transportation was unable to explain the discrepancy. Used these reports, as they were relatively steady over the four years recorded (i.e. there would not have been a doubling of fuel use over 2 years).
- 4/18/01** - Dir. of Transportation called me to ask if I had found out the annual fuel consumption, average fuel efficiency, or up-to-date fleet size. He needed them for a report he was working on. I gave him what I had.

There is no set formula for this process; all universities are set up differently and you will undoubtedly come upon unknown challenges as you navigate the institutional bureaucracy. For example, at one school finding the information regarding electric consumption and fuel consumption from heating was easy because the Energy Manager had already performed some of the same analysis and had previously compiled historical information. On the other hand, finding information on university fleet fuel consumption at the same university was much more difficult and unreliable (see text box). Several people will probably have to be contacted in search of one dataset and so it is important to keep a list of who was contacted, when they were contacted, and what their response was. As illustrated, sometimes this communication gets complicated and without a record it is easy to forget who has been talked to and when they were supposed to respond. It is important to set a deadline for a response to each person contacted. For example, when someone says they will respond at a later date with an answer, explain to them that if you do not hear from them by that day than you will try again. That will encourage them to follow through. Keep in mind that most of the people contacted will already have enough (or too much) work to do and be considerate of their timelines, though they will probably need to be pushed a little. Also keep in mind that they will likely need to be contacted again with more questions, so be sure to build a good working relationship, with plenty of recognition in your public documents and events.

In the data collection journal, it is also vital to keep track of the sources of all information collected. While at the time it may seem obvious that a certain number or set of numbers came from a certain person or office, three months later when writing up the results it is easy to forget. Don't forget that there will also likely be staff changes in the offices from which you get data; record the full source if possible (i.e. if it is from a departmental report) or a person's name and contact information if it is from a person. Keeping records, like annotated digital copies, of your sources will allow any future questions to be answered quickly and efficiently, while also making the inventory more reliable which is important because it will hopefully be used to shape university policy.

### ***Compiling and Entering Data***

Data can be temporarily recorded on paper in the tables included in the appendix of this document. When entering data in the Campus Carbon Calculator, remember that green cells are input cells for you to input data. It is important to have all the data from each year being inventoried (with the exception of data that does not apply – for example if there are no animals at the school the animal section can be left blank). If some data is simply unavailable, leave it blank but be sure it is noted in any report on the inventory. Remember to save often while entering data.

For intensely collaborative projects we also recommend Google docs, rather than shared files. Google docs are a free service that allows users to access fully collaborative work at the same time, in word and excel format on the web. This is ideal for your data collection journal, and data input sheets. For more information on Google documents go here ([link](http://docs.google.com)).<sup>7</sup>

There are four sheets for data entry in the input section of the inventory module: Input\_InflAdj, Input\_CustFuelMix, and Input\_Commuter. Please see Appendix X for a data collection and entry matrix

### ***Calculating Emissions***

The Campus Carbon Calculator determines your emissions by applying emissions factors to the data you enter in the Input Module. These factors are stored in the Emissions Factors (EF) section of the inventory module, whose sheets are identified by the prefix “EF\_”.

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<sup>7</sup> <http://docs.google.com>

The emissions factors are all taken from U.S. government documents, and are converted from the units in which they are given to the units the Calculator requires using the constants on the EF\_Constants sheet. Specific sources for each of the emissions factors in the Calculator are noted on the EF\_Reference spreadsheet. If you want to know where the numbers on any of the EF sheets come from, scroll down to the bottom of the column for the cell in question, and follow the hyperlink in the bottom cell.

Throughout the EF Module, cells that are color-coded blue contain original emissions factors. The emissions factors are all taken from U.S. government documents, and are converted from the units in which they are given to the units the Calculator requires using the constants on the EF\_Constants sheet. Specific sources for each of the emissions factors in the Calculator are noted on the EF\_Reference spreadsheet. At the bottom of each column in the EF worksheets is a grey cell containing a link to the reference for either the emissions factor reference, or the formula used for the calculation. If you want to know where the numbers on any of the EF sheets come from, scroll down to the bottom of the column for the cell in question, and note the formula or follow the hyperlink in that bottom cell.

You may replace emissions factors values if you have access to more recent, more accurate, or special customized emissions factors. Be sure to enter any values in the units given in the column label. If you change any emissions factors, be sure to add the reference for the value you enter to the reference sheet and update the reference at the bottom of the appropriate column; providing, in addition, an explanation for the change in the “notes” section of the reference sheet can also save headaches later.

Cells with white (no) fill contain the calculations necessary to convert emissions factors from the units in which they are given to the units the Calculator uses. **DO NOT CHANGE THE FORMULAS OR VALUES IN THESE CELLS.** Changing these cells will result in miscalculations or other errors.

The first five EF sheets are summary sheets that bring together per unit factors for all sources. EF\_CO<sub>2</sub> shows kg of CO<sub>2</sub> emitted per source unit. EF\_CH<sub>4</sub> shows kg of CH<sub>4</sub> emitted per source unit. EF\_N<sub>2</sub>O shows kg of N<sub>2</sub>O emitted per source unit. EF\_eCO<sub>2</sub> combines the values from the previous three sheets with global warming potentials to give metric tons of carbon dioxide equivalents emitted per source unit. EF\_Energy shows the energy content, in MMBtu, per source unit (when applicable). The rest of the sheets contain the values and calculations required to produce these emissions factors.

**Note on emissions factors:** Fuels have a higher heating value (HHV, also called a Gross Caloric Value, GCV) and a lower heating value (LHV, also called a Net Caloric Value, NCV). The HHV is the quantity of heat that would be liberated by the complete combustion of one unit of fuel, assuming that the produced water vapor was completely condensed and the heat from it recovered. The LHV takes the HHV and subtracts the heat content of the water vapor. The LHV provides a better estimate of the real-world heat value of a fuel, as most of the heat contained in water vapor is not recovered. Emissions factors are calibrated for either the HHV or LHV, and must be used with the corresponding fuel heating value. Following the US EPA’s example, the Calculator’s emissions factors are calibrated for HHVs. If you replace any of the heating values or emissions factors in the Calculator, be sure to use HHVs or factors calibrated for HHVs. If you are entering a custom fuel, be sure that the heating value and emissions factors you enter are compatible.

### *Viewing Summary Data and Graphs*

Once it has calculated emissions totals based on the input data, the Calculator will also provide analysis and graphs of them. These totals are given in both the absolute weight of each of the gases, and in the internationally standard units of “Carbon Dioxide Equivalents, or eCO<sub>2</sub>, according to their Global Warming Potential (GWP), a measure of each gas’ contribution of to climate change relative to that of carbon dioxide (colloquially referred to as “carbon”). For example, one molecule of methane (CH<sub>4</sub>) is 23 times more potent than one molecule of CO<sub>2</sub> (whose GWP = 1) over the same timeframe.

Annual emissions are displayed and analyzed in the Summary Module, whose sheets are identified by the prefix “S\_”. The first four Summary sheets multiply the values on the Input sheet by the relevant emissions factors to give the emissions from each source. S\_CO<sub>2</sub> gives the kg of CO<sub>2</sub> emitted from each source, S\_CH<sub>4</sub> gives the kg of CH<sub>4</sub> emitted from each source, S\_N<sub>2</sub>O gives the kg of N<sub>2</sub>O emitted from each source, and S\_Energy gives the MMBtu of energy used from each source.

The next five Summary sheets (identified by the suffix “\_Sum”) sum the emissions from all the sources in a particular sector (such as transportation). S\_CO<sub>2</sub>\_Sum gives the kg of CO<sub>2</sub> emitted by each sector, S\_CH<sub>4</sub>\_Sum gives the kg of CH<sub>4</sub> emitted by each sector, and S\_N<sub>2</sub>O\_Sum gives the kg of N<sub>2</sub>O emitted by each sector. S\_eCO<sub>2</sub>\_Sum combines the values from the previous three sheets with global warming potentials to give the metric tons of carbon dioxide equivalent emitted by each sector. S\_Energy\_Sum gives the MMBtu of energy used by each sector.

S\_Annual sheet displays the emissions from any single year in a table and pie graph. The S\_Demo sheet displays emissions and energy use data normalized by budget, population, square footage, and heating and cooling degree days.

The GraphControl sheet allows you to access pre-designed graphs of emissions and energy use data. Customize which years of data will be displayed by setting the “Start Year” and “End Year,” and then click on a graph title to go to its sheet. The left-hand column links to sheets with a summary of multiple graphs, while the right-hand column links to individual graph sheets. All graph sheets are identified by the prefix “G\_”.



# Projection Module

## Purpose

Version 6.0 of the calculator offers a reworked Projection Module, formerly the Energy Demand and Cost Projection Module. Once you have gathered all of your inventory data, the Projection Module projects what your emissions profile might look like in the years up to 2060 if your university pursues “business as usual” (BAU). It uses the historical energy use of the university, follows the trend in each activity, and then calculates the emissions for each future year.

