# NJHEPS WebQuest #5:
# Impacts of Climate Change on Campus

This draft of the fifth NJHEPS WebQuest, on the impacts of Climate Change on an educational campus, was developed by the following team:

MBA Class at Rowan University, Spring 2008, Prof. Tom Bryant

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**Task forces** (= SubCommittees)

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| 2. Energy | Rich Caban | David McGarvey |
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The student participants were members of a combined MBA class, encompassing students in a Special Topics in Business (600: selected by Prof. Bryant as "Sustainability"), and Corporate Ventures (506: one of three courses in the MBA specialization in Entrepreneurship). The course focused on the management of innovation in larger organizations, with a special focus on sustainability.

Our exercise involved developing the outline for this WebQuest and testing it on the campus of Rowan University. We were fortunate to have extensive expertise within the class, and ready access to university personnel and data.

# Module 1: Voice of the Executive

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With the assistance of MBA candidates, Kathleen Takemoto and Peng Xu

And the other members of ENT506/BUS600: Innovation Management / Sustainability

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## Preamble

This module is one of seven in this WebQuest. The Quest is an opportunity for students to explore issues related to the impacts of climate change on their own campuses, with the intention of sorting out action alternatives. This module, the Voice of the Executive, is unlike the other six. While each of the others takes a sectoral or disciplinary perspective, this one is designed as the integrator.

Here, we ask the questions of the chief campus executive. At a university, that person would be the President. At a college, it might be the senior Dean or Provost. At a high school, it will be the Principal. Regardless of the title, the person for whom this module is developed is the senior executive or decision-maker concerning matters affecting the campus to which the WebQuest is being applied.

What we have tried to accomplish here is what management scholars sometimes call the "voice of the client." The WebQuest will lead to a presentation of the team's recommendations – to the senior campus executive. This module provides guidance about the framework for that presentation by asking questions from that chief executive's perspective.

One of the most important things for Questers to understand is that the chief executive must make the trade-offs between the best ideas in each of the other six modules. How, for example, does the campus choose between a really good idea from the Waste management team, and a really good one from the Energy team? This module asks those questions.

It is expected that the participants on the Executive subcommittee will meet with the chief campus executive or his/her delegates early in the Quest. Among the important roles of this subcommittee is feedback from that meeting to the other subcommittees as they proceed with their work. As those other teams pursue their parts of the Quest – what are the special concerns of THIS client? For THIS campus? The other subcommittees

rely on the Executive team to make sure they address the more important issues, and produce their work in terms that help the campus executive make good decisions.

## Question 1: Where Are We Now?

What is the situation on this campus now?

What have we already accomplished?

What are we in the middle of doing?

What is planned?

How do we stand up with our peers?

### Websites of interest

To get good information about your own campus, start with the Home webpage, and see if you find anything Green there. Do local searches for Sustainability and Policy or Programs. Take a look at the President's or Principal's webpage, speeches, and Board of Trustees Minutes.

To assess broader issues, and develop some comparative standards, try:

http://www.sustainablecampus.org/

http://www.aashe.org/

http://mitpress.mit.edu/catalog/item/default.asp?ttype=2&tid=10094

and, of course, our own NJHEPS website: http://www.njheps.org/

and especially the NJHEPS Sustainable Campus Initiative:
http://www.njheps.org/projects/SCI.htm

Smaller campuses are like smaller businesses – where do we start?

At http://www.thestreet.com/story/10414913/1/reduce-your-companys-carbon-footprint.html, Kelsey Abbott identifies some starting points, and some more links to additional sources.

## Question 2: What Commitments Govern Our Choices?

What are the more important commitments we have already made?

Have we signed the President's Commitment?

What have our major funders established as the guidelines for us?

What laws and regulations are the most important constraints (or motives) for our choices?