While it is a worthwhile effort to compile only the inventory data, your carbon management plan will be more effective and compelling if you can show stakeholders how energy use and greenhouse gas emissions will grow in the future if you stick with business as usual. First, this will help them think about how much the energy budget will need to increase, thus supporting your case for any emissions reduction projects that will produce a positive rate of return. Second, if they have or plan to set an emissions goal for some point in the future, such as 2020, then projecting what the BAU scenario will look like in 2020 will help set a context for emissions reduction projects.

## What information you need

Once you have completed the Inventory Module, you have all of the information necessary to use the Projection Module. However, an understanding of several aspects of your university’s growth trends and plans will inform your choices of how to project your data and subsequently make your projection more relevant to policy discussions. First, it is helpful to know whether general energy use or specific inputs tend to change as the number of students or building square footage changes. For example, you may find that as the number of students enrolled increases 10% your university’s electricity usage also increases 10%. You may be able to make an educated guess about this by looking at your inventory data, or you might solicit either the technical analysis of a statistics professor/student or the experience of someone in your Facilities Department. The second helpful piece of information is your university’s plans for future growth. Many master plans project student body growth from year to year.. It takes several years to bring a new building online, and additions to the campus are often projected far into the future. Taking this targeted growth into account will help your projection be a more realistic starting point from which you can set emissions goals.

## Methods of Projection

There are four methods of projecting your data available in the calculator, and you can choose to have all activities projected by one method or you can choose the method for each activity.

- **Linear:** The simplest projection method is a basic linear projection using the trend created in your inventory data. For each activity, the calculator creates a linear function and extends it into the future.
- **Normalized by students:** This method is best for activities that you believe follow the growth in the number of students. In this method, for each year of your inventory data, each input is divided by the number of students in that year. Then the calculator finds the average input per student (gallons of diesel/student for example). To establish the magnitude of that input for a year in the future, such as gallons of diesel in 2015, that average is multiplied by the number of students projected to be at the university in that year. For the purposes of calculating the number of students, full time students count as 1, part time students count as 0.5, and summer students count as 0.25.
- **Normalized by square feet:** This method works the same as normalizing by students, but it uses the building square footage instead of number of students. You may want to use this method for all inputs, or only inputs that buildings use like heating and cooling.

- Finally, custom trends: You also have the option of specifying an annual rate of growth for all inputs, a single input for all years, or for a specific input in a specific year. When using this option, the rate you specify will be multiplied by the previous year's value to create the next year's value. So for example, if you already know that fertilizer use is going to decrease 2% per year, you would input -0.02 for the annual rate of growth for fertilizer.

### **Steps in using the Projection Module**

To begin using the Projection Module, start at the worksheet called "Detailed Projection." You will notice that it has a series of steps laid out at the top in a way that is a little different than in the rest of the calculator. Hopefully, these steps will help you mark all of your projection method choices fairly easily.

In Step 1, use the drop down menu to choose to make your projections for the energy inputs all linear, all normalized by student, all normalized by square foot, all a custom growth rate, or to specify by activity. You can also choose between all linear, all a custom growth rate, or specify by activity for the institutional data (columns C-L). This is your last step if you choose all linear, all normalized by student, or all normalized by square foot.

If you chose all a custom growth rate for the institutional data and/or the energy inputs, enter that growth rate in Step 2 and this is your last step.

If you chose to specify by activity, use the drop down menus in Step 3. You must make a choice for each activity, but they can all be the same except one if you want. In fact, they can all be the same but in that case it would be easier to simply stick with Steps 1 and 2. You only need to choose a method in Step 3 for the category or categories for which you chose "choose by activity" in Step 1. For example, if you chose "all linear" for the institutional data and "choose by activity" for the energy inputs, then in Step 3 you only need to choose a methodology for activities in columns M through DF.

If for any activity you chose to use a custom trend, click on the link in Step 4 to input your growth rates. Once you are on the "Custom trends" worksheet, first, choose in Row 15 for each activity to A) specify a growth rate for the entire column that will be constant over the years, or B) specify a growth rate for each year in your projection. If you chose to enter a constant rate, input a rate for each activity in Row 16. If you chose to enter a variable rate for each year, you may do so in the blue cells. Your choice in Row 15 dictates what rate is used in the projection for that activity even if you enter rates in both Row 16 and the blue cells.

### **Not a precise science**

Deciding how to project your data will not be a cut and dry decision. There are a lot of factors that could be taken into account with varying levels of importance. Moreover, even if you choose the most appropriate projection method, we are talking about the future here. Things can, and will, change. That said, a defensible projection will still help your emissions reduction planning. For example, one university might look at their 2000 emissions and set the goal of being 20% below 2000 levels by 2015. Using the Solutions Module, they can access what the most cost effective projects will be and how many they will need to achieve their goal. However, if they don't project their future energy needs and take into consideration that the Dean of Admissions plans to admit 15% most students each year by 2015, then they may have difficulty meeting their goal. So gather whatever insights into your university's future growth and then make the best decision you can. It won't be entirely precise, but it will still help your university achieve strong emission reduction goals.

# Assessing the Costs and Benefits of Carbon Reduction: The Solutions Module

## Getting Started: What can I do with the Calculator?

The Calculator will help your campus figure out the most cost-effective way to cut its carbon emissions. Basically, it's a decision support tool. Much of the shift we need on our campuses can only be judged qualitatively, but the Calculator will help people who are interested in assessing the quantitative costs and benefits of cutting their carbon. Our goal is to take minimal numerical inputs and produce a comprehensive analysis of the reduction measures such that we can say with some certainty "how much will cutting carbon cost?" We've spent decades pondering the consequences of *inaction* on this issue – this is your chance to explore the consequences of *action*.

Similar tools have been used by college students and financiers alike to assess risks, revenues, costs, and benefits of carbon reduction and carbon neutrality. This information, when presented cogently, allows stakeholders (from grassroots groups to staff) to engage financiers on a level that assures mutual understanding of carbon reduction. As we hear throughout the environmental community, there is no "silver bullet" to dealing with the climate crisis, but there are many good ideas out there. This tool will help serve as a common denominator, to see how good your ideas really are.

Here's a general overview of the process: come up with a number of ideas for projects that will dramatically reduce your school's carbon footprint -- make better buildings, change purchasing policies, conserve energy, buy more efficient appliances, switch fuels, etc - then enter a few simple pieces of data on each proposal. The numbers you input are used to evaluate the projects over time with respect to each other. We use conventional tools of finance to prioritize the projects: Internal Rate of Return (IRR), Net Present Value (NPV), and Payback Time. We'll go over what exactly these terms mean, and how you can use them to learn more about your project ideas – you don't need to be a finance professor or professional to understand this stuff. . . but it wouldn't hurt to befriend one. Good Luck!

***A Brief Note on Accuracy:*** It's important to be aware of the significant distinction between the first module of this tool that deals with the past (inventory), and the subsequent modules that deal with the future (Projection and Solutions Modules). In the inventory section, the numbers you input are the limiting factor in the accuracy of your product, and most of those numbers should be quite accurate because they are derived from financial records like bills of sale. Because we don't have next year's heating bill just yet, many of your calculations will be inaccurate by no fault of your own. It's important to recognize this, but not let it limit your ability to propose project ideas. *As long as you document exactly how inaccurate your input data is,* you might as well just assign putative values for some of these projects. For example, if you know how much new steam piping costs, but you don't know the efficiency of your current steam pipes, feel free to make some assumptions and document them, for example "Assume new pipes will be half as inefficient as the current pipes." Such assumptions are not enough to finance the project, but they're enough to get the ball rolling.

### ***"Project" Inputs***

We define a project as "a change in business-as-usual associated with a quantifiable reduction in carbon emissions." Projects can be as simple as a picnic outside that avoids electric lighting, or a multi-million dollar investment in on-campus wind power.

#### **Inputs: The big three**

- 1- Timing - Start Year and Project Duration
- 2- Cost - Total capital Cost and Cost Assumptions modifications if data is available

3- Activity Change - Will we be burning less fuel oil? Reducing our electric bill? Burning More Biodiesel?

### 1- Timing:

The timeframe of a capital cost project is very important when comparing it to similar projects. Knowing when a project can realistically start, and how long it will last, is crucial information for carbon reduction timelines. Here are some important timing conventions to be aware of:

**Fiscal Years** - First of all, bear in mind that there is an underlying fiscal year convention within the tool. Much of the data needed for the GHG inventory comes from data collected in July from the previous July-June fiscal year. Also, remember that years within the tool refer to the end year of your school's fiscal year, so 2007 = FY06/07.

**Start Year** - It is assumed that at the very beginning of this year the project is off and running. The facility is built, the fuel is switched, and the annual savings will be building up throughout this given year. Therefore, the accounting for fiscal and GHG savings will be reported at the end of that given year. For example, if the "Start Year" for a project is 2008, the tool assumes that the capital cost will be accrued in the beginning of the 2008 fiscal year, and the annual cash flow assessed at the end. To simplify this, we just assume that all cash flows are evaluated *at the end of each fiscal year*, and take the project date back a year when we calculate capital cost, which is accrued at year Zero. To clarify that point, here's a quick example:

You input the following:

Project: 1 Hybrid Civic, as opposed to a normal Civic

Start year: 2007

Capital cost: -\$3,000

Activity Change: -450 gal of gasoline

What this means in terms of fiscal year convention, and our timing assumptions:

July 1<sup>st</sup> 2006

You paid for the hybrid car in full

July 1<sup>st</sup> 2006 – June 30<sup>th</sup>, 2007

You benefit from your investment by saving gas!

June 30<sup>th</sup> 2007

Year 1 data is in! Now we know how much you cut costs and cut carbon.

Bottom line:

- Capital costs are accrued in year zero ("2006"), which means the very beginning of "year 1"
- The "Start Year" is the same as "year 1"
- Marginal costs/benefits for each year of operation are assessed at the end of the stated year (like activity data for "2007").

### 2- Cost

Costs and benefits are the means by which all decisions are made. Our recommendation is that you try to quantify as many costs and benefits as possible. Here are some tips to help you out:

**Working With Marginal Cost** – You may notice that the Hybrid Civic Project in the example above has a very low cost. That's because it's the marginal cost of the decision to diverge from business as usual. In a situation where you don't need to buy a vehicle at all, the marginal cost would be the difference between the cost of a new hybrid (\$22,600) and \$0. However, if you're looking to purchase a new sedan anyway, and you are deciding between a new civic and a new civic hybrid the marginal capital cost is reduced to a mere \$3,000. Here's the math:

Price of a 2008 Honda Civic EX Sedan:	\$19,500
Price of a 2008 Honda Civic Hybrid:	\$22,600
Marginal Capital Cost of Buying a Hybrid:	\$3,100

**O&M:** Operation and Maintenance. When talking about “new projects,” many college administrators are afraid of staff time. Human resources are costly, and take much administrative juggling to manage. Any reduction in O&M caused by your project ideas will be met with sighs of relief. However, any increases in person-hours should be recorded as an added annual cost over the duration in the “Annual marginal operating cost per unit” field. In the end, both increases and decreases in annual expenditures due to O&M should be accounted for if possible.

### **Financing Incentives and Disincentives:**

**Grants:** Grants are free money. Sometimes they are designed to help out with startup costs, and other times they are offered annually. The input sheet has a field for “one time grants,” but annual grants offered over the duration of a project can be input into the “misc. annual savings” field. As of Jan 08 there are no opportunities for federal level grants for renewable energy projects; however, is coupled with research funding, and/or state level grants, these can really helpful. We recommend that you speak with members of your engineering or business departments, to see if anyone has funding that includes to-scale implementation of educational/research subject matter.

**Loans:** Loans must be paid back, but, if you can get a loan with a lower interest rate than your discount rate, the net present value of the project will be higher and investment will be more feasible. There are probably issues with credit, and the ability to receive more loans in the future, so be sure to chat with whoever deals with capital project finance about loans before you make too many assumptions. However, it is not uncommon to have loans set up for annual discretionary projects, and in some cases, even “environmental” projects. In our calculations we assumed that interest would be compounded annually.

**Bonds:** Oftentimes you can get loans with a set payback time, but no interest. These are bonds. The way bonds usually work is like this: investors contribute capital to your project at a set interest rate to be paid back at the end of a given timeframe. The interest is not paid by you, it’s paid by the government, or whoever helped facilitate the bond. Some states offer bonds specifically for renewable energy investments, and recently the federal government introduced CREBs: Clean Renewable Energy Bonds.

**The Discount Rate:** The discount rate is critical if you hope to compare your proposed investment to business as usual. By definition, a discount rate is “the annual growth rate of an investment,” and in our case more specifically “the annual growth rate of an investment used when a future value is assumed.” In the case of a college or university, this is usually a little higher than the annual return on their endowment. Your school may also have a special endowment that it uses for “green” projects. The people to ask about this are professors in the economics business departments (namely in finance, or microeconomics), administrators who work on capital projects, and leaders in your student investment club. If you don’t know what your school uses to discount capital cost, we recommend using the [Federal Funds Rate](#).

### **3- Activity Change**

As with assessing costs, activity change data should be entered in terms of marginal values as well. These inputs can be a little demanding, and can require some external research, and most importantly, out-of the box thinking. It’s a good idea to stay in touch with whoever worked on your inventory to make sure all the data you use is coming from the same places. To illustrate these points, let’s revisit the Hybrid example used earlier:

MPG of a 2008 Honda Civic EX Sedan:	24	Source: <a href="http://www.fueleconomy.gov">www.fueleconomy.gov</a>
MPG of a 2008 Honda Civic Hybrid:	42	(city/hwy combined mpg)
(note, not enough data to calculate activity change)		

Annual miles traveled per year:	8100	Source: James Brown, College Fleet manager, Facilities.
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Marginal Activity Change of Buying a Hybrid: **-(450)** gal of gasoline

Your activity change input will then flow through the emissions and cost assumptions sheets to calculate the annual emissions reductions and annual \$ reductions based on your emissions factors and year-specific fuel prices.

### ***Challenging Assumptions***

The General Flow of the Solutions Module is as follows: Inputs => Assumptions => Summary Data (graphs and charts). Entering simple inputs, and receiving summary data is important, but so is being precise and credible. Each campus runs on a unique blend of fuels, ideas, and frankly, markets. It's up to you to zero in on what is more viable to your given institution/region, and therefore challenge the somewhat putative assumptions we make in this tool. Here's a summary of the assumptions we made

#### **Emissions Assumptions:**

These values should be quite accurate. For the vast majority of fuels, we have a very precise understanding of how much they contribute to climate change. This sheet is a resource as much as it is a place to update emissions factors. All values are given in terms of eCO<sub>2</sub>/unit, which should make shorthand calculations much easier if you're trying to parse out the viability of project ideas. Things to change/update would be specific emissions factors tied to biogenic sources, and alternative fuels that vary by region and combustion technology.

A good example of a fuel source with varying data is "woodchips." We used data from regions with a highly commoditized market, and a specific blend of mill residue and forest product. Your local wood chip market may vary greatly in terms of both chip quality and price. Let's discuss wood chip combustion methods for a moment. Our tool assesses chip emissions by looking at the combustion of 80% moisture content chips in a crude wood chip stoker boiler. Now let's say you find chips with a different moisture content, and assume a slightly different combustion method, like gasification – that's fine – but we need to make sure we account for it in our emissions factors. Gasification of wood chips is far more efficient, and produces fewer CH<sub>4</sub> and N<sub>2</sub>O emissions. To account for that reduction, we recommend that you make a note of it in your project documentation, and then change it in the "emissions factors assumptions" section of the Solutions Module. Changing numbers on this sheet will make your Solutions Module calculations more accurate without altering any of your emissions inventory calculations.

#### **Cost Assumptions:**

If you're going to challenge any of your assumptions, it should be cost. Many of the renewable energy sources and fuels are rapidly developing, so updating the "per unit" costs of new fuels and technologies is important when assessing the benefits of high cost capital projects. It is important to note that changing the values in the two assumptions sheets will not impact the inventory module – these values are meant to be altered. To better understand the assumptions you'll challenge, let's look at assumptions by fuel type:

**Fossil Fuels:** Our assumed values are quite reliable for conventional consumers; however, campuses are not conventional consumers. This data may be very difficult to obtain, and not very easy to share. Most large corporations and institutions will bid on fuel delivery packages, using their high demand to argue for lower prices. Sometimes colleges will even work with multiple providers of the same fuel to keep costs down. Keeping track of fossil fuel prices will be a key component of your analysis, but it may also be important to assure the powers that be that the \$/gal figures for petroleum products they share with you will not be made public. It can be helpful to note how volatile these markets are. The price of these fuels dictates the price of "business as usual", and if there's anything financiers value, it's minimizing risk. Whomever deals with fuel procurement on campus can help you with this fuel price; on your campus it could be the Energy Manager at Facilities, Controller, and/or the VP of Finance –.

**Biofuels:** The prices of biological fuel sources are tied to the geography of your region. Soy-based biodiesel refineries are plentiful in the Midwest, but not on the east coast. Yet a thriving forestry sector makes wood chips more plentiful in the northeast. The prices we found for biofuels are quite volatile – especially for unprocessed solid fuel. Not only will you need to look into regional prices, it would also behoove you to explore recent price trends. Much of the biofuel market is in its infancy, which means that prices are subject to change, and will most likely go down. Then again, in some regions demand may be skyrocketing too, which will actually increase price. In the end, the best thing to do is get a sense of how the biofuel market works in your area. The best people to talk to are foresters, private forestry management services, associations and trusts, petroleum dealers, and the on-campus individuals who are in charge of procuring petroleum – chances are they’ve considered biofuels switching and have a sense for pricing.

**Price Projections:** Fortunes are made from predicting future energy prices. In the business world, investors pay large sums of money for energy price forecasts, and chances are your school may try to do some forecasting as well. Our projections are based on government forecasts, which are well sourced, but represent broad generalizations - especially with markets sensitive to political instability. In general, the government trends for fossil fuels depict a price peak in 2008 , despite years of increasing prices. Prices then dip until around 2015, and then perk up in a linear fashion until 2030. For the sake of long-term price estimations, we extended the government’s linear projections until 2060 for all fossil fuels.

Projections for alternative energy are more difficult to make, so we took current values, and flatly extended them, assuming no change in average price over time. When comparing long-term energy changes, feel free to alter our predictions however you like within the “Cost Assumptions” sheet – you can always reenter the formula. In the end, it’s near-impossible predict energy prices with high degrees of accuracy, and it’s important to recognize that. However, we *can* make a few valid observations about the fossil fuels we’re using: their prices are increasing, supply is shrinking, demand is growing, and they are being phased out by legislation on the state, national, and international levels.

#### **Data Logs, Journals, and Documentation:**

Like the inventory itself, it’s important to source your data, whether that data is a conversation, a government document, a blog, whatever. As we mentioned earlier, Google docs are a fantastic way to document collaborative work: (<http://docs.google.com>). Don’t be afraid to account for values you’ve inputted as assumptions, or putative values either. As long as those values are tied to an individual, and some logical thinking, they’re better than nothing.

### ***Understanding Final Product***

#### **Outputs: The Big Three**

- 1-Internal Rate of Return (IRR)**
- 2-Net Present Value (NPV)**
- 3- Payback Time**

#### **1- IRR (Internal Rate of Return):**

This is the average annual rate of return on investment for a specific project. Any project with an IRR higher than the discount rate is a project that should be done, environmental benefits aside. The executive summary will automatically prioritize projects by IRR, that way the most cost effective projects appear first.

## **2- NPV (Net Present Value):**

The total value (+ or -) of an investment at a given time, discounted to internalize opportunity cost. The NPV at the duration of a project shows the value of that investment in terms of present day dollars. Investors will ask themselves – will the value of my investment increase over time? Will it increase faster than the value of my other investments? In the Executive Summary a positive NPV dictates a net gain on investment, even with the discount rate internalized. NPV is a great way to assess the “Net” cost of carbon reduction over a set time horizon.

## **3- Discounted Payback Time:**

There are actually two types of payback time -- simple and discounted. The Projection Module only uses discounted payback time. With a discounted payback period, the costs and benefits of the project are discounted as they occur over time to take into account the lost opportunity of investing elsewhere. Basically, over time the NPV of a project increases, and the discounted payback time is the time it takes for NPV to break zero. Payback time is a good way to assess risk in a project – higher payback time means higher risk. Payback time is also a good tool to demonstrate how carbon reduction projects may eventually create revenue.

## **Summary Data:**

We tried to make the summary section as streamlined and pertinent as possible. The Executive Summary takes all your inputs and boils them down into a page-sized table fit to be re-printed in a document. It contains the bare-bones data decision-makers need when assessing prioritization amongst your projects. For a more thorough data set by project, you can use the “Project Summary” page as well. Some interesting cumulative data appears here in the full summary, such as NPV and GHG reductions for all projects combined, or all projects with a positive IRR. Now if someone asks you “how much will this carbon reduction strategy cost,” even if they’re just asking the question rhetorically, you’ll be able to give them a credible response!

Depending on what you look at first, you’ll either see some ugly grey rows in the summary pages, or some hideously out-of-proportion graphs. These phenomena are related, and can be fixed very easily. The Summary page takes each unnamed project and turns the whole row grey, and adds the text “HIDE THIS ROW.” If you highlight all the rows by number on the left margin, left click them and choose “hide,” they will disappear from view on both the summary pages and the graphs.

## **RECs Offsets, and Additionality:**

Many campuses have their sights set on Carbon Neutrality, a full negation of emissions associated with the college. Currently no institution can achieve carbon neutrality without offsetting emissions through the purchase or RECs or offsets. Though carbon neutrality is a goal sought by many, offsets and RECs have been subject to much controversy and confusion. We hope that the design of this tool will help you distinguish between the merits of different types and calibers of footprint-negating purchases. Regardless of the distinctions we make, it is important to note that there is no concrete definition of carbon neutrality: it’s possible to argue that you are carbon neutral if you say you are - the question is whether or not your friends believe you.

**REC: (Renewable Energy Certificate)** A tradable commodity, representing the purchase of renewable energy. Usually sold by the MWh, but RECs are sometimes called “offsets” and sold by mass of CO<sub>2</sub>. Any transmission of qualitative energy consumption credits from one entity to another involves RECs, but not all RECs are additional.

**Carbon Offset:** A type of REC sold in units of CO<sub>2</sub>, usually short tons but sometimes metric tonnes.



**Additionality:** Emissions reductions are "additional" if they occur because of the incentives associated with the existence of GHG markets. A variety of additionality “tests” have been proposed, but at its root demonstrating additionality means showing that the emissions reductions being used as offsets are not “business as usual.”

Now that you understand the tools of finance, we can have a brief discussion about how renewable energy projects, and therefore offsets, are financed. When the NPV of a project is positive over the time horizon of the project, the project pays itself back, and is considered cost effective. If that is the case with a renewable energy project, and RECs are sold in the GHG markets, and REC value is not included in the financing calculations, those RECs are NOT additional, because their sale alone was not responsible for creating new renewable energy. However, let’s say that at the time horizon of a given project the NPV is not yet positive. That difference, between the negative NPV and zero, is the amount of money needed to make that project economically feasible. That amount of money is divided by the tonnage of GHGs *avoided* by making that investment, and the result is the wholesale offset price for carbon offsets *with* additionality.

For more information on Offsets, RECs, and additionality, check out Clean Air-Cool Planet’s [\*A Consumer's Guide to Retail Offset Providers\*](#), a report put together by the firm Trexler Climate + Energy Services.

### *Next Steps: The Beginnings of a Climate Plan*

Now that you’ve completed an emissions inventory and developed a list of reduction projects, you’re well on your way to the foundation of a climate action plan. Drafting a plan will help unite your institution around common goals. Good climate action plans include emissions reduction targets, concrete plans to continue reporting annual emissions, a portfolio of carbon reduction measures, and an outline of how to finance them. Most schools will also describe how carbon reduction will be incorporated into the educational process. For more concrete examples of what to look for in a climate action plan, we recommend consulting the ACUPCC implementation guide ([link](#)) No institution can foresee the exact path they will take, but what they do recognize is the need to start restructuring the definition of business as usual, and that process starts with a list of project ideas.

This section of the users guide is meant to help guide you through the process of presenting administrators and trustees with emissions reduction targets and other concrete asks so that your climate plan can develop into a fully institutionalized force on your campus. Much of our advice in this section is focused around building a persuasive argument in favor of meeting emissions reduction targets and financing/ratifying various elements of your climate action plan. In the end, your good judgment will be essential to successfully navigating specific subtleties of your institution’s administrative processes. If you don’t know where to start your climate action plan, or you just want to build a more nuanced argument, hopefully these passages will help.

#### **Setting Goals:**

There are two major goals for institutions seeking to enact bold and comprehensive carbon reductions: setting emissions reduction targets and drafting a climate plan. Setting concrete goals, even long term ones, is a key step towards uniting people under a common cause. It is important to send a persuasive message to everyone in the campus community that carbon reduction will be incorporated into the educational curriculum. Committing to concrete steps toward carbon reduction also sends a signal to clean technology markets and the higher education community. As more universities publicize their commitments, peer institutions that can assist each other by sharing valuable information as they work toward carbon reductions.

**Carbon Reduction Targets:** Since the US and other nations signed<sup>8</sup> the Kyoto protocol in 1997, carbon reduction targets have been set in relation to 1990 emissions levels. Kyoto mandated 7% reductions below 1990 levels by 2012. Many campuses, cities, and communities exceeded the Kyoto goal, pledging to reduce their emissions >7% *before* the year 2012 (Lewis and Clark), or at a higher rate than dictated (Middlebury, Tufts). Recently, many institutions have adopted the ACUPCC (American College and University President’s Climate Commitment), in which campuses pledge to reduce their footprints as much as possible, and then offset the remainder of their emissions by purchasing carbon offsets – effectively becoming “carbon neutral.”

**Concrete “Asks:”** Whether you’re a student or an administrator, coming up with tangible suggestions for policy change is key when presenting your data. Asks can be anything from a carbon reduction commitment to new personnel recommendations – like hiring a sustainability coordinator. More examples of policy asks include establishment of a revolving green loan fund, grant money for student-run pilot projects, hiring facilities staff to oversee GHG progress and the carbon reduction project portfolio, setting a carbon neutrality goal, or investing in better energy monitoring software so that more accurate project data can be harvested.

### **Reexamining Risk and Discount Rates:**

Assessing financial risk when talking about the fate of our climate can be ironic at times and much ink has been spilled on the subject. There are a great number of risk factors at play here though: the risk of climate change, the risk of fossil fuel dependence, the risk of investing in developing technologies, and the risk of acting upon potentially incomplete information compiled by individuals with an obvious agenda (like student activists).

Sometimes risk is internalized within discount rates – for better, or for worse. Some colleges insist on using a discount rate of up to 15% to judge the viability of student-proposed projects. Others reduce the discount rate dramatically (or all together) to account for external benefits, like fuel diversification (a hedge), or a forthcoming national cap on carbon dioxide. An excellent discussion on adjusting discount rates for clean technologies can be found in section 6.5 of Eban Goodstein’s definitive text: *Environmental Economics*.

Regardless of whether or not you’re advocating for a change in discount rate, inserting financial risk into the equation is always a good idea when talking about reducing dependence on fossil fuels. Much of our oil comes from volatile nations overseas, and demand from other nations is steadily increasing. Coal is coming under more and more scrutiny in the academic and social justice communities, and forthcoming national climate legislation will make it difficult to sell coal at consistently low prices. Natural gas is a lower carbon fuel than others, but as domestic natural gas supplies dwindle, prices are beginning to fluctuate more than they have in the past. Carbon reduction investments have the added benefit of reducing your campus’ reliance on potentially risky fossil fuel commitments. Financiers will generally take note of hedges like this, but it’s not a bad thing to point out.

### **Alternative Finance Schemes:**

As comprehensive as this tool may be, its financial tools help you decide *what* to finance, not *how* to finance. The Campus Carbon Calculator generally assumes that all expenditures come out of an endowment with a high, predictable interest rate. Project financing may include taking out loans to cover some or all of these expenditures, but the assumption is that any money invested in a project would

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<sup>8</sup> The US signed the protocol but failed to ratify it, so we as a nation are not actually bound by the treaty. However, our historic lack of national participation in national and international climate legislation has helped propel over a decade of local, state and regional

otherwise have been earning interest in the endowment. Some schools are working to make green investments more accessible to students by establishing alternative financing methods.

One great example of a scheme that works well is Harvard's "revolving" Green Campus Loan Fund. As reported on 11/07 Harvard has been able to reduce over 33,200 metric tons of eCO<sub>2</sub> by financing projects whose annual ROIs (Returns On Investment) average 27% ([link](#)). These projects are all proposed by students, who have access to a revolving fund set aside for swift investment in such projects. Cash flow is monitored such that money recycles back into the "revolving" fund, so next year the students will have even more money to invest in high performance on-campus efficiency projects. For more examples of schools that have successfully adopted revolving loan funds, check out AASHE's how-to guide for students ([link](#)).

## **Using Your Data Effectively:**

### **Recognizing the Calculator's Limitations**

When unknowns become quantifiable they cease to be unknowns, but some uncertainty will always be a factor when making abstract decisions. It's important to realize that this tool will help with prioritization of carbon reduction projects, but it is by no means the final word on whether or not these projects can or should be enacted. This will not be the first time your school has made decisions that are not solely based on quantitative economics.

A phrase that has popped into the business world's vocabulary lately is the "Triple Bottom Line:" People, Planet, and Profit. Proponents of this concept argue that the fiscal bottom line does not properly evaluate the potential benefits of investing in social or natural capital. Though it is difficult to sum up this triune equation, the Calculator will let you do a fairly comprehensive job with the planet, and profit angles, but any assessment of social capital opportunities must be assessed by you. Many economists deal with social capital, and would be great allies in building a case for the social benefits of carbon reduction – this would mostly be qualitative data to supplement what you already know about emissions and cost.

It's up to you to present the quantitative data that you *do* have in a cogent manner such that uncertainty is minimized but not necessarily erased. Your project data will support key decisions, like the decision to spend more staff-hours looking into a project. The financial decisions involved take time – especially for large capital projects – so don't be disheartened if your work does not seem to result in immediate fiscal action.

Obviously, the metrics in this tool cannot sum up the true benefits of carbon reduction projects. Unfortunately, most financiers aren't used to weighing qualitative factors in their decision-making process. It's up to you to demonstrate the more abstract benefits of climate friendly investments in an academic institution. Trustees and administrators want to see that students understand sacrifice if that's what it will take. Take a serious look at your proposal and recognize the true cost of what you're undertaking – then go for it if that's your final decision.

### **Getting Qualitative**

Qualitative suggestions that supplement your quantifiable ones can be acted on quickly, and add weight to your package of carbon reduction projects. In the end, decision makers don't just look for logic; they look for qualities like resolve, confidence, and competence. Many of the most effective carbon reduction measures you start with won't look or feel very different from business and usual, so painting a complete picture of all the subtleties and opportunities associated with these intrinsic and not-so-visual measures is key. Here are some angles you might include:

Potential to . . .

- Involve students and faculty

- Connect with the local community
- Assume a leadership role amongst peer institutions and in the state/region
- Improve the college's reputation amongst potential students
- Make the college more appealing to potential employees
- Increase satisfaction amongst students – giving the impression that the administration is on the same page with them.
- Strengthen post-college bonds and alumni identity
- Increase current alumni engagement
- Increase on-campus student extracurricular involvement
- Strengthen ties with overseas institutions who may judge us for our climate change policies
- Better equip students to compete in a world increasingly concerned with sustainability and carbon accounting
- Increase pre-entrepreneurial research
- Lead the community fighting to preserve the cultural heritage of the school or region's past climate (i.e. broomball, skiing, maple syrup)

### **Conclusion: The Power of Narrative**

One of the most powerful ways people relate to climate change is through the larger narrative of people connected by one common campus-wide/community-wide/international goal. By participating in carbon reduction on your campus, you are joining that that story. Communications, admissions, even athletics can be a part of the story you will tell. Be it “students and administrators working together,” “dining services partnering with local dairy,” or “football team switches to biodiesel” the sound bytes associated with your journey will only add to the sense of intentional community we're all trying to foster at institutions of higher education.

It's important to recognize that what's happening on America's campuses is more than just reducing emissions; it's building a base of knowledge and hope strong enough to tackle the defining challenge of our generation. This process is not just about carbon, it's about relationships - it's about building a microcosm of what needs to happen on a much greater scale. With your help, we can mobilize the next generation to action. Let's get to work!

## *Using Macros to Transfer Your Data*

A new feature of v6.4 is a series of macros, or automated actions within Excel, that will transfer your Calculator data from any previous v6 file to this new version. Unfortunately, if your data is in v5 or any previous version, you will still need to manually transfer all data. Before beginning to transfer your data, you must have both versions of the Calculator open and your old file must be renamed "Calculator\_v6.xls"

You may run each macro by clicking on the buttons located at the bottom of the Introduction tab. The macros are separated by module so that you may use only what you need and so that any problems are easier to track down, however for those modules that have two links both are necessary. Before clicking on the links, make sure that:

- 1) Macros are enabled within your security settings
- 2) All of the boxes on the left side of the Input worksheet are selected
- 3) The worksheets you are updating are unprotected in both files
- 4) When you run the first macro for the Solutions Module, a dialogue box will open asking if you want to use the named array for Project Years in the old or new (destination) file. Click "Yes."

There are a few things that still must be updated manually:

- 1) Your background data at the top of this sheet
- 2) Your electric grid region on the map worksheet
- 3) Any extra rows on the P\_Sum and P\_Exec\_Sum sheets within the Solutions Module must be hidden
- 4) You must re-select your customization options in the Projections Module, as well as input any custom growth trends. While previous versions of the Calculator included a macro to transfer these selections, we have fixed a portion of the module for v6.5 and copying the selection cells would also transfer the previous error.

Additionally, some users may have made additional customizations of the emissions factors or calculations within the file. The following are a few examples of customized additions that must be transferred manually:

- 1) Anything changed within a white calculations cell, such as budget information entered directly on the Input worksheet rather than on the Input\_InfAdj worksheet
- 2) Anything added to the grey columns on the ACUPCC\_Reporting worksheet
- 3) Any customized graphs
- 4) Any additional notes or references made to track changes or sources of information
- 5) Any custom emissions factors added, such as local information on biofuels

## Supplementary Materials

### *Appendix 1: Data Collection Outline*

This outline summarizes the data you will need to collect to complete an emissions inventory and offers suggestions of people to contact to find this information. This information may also be useful when collecting data for project ideas, so be sure to stay in touch with these key individuals.

#### **I. Institutional Data**

It may seem odd to start a greenhouse gas emissions inventory by collecting data on your institution's budget, population, and physical size, but this data is important to normalize your emissions for comparison with other institutions and for projecting future emissions trends. This data should also be fairly easy to find. That said, the number of full-time equivalent students, staff and faculty, and the number of gross square feet, are the most important pieces of information in this section—the rest is nice to know, but not worth expending a lot of time or effort on if not readily available.

##### a. Budget:

**Contact:** Controller's Office

**Data:** Annual operating, research, and/or energy budget

**Definitions or parameters:** The Operating Budget consists of all sources of funding the University has financial control of and is plainly considered as *the cost to operate* the institution. Research Dollars includes all sources of financial funding the institution *receives* for its cumulative research endeavors. The Energy Budget is total *spent* providing the energy needs for all operations.

**Units:** Nominal dollars (i.e. 2005 dollars for 2005 budget, 2006 dollars for 2006 budget)

**Entry Sheet:** Input\_InflAdj

**Entry Info:** Budget data is generally maintained in nominal dollar values for each year (2005 dollars in 2005, 2006 dollars in 2006, and so on). Enter these values on the Input\_InflAdj worksheet. To allow meaningful comparisons across a historical timeframe, this sheet automatically adjusts budget data to 2005 dollars using the U.S. Bureau of Economic Analysis' chained GDP deflator values. Projected deflator values are taken from the U.S. Department of Energy's Annual Energy Outlook. These values will need to be updated as more accurate numbers become available, or if a new base year is selected. To ensure accurate adjustments in the future, it is very important that you enter budget info in nominal dollars from the appropriate year (enter the 2006 budget in 2006 dollars), and keep a record of these values. This should be easy because budget values will probably be reported in nominal dollars, so you need only enter these on the Input\_InflAdj sheet and then ensure they are not changed.

##### b. Population

**Contact:** Institutional Research and Assessment (best); or, try Registrar / Human Resources

**Data:** Annual number of faculty, staff, and full-time, part-time, and summer school students

**Definitions or parameters:** In the case of faculty and staff, you are looking for full-time equivalents. Different institutions have different formulas for coming up with these numbers; in fact, the same institution might have different formulas used for different purposes by different offices! The most important thing is that you are using a number derived from the same source/methodology from year to year. The Calculator generally counts part-time students as half-time; if your IR or Registrar's office has a different average equivalency for part-time students, you will need to either adjust your input numbers, or change the projection and commuting formulas in the Calculator. The number of summer school students is included for reference, but not used in any calculations (so don't spend too much time on this number!)

**Units:** Number

**Sheet:** Input

c. Physical Size

**Contact:** Institutional Research and Assessment / Energy Manager / Director of Facilities

**Data:** Annual total building space and research building space

**Definitions or Parameters:** Typically campus planners/development officers will keep records of square foot space which may include many details you would not normally consider in assessing building space, such as wall, stair and window space. We recommend using gross square foot data here. Remember, your organizational boundaries should guide your data collection; make sure they remain consistent (i.e., if your institution is renting out building space, include this gross square footage here only if information about the utilities for the space in question is also being included.) FYI, building space, like everything else, is meant to be tracked on the basis of fiscal years.

**Units:** Square feet

**Sheet:** Input

## II. Scope 1 (Direct) Emissions Sources

a. On Campus Stationary Sources: all fuel used on campus, excluding vehicle fuel use

**Contact:** Energy Manager / Director of Facilities / Fuels Purchaser

**Data:** Annual on-campus stationary fuel use (residual oil, coal, natural gas, wood chips, etc.). Annual output and generation efficiency for electricity and steam from any cogeneration (combined heat and power) plants

**Definitions and Parameters:** On-campus stationary sources generally account for the majority of Scope 1 emissions. The category includes all emissions from stationary fuel combustion – mostly oil, coal, or natural gas for heating campus buildings. If you have a cogeneration (combined heat and power) plant, its emissions fall in this category. NOTE: Following IPCC protocol, CO<sub>2</sub> emissions from biogenic sources are not reported as part of your Scope 1 emissions; they are calculated and reported separately. However, since the same “activity data” that results in biogenic carbon emissions also results in anthropogenic emissions of other greenhouse gases, the activity data for these sources (e.g. biomass burned in a physical plant or boiler) **are** included as part of your Scope 1 data inputs. For more information, see the “Biogenic Carbon” section.

**Collection:** Contact the Facilities Director or Energy Manager to find out the types and amounts of fuels used on-campus, excluding vehicle fuel use. If no such person exists, contact the Facilities Office and ask who is in charge of purchasing fuels. This person will probably also be in charge of purchasing electricity. If they have not already compiled the information, someone may need to dig through monthly bills or other statements. First ask if they can compile it, but offer to do it yourself if they feel they don't have the time. If you want it done quicker than they can promise it, you may have to do it yourself.

**Units:** Gallons, short tons, MMBtu, kWh, or % generation efficiency

**Entry Sheet:** Input

**Entry Info:** On the Input sheet, enter the amount of each type of on-campus stationary fuel used in the labeled units. **Note that there are separate columns for fuels used in cogeneration plants** – if your fuel is burned in a cogeneration plant, it will be input somewhere in columns N-AC. All fuels burned in stationary campus applications that are not cogeneration plants should be totaled and entered in columns AD-AO. If you have one or more cogeneration plants you will need to find out their total electricity and steam production, as well as the production efficiency of each.<sup>9</sup> This allows emissions to be assigned correctly to either steam

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<sup>9</sup> If you have multiple cogeneration plants, you'll need to figure out the combined average steam and electricity production efficiency for all the plants

production or electricity production. If you do not enter these efficiencies, your emissions from cogeneration will not be calculated properly.

b. Direct Transportation Sources: all fuel used in university-owned vehicles

**Contact:** Director of Transportation

**Data:** Annual fleet vehicle fuel use (gasoline, diesel, biodiesel, etc.)

**Definitions and Parameters:** This category includes the emissions from any vehicles that are owned by your institution. Most universities keep a fleet of vehicles that are used for everything from moving equipment around campus, collecting solid waste or materials to be recycled, delivering campus mail, or managing the grounds and roads. The university will often have its own fueling station that may be filled by the state (at state universities) or by private arrangement.

**Collection:** Contact the Director of Transportation to find out who is in charge of managing fleet fuel use.

**Units:** Gallons, MMBtu, or kWh

**Entry Sheet:** Input

**Entry Info:** On the Input sheet, enter the amount of each university fleet fuel used in the labeled units. If you want, you can also enter the electricity used by any electric vehicles. Note that emissions from electricity production are already accounted for under Scope 2, purchased electricity (if you purchase electricity from off campus) or Scope 1, on-campus stationary sources (if you generate all your own electricity). Do NOT subtract the values you enter in this column from anywhere else – doing so will result in an under-estimate of your total emissions.

c. Refrigerants and Other Chemicals

**Contact:** Director of Facilities / Plant Maintenance / Air Conditioning Managers

**Data:** Annual Perfluorocarbon (PFC), Hydrofluorocarbon (HFC), and SF<sub>6</sub> emissions

**Definitions and Parameters:** When chlorofluorocarbons (CFCs) were found to be damaging to the ozone layer, alternatives such as hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs) were required. Unfortunately, these chemicals were later discovered to also be strong greenhouse gases. These emissions will be estimated in this section. IPCC and US EPA protocol does not include CFCs in greenhouse gas inventories because they are being phased out under the terms of the Montreal Protocol and US Clean Air Act.<sup>10</sup> You do not need to compile CFC release information, but the Campus Carbon Calculator has the capacity to include any other greenhouse gas, so you may want to include any CFC emissions as a sidebar in your report.

**Collection:** Information regarding the release of HFCs and PFCs should already be reasonably accessible, as universities are required to record all fluorocarbon releases for the EPA. You may need to be assertive, but this information should be available for use. The Energy Manager should know whom to contact for this information –it may be whomever is in charge of environmental compliance at your institution. This number may be estimated by subtracting the amount of recovered refrigerant from the purchased refrigerant.

**Units:** Pounds

**Entry Sheet:** Input

**Entry Info:** On the Input sheet, enter the pounds of each chemical emitted. If a gas you need is not listed, select “Other” from the drop-down list, then go to the EF\_GWP sheet. Scroll to the bottom, and replace the “Other” at the bottom of the list with your chemical. Enter the

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<sup>10</sup> United Nations Environment Program, Handbook for the International Treaties for the Protection of the Ozone Layer, 5th Version 2000, <http://194.51.235.137/ozat/protocol/main.html>  
US EPA, Clean Air Act, <http://www.epa.gov/oar/caa/contents.html>



chemical's 100-year global warming potential in the cell to the right, and the source for this number in the cell to the right again.

d. Agriculture Sources

**Contact:** Barn Managers / Grounds Managers / Agriculture-related departments

**Data:** Annual fertilizer use, type, and nitrogen content. Annual number of animals

**Definitions and Parameters:** This section includes methane and nitrous oxide emissions from agriculture. Many animals, especially dairy cows, release methane generated by microbes in their guts. Methane is also released from decomposing manure. While this source will likely be only about 1% of total emissions, it is worth noting if your university has animals.

This section also includes fertilizer application on fields and grounds. After the application of any nitrogen-containing fertilizer, some percentage is released as nitrous oxide (N<sub>2</sub>O).

**Collection:** To find this information, contact the people that manage the animal barns and agriculture. Look through a campus directory for "dairy barns," "agriculture," or any related department. You will need to collect headcounts of dairy cows, beef cows, pigs, goats, sheep, horses, and poultry that the university has maintained over the years. Herd size usually varies throughout the year and so you will need to develop an average annual herd size. You may need to take the first headcount of the year and average it with the last headcount of the year. Any small variations due to a changing herd size will probably be insignificant.

To estimate emissions from fertilizer use, you will need to know the total pounds of fertilizer (both synthetic and organic) applied and their percent nitrogen content. Synthetic fertilizers are labeled with their chemical makeup using three numbers to represent the percentages of nitrogen (N), phosphorus (P), and potassium (K). So 15-10-10 fertilizer is 15% nitrogen. Nitrogen contents for organic fertilizer are about 1% for manure and 4.1% for other organics.

**Units:** Pounds, % Nitrogen, or number

**Entry Sheet:** Input

**Entry Info:** On the Input sheet, enter the pounds of fertilizer used and number of animals. Be sure to include the % nitrogen content of fertilizers.

### III. Scope 2 Emissions Sources

a. Purchased Electricity

**Contact:** Energy Manager / Director of Facilities

**Data:** Annual purchased electricity. Annual electricity production fuel mix (if known)

**Definitions and Parameters:** Unless you have an electricity fuel production mix that is high in renewables or produce much of your electricity on campus, Scope 2 emissions from purchased electricity are likely to be a significant emissions source. Electricity is used in many ways on the campus: lighting, computers, refrigeration, air conditioning, cooking, and sometimes even cooking.

**Collection:** This data will hopefully already be compiled, but may require digging through monthly records in the Energy Office. You will need to know how much electricity was purchased each year. This information will probably be gathered in kilowatt-hours (kWh) - one kWh is the amount of energy that will power ten 100-watt light bulbs for an hour.

**Units:** kWh

**Entry Sheet:** Input, CustFuelMix

**Entry Info:** On the Input sheet, enter the annual electricity purchased in kWh. Then click the link in the Purchased Electricity column to go to the EF\_ElectricMap sheet and select your state and pre- and post-2006 eGRID region. This allows the Campus Carbon Calculator to select the proper emissions factors and fuel mix for your electricity region from the EPA's eGRID database. If you know the exact fuel mix that your electricity provider uses, check the "Use

Custom Fuel Mix” box at the bottom of this sheet. Then click on the link to the right to go to the CustFuelMix sheet and enter the fuel mix of your electricity provider.

NOTE: If you check the “Use Custom Fuel Mix” box but do not fill in the CustFuelMix sheet, your electricity emissions will not be calculated. You should also still set your state and eGRID regions even if you use a custom fuel mix.

b. Purchased Steam / Chilled Water

**Contact:** Energy Manager / Director of Facilities / Steam or Chilled Water Provider

**Data:** Annual purchased steam and chilled water, production fuel mix, and transport losses

**Definitions and Parameters:** This section will estimate emissions from off-campus steam / chilled water production. If your campus produces its own steam and/or chilled water, the associated emissions will be captured in the “On-Campus Stationary Sources” section (since it will be produced with the other fuels) and should not be included here. Imported steam is a common energy source for urban campuses in cities with centralized steam production.

**Collection:** This data will hopefully already be compiled, but may require digging through monthly records in the Energy Office. Steam and chilled water use data will be collected in “MMBtus” (million British Thermal Units). Chilled water data may also be recorded in “tons,” which actually refers to the equivalent of the amount of cooling from one ton of ice melting in an hour (This factor is equivalent to 12,000 Btu/hour. Multiply "Tons" by 0.012 to get MMBtu). You will also need to know how the steam/chilled water was produced and the approximate loss of energy in the pipes between the generation facility and the campus. You may need to contact the steam provider to find the types of fuel used to produce the steam each year. The provider's website is a good place to start and you may find it there. This information will be in terms of percent fuel type. (For example, your steam production for the year 2000 could be 11.8% natural gas, 0.6% distillate oil, 25.7% coal and so on). The default fuel mix in the Calculator is 50% natural gas and 50% distillate oil, with 5% transportation loss between the generation facility and campus. This information is needed because the emissions associated with the production of the university's steam will be included in the inventory under Scope 3, transmission losses for steam / chilled water.

**Units:** MMBtu, % generation fuel use, and % transportation loss

**Entry Sheet:** Input, EF\_Steam, EF\_Water

**Entry Info:** On the Input sheet, enter the MMBtu purchased of steam and chilled water. Then click the links in the Steam and Chilled Water columns to set the production fuel mix and transmission loss.

#### IV. Scope 3 Emissions Sources

a. Commuting: daily commuting by faculty, staff, and students

**Contact:** Director of Transportation / Human Resources / Registrar

**Data:** Annual number of commuters, mode of transportation, number and distance of trips

**Definitions and Parameters:** This category may be one of the most difficult to estimate. The goal is to estimate the number of annual miles traveled by faculty, staff, and student commuters. This estimation should be limited to home to school to home trips. This is included in university emissions because the university could influence this travel by offering alternatives (bus, shuttle, etc.). To estimate this you will need to know how large these communities are, what their "average" commuter habits are (frequency of trips from home to school and back), the distance from home to school, and the number of commuting days.

**Collection:** The community size can probably be gathered from the Human Resources (Personnel) Office for employees and the Registrar for students. In addition, these offices may have a list of where these people live, which will assist in determining from where they are commuting. The Transportation Office may have completed a survey to estimate commuter

habits in order to better meet commuter's needs with buses or shuttles, and a good deal of information may be able to be deduced from the vehicle parking permit database. If not, you may need to come up with your own estimates to approximate commuter habits. Faculty and staff are calculated separately because most staff will work 40 hours a week on campus while faculty may have more variable hours and habits. You may want to estimate the average fuel economy for faculty, staff, and students if there is a noticeable variation in vehicle preference in your region from the national norm (the default national averages for each year are already entered in the spreadsheets).

**Units:** % commuting, trips per day, days commuting per year, miles per trip

**Entry Sheet:** Input\_Commuter

**Entry Info:** On the Input\_Commuter sheet, enter the information on commuting. Note that the columns labeled “% [mode of transit]” refer to the % of the total number of faculty/staff/students that use that mode of transit – so in the “Faculty” section, “% Light Rail” means the % of the number listed in the “Faculty” column that commute via light rail. For students, the Calculator automatically enters the number of full-time students plus half the number of part-time students in the “Students” column – you may adjust this value if you have more accurate data on student commuting habits.

b. Directly Financed Outsourced Travel: travel paid for by the university

**Contact:** Director of Transportation / University Travel Office / Travel Agent

**Data:** Annual faculty, staff and student miles traveled and mode of transportation

**Definitions and Parameters:** This category includes any travel that is paid for by the institution but uses vehicles that are not owned by the institution. The President’s Climate Commitment requires signatories to report emissions from directly financed faculty and student air travel, to the extent that data are available. You may also choose to report directly financed travel via train, taxi, bus, ferry, rental car, or travel in personal vehicles that is reimbursed by the university.

**Collection:** This data should be collected in terms of “miles traveled” for students and faculty/staff and may be available through the university Travel Office, the Student Activities Office, or individual departments.

**Units:** Miles

**Entry Sheet:** Input

**Entry Info:** On the Input sheet, enter the miles traveled for each category.

c. Study Abroad Air Travel

**Contact:** Study Abroad Office

**Data:** Annual air miles traveled by students studying abroad

**Definitions and Parameters:** Although student air travel for study abroad programs is rarely directly financed, many universities encourage or even require their students to study abroad and so feel a responsibility to estimate and report the emissions associated with this travel.

**Collection:** This number will almost certainly have to be estimated. The Study Abroad or Registrar’s Office may be of assistance in this process.

**Units:** Miles

**Entry Sheet:** Input

**Entry Info:** On the Input sheet, enter the air miles traveled by students studying abroad.

d. Solid Waste

**Contact:** Waste Management Supervisor, Grounds and Roads department, or Director of Facilities. You may need to contact the landfill with questions regarding the type of landfill.

The EPA also has information on some landfills, check out: U.S. E.P.A's Landfill Methane Outreach Program (<http://www.epa.gov/lmop/profiles.htm>) for more info.

**Data:** Annual waste production and disposal method (incinerated, landfilled without methane control technology, landfilled with methane flaring, or landfilled with methane recovery)

**Definitions and Parameters:** Institutions have several methods for managing solid waste. The two most common are incineration and landfilling. Waste that is incinerated releases greenhouse gases when combusted and waste sent to landfills releases methane as it decomposes.

**Collection:** First, contact the person in charge of waste management to inquire about historical data for the amount of solid waste generated that is sent to a landfill or incineration. The institution will likely pay a tipping fee each month and will hopefully have records of the amount of waste disposed.

Second, find out where the waste goes: (1) a mass burn incinerator, (2) a refuse-derived fuel incinerator, (3) a landfill with no methane collection, (4) a landfill that collects methane emissions for flaring, or (5) a landfill that collects methane emissions for electricity generation. You may need to contact the landfill to find this information.

**Units:** Short tons

**Entry Sheet:** Input

**Entry Info:** On the Input sheet, enter the short tons of solid waste in each category. The Campus Carbon Calculator uses emission factors for an "average" composition of solid waste. If you have access to specific information regarding the composition of your waste, you can use the EPA's Waste Reduction Model (WARM) to develop a specific emission factor for your institution.<sup>11</sup> Follow this ([link](#))<sup>12</sup> and enter your waste mix as percents. Then enter your emission factors on the EF\_SolidWaste sheet in the Calculator.

e. Offsets

**Contact:** Campus Sustainability Coordinator / Energy Manager / Director of Facilities

**Data:** Annual offsets purchased or created (composting, forest preservation, renewable energy credits, retail offsets, etc.)

**Definitions and Parameters:**

It is increasingly common for universities to offset some portion of their greenhouse gas emissions in various ways. An offset is achieved when the campus invests in a reduction in GHGs outside of its institutional boundaries, such that it exerts some financial control on that entity, and is therefore responsible for that entity's reduction in GHGs. Examples of offsets include on-campus carbon sinks, like compost, off-campus institution-funded carbon reduction projects, and the purchase of Renewable Energy Certificates (RECs), also known as "green electricity" or "green tags." It is assumed that purchasing a given MWh of RECs can be equated to the same MWh of electricity produced using one or several renewable technologies, such as wind, solar or small-scale hydroelectric. The actual electricity associated with the credits is not necessarily being produced near the university or even on the same electric grid. Because they do not directly *reduce* the institution's carbon footprint, RECs are not simply subtracted from total electricity emissions, but instead are entered in a separate section for "offsets," apart from the three Scopes. Another type of offset is the purchase or protection of forest lands that function as a carbon sink. These lands could be near campus or in another country. An on-campus offset practice that many universities are engaged in, though often for reasons other than carbon sequestration, is composting. Composting, when managed properly, does not generate CH<sub>4</sub> emissions, but does result in some carbon storage (associated with

<sup>11</sup> Solid Waste Management And Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks, 2nd Edition, EPA530-R-02-006, May 2002. <http://www.epa.gov/epaoswer/non-hw/muncpl/ghg/greengas.pdf>

<sup>12</sup> <http://yosemite.epa.gov/oar/globalwarming.nsf/content/ActionsWasteWARMOnline.html>

application of compost to soils).<sup>13</sup> Retail offsets are available for purchase by institutions like yours, but there can be vast differences in offset quality in the booming offset market, so it's important that your campus community understands the difference between various calibers of offsets. For a more thorough discussion of offsets, see the project module section of this document.

**Collection:** For information on RECs or retail offsets, contact your Campus Sustainability Coordinator, Environmental Affairs, or Energy Manager. For forest preservation, contact the Land Manager or Project Coordinator. For composting, contact the Waste Manager.

**Units:** Short tons, MT eCO<sub>2</sub>, kWh

**Entry Sheet:** Input

**Entry Info:** On the Input sheet, enter the number or amount for each type of offset.

### **Adding Custom Emissions Sources**

The Campus Carbon Calculator allows you to add custom fuels or other emissions sources that have not been built-in. To add a custom on-campus stationary fuel (either for use in a cogeneration plant or not), a custom direct transportation fuel, or a different animal, go to the Input sheet, find the relevant section, and click the "Other" label at the end of the section. This will take you to an EF sheet with a column labeled "Other..." (i.e. "Other Fleet Fuel"). Change this label to the name of your custom emissions source and enter the emissions factors in the blue columns using the indicated units. You must fill in all the cells in any blue emissions factors column. Be sure to use the units indicated, and note the source for these emissions factors at the bottom of the column.

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<sup>13</sup> Solid Waste Management And Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks, 2nd EDITION, EPA530-R-02-006, May 2002 2002 <http://www.epa.gov/epaoswer/non-hw/muncpl/ghg/greengas.pdf>

## *Appendix 2: Campus Carbon Calculator FAQs*

1) When I open the Calculator, I am always prompted with an Excel pop-up window that asks if I want to enable macros, and that macros can harm my computer. Why is this and what should I do?

The pop-up is there because some computer viruses are written in macros; Excel's security features are only looking after the best interests of the user with this prompt. In this case, you should click to enable the macros. If you disable them, some features of the Calculator will not work and could cause some problems. The macros in the Calculator do not contain viruses and will not cause harm to your system. If you have been working with macros disabled, and some features do not appear to be working, save your work, close the Calculator and re-open it with macros enabled. This should help the user-friendly features of this tool to function properly.

If you would like to see a list of the macros to know if they could be the source of your problems, select Tools>Macro>Macros from the menu bar or press Alt+F8.

2) Is there a user's guide to the Calculator?

Yes! When you downloaded the Calculator from the CA-CP website, there was a separate link to download the user guide. If you did not access it when you downloaded the Calculator, you can find it by clicking on the "1.2 -Calculator" menu now.

3) My school does not have historical records which go back to 1990. What should I do?

Unfortunately some schools may not have found it in their interest to maintain historical records of previous energy use data. If gaps exist in your data, you should include what you can and reference the first complete energy year for your institution's baseline. You may want to contact your professor/faculty advisor to determine how best to estimate previous emissions for which no records exist. In any event, be sure to document data gaps in your inventory write-up to highlight the need for more successful record keeping in years to come.

4) My school does not have data recorded for some of the data input fields in the Calculator. Will this effect the emissions calculations?

Yes and no. The tool calculates emissions based on the data you enter into it, so you will only be calculating emissions based on the data you are able to enter. In particular, some smaller colleges and universities may not have many of the energy features the Calculator is capable of working with. In the end, the more you are able to enter for your institution, the more complete your inventory will be.

5) What is meant by "Research Dollars" in the budget section?

"Research Dollars" is simply the amount of money your institution receives in research grants from external sources. It is a convenient measure to use in showing your school's emissions, especially when institutions have operating budgets highly dependent on research grants.

6) In the "Physical Size" section of the input worksheet, what is meant by, "Total Building Space" and "Total Research Space"?

Typically campus planners/development officers will keep records of square foot space which may include many details you would not normally consider in assessing building space, such as wall, stair and window space. We recommend using gross square foot data here. Your institution may also own facilities off campus which it maintains. In general, you should include data for as many institutional facilities as possible. However, if your institution is renting out building space, include this gross square footage only if your institution is paying the utility bills. FYI, building space is meant to be tracked on the basis of fiscal years.

7) Is electricity use tracked on a calendar year basis, or fiscal year basis?

Your campus energy office may keep this data on a month to month basis, or over the period of a fiscal year. Use the fiscal year period for this data.

8) My institution does not keep track of air travel. How important is it that I include this data?

GHG emissions from air travel are a very significant source for all institutions, although it may not be an area of emissions easily influenced by greenhouse gas reduction efforts. While this part of the inventory is probably going to be most useful when your institution adopts a policy of keeping air travel records, you are most likely to get a good estimate of air travel by conducting a survey from a representative body of population from your institution or contacting your schools primary travel agents. You can also track down a lot of information by asking to see receipts from the respective accountants.

9) In the 'Offsets' section of the inputs, how do I calculate the carbon sequestered by forest preservation?

The IPCC has a list of coefficients for calculating carbon sequestration here: [\(link\)](#)<sup>14</sup>. From there, you can calculate the amount of C sequestered by various ecosystem types in the different climatic regions in North America. Because it is a fairly common practice to purchase lands in tropical climates (outside of the U.S.) where C sequestration is high, it is important to know what type of land is acquired. You can continue to use the same source of land year after year, as the forest preservation figures represent annual C storage. Caution: the units used by the IPCC here are short tons, so be sure to convert to tonnes, (a.k.a. metric tons).

10) A refrigerant my school uses are listed in the Calculator. Where can I find the appropriate GWP value?

Some of the most common values can be found on the IPCC website at <http://www.grida.no/climate/ipcc/emission/123.htm> and if you do not see your specific refrigerant in that list, then a good Google should do the trick.

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<sup>14</sup> [http://www.grida.no/climate/ipcc/land\\_use/007.htm](http://www.grida.no/climate/ipcc/land_use/007.htm)

11) I can't find the unit conversions I need in the "EF\_Constants" worksheet of the Calculator. Where can I find an accurate conversion factor for entering data in the units the Calculator is set up to handle?

Most chemistry and physics textbooks have tables of common conversion factors. A very easy to use online resource for converting units can be found at <http://www.onlineconversion.com>. If you can't find the units you are looking for there, it's probably best you first try to understand what the units mean before tracking down someone to ask them for help.

12) How do I change the graphing features to show the new data that has been entered?

Actually, the graphing features should automatically show the new data. What happens is, as you change the input data, the result data automatically renews itself, and so do the graphs. If this is not the case, then check to see if you changed the source data used by the pre-configured excel charts. If you changed the source data for the charts, or edited their format in certain ways, you will need to reformat the source data by right clicking over the graph and re-referencing the data from which each graph originates.

### **Troubleshooting**

You get the message: *"The cell or chart you are trying to change is protected and therefore read only"*

In order to reduce accidental changes to the spreadsheets, they have all been 'protected' against change (except the input cells). If you are sure that you want to change a protected cell (or alter a graph), put the arrow over 'Protection' in the tools menu and choose 'Unprotect Sheet.' Be sure to turn protection back on after you make the change to eliminate any accidental changes.

You see "###" where you think there should be numbers

There is a number that is too big to fit within the column – make the column bigger by dragging one of its borders wider (at the top by the row of letters). You may need to disable protection (see above).

You see labels on a graph that are jumbled on top of one another and unreadable

Double click slowly on the label that needs to be moved. When a box has appeared around it, drag it to the desired position. You may need to turn off protection (see above) to alter the graph.

You see labels on graphs that say *"HIDE THIS ROW"*

Scroll down until you can see a text box below the graph. Follow the instructions in the box.

You see labels on graphs that do not apply to your institution

You can simply click slowly on the label that does not apply (i.e. if your school has no animals) and press delete when the label is highlighted. This deletion is permanent, so be sure the label is not needed.

When saving the calculator, you get an error that reads "A formula in this worksheet contains one or more invalid references."

If you have not yet completed the Inventory Module, the message is probably just referring to the errors in the Projection Module due to trying to project data that doesn't exist. Click "okay" and it should continue to save.

When saving the calculator, the Compatibility Checker lists that some cells have a "Minor loss of fidelity."

This is telling you that if you reopen the tool in an earlier version of Excel, some of the formatting may look different. However, the calculator should function the same. If you have a more strongly worded error it is worth looking into.