### Websites of interest

This whole WebQuest begins with a question about the Presidents' Commitment, and it is worth reviewing in this specific context:

http://www.presidentsclimatecommitment.org/

One of the big issues in the recent past has been the Kyoto Protocol, to which most countries (notably excluding the USA during President G. Bush's tenure) are signatories. It mandates radical changes in carbon and other emissions. How would our campus adapt if similar standards were applied to us? Now? To our growth plans for the next 10-50 years?

http://www.washingtonpost.com/wp-dyn/articles/A27318-2005Feb15.html

http://unfccc.int/kyoto_protocol/items/2830.php

http://ec.europa.eu/environment/climat/kyoto.htm

http://en.wikipedia.org/wiki/Kyoto_Protocol

http://www.eia.doe.gov/oiaf/kyoto/kyotorpt.html

US rules are dominated by the Environmental Protection Act and its derived agency, the EPA.

http://www.epa.gov/

Many states are enacting new standards, sometimes with incentive programs.

There is a nationals database of such programs at:
http://www.dsireusa.org/index.cfm?EE=1&RE=1

For an example, see what's going on in New Jersey:

http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=NJ12F&state=nj&CurrentPageID=1&RE=1&EE=1

In the Buildings sector, be sure to look at the work of the US Green Building Council

http://www.usgbc.org/

And an example is: http://www.edcmag.com/CDA/Articles/Leed/BNP_GUID_9-5-2006_A_10000000000000135452

## Question 3: Values and Metrics

What aspects of Sustainability are most important at this Campus? Is that changing?

How do you measure our performance? How do we know how important different things are?

What are the examples (stories) you use most often to communicate our values?

### Websites of interest

Chief Executives have to manage scarce resources across the entire enterprise / campus, to get the best possible results in a very multivalent world.

One starting point is the money: How much does it cost? But, that's not really even half of the equation, is it? We need to know more about other costs, such as time of staff, renovations to cherished buildings and landscapes, etc. AND, we need to know about benefits – in terms of subsidies available, cost savings in the future, and many other benefits, including public relations, community goodwill, educational merits, and organizational reputation.

Let's begin with the money. What would it cost? What are the expected financial benefits?

http://www.env-econ.net/2005/07/costbenefit_ana.html

http://en.wikipedia.org/wiki/Cost-benefit_analysis

Next, let's expand the discussion by looking at a "Triple Bottom Line." Add the financial discussion to ones covering the geophysical environment – and the impacts on social justice.

CERES (Coalition for Environmentally Responsible Economies)

http://www.bsdglobal.com/tools/principles_ceres.asp

Andrew Savitz' blog: http://getsustainable.net/blogfiles/blog.html

Includes a Blogroll of "The Best Sustainability Sites" on the Web. └

http://en.wikipedia.org/wiki/Triple_bottom_line

http://www.bsdglobal.com/tools/principles_triple.asp

Finally, how do we make trade-offs?

http://www.smallfailures.com/

## Question 4: Long-Term Vision

In the long-term, say over the next generation or longer, how do you see this campus changing?

How does Sustainability fit into that picture?

### Websites of interest

Definitions of sustainable organizations:

http://www.bsdglobal.com/tools/principles_sbp.asp

The World Business Council for Sustainability shows how good environmental stewaqrdship is good for companies (and campuses) in the long run. Start here, and explore WBCS:

http://www.wbcsd.org/plugins/DocSearch/details.asp?type=DocDet&ObjectId=Mjk2MzQ

Some people see sustainability as a matter of intergenerational justice and stewardship. Take a look at the Aboriginal vision.

*Seventh Generation takes its name from the Great Law of the Haudenosaunee, which states that "in our every deliberation we must consider the impact of our decisions on the next seven generations."*
http://www.fastcompany.com/social/2008/profiles/seventh-generation.html

http://en.wikipedia.org/wiki/Seventh_generation

What about the leadership dimensions, and any leader's lkegacy?

http://www.cdl.org/resource-library/articles/ldr_sustainability.php

http://www.sustainabilityleaders.org/

http://www.sustainabilityleadershipalliance.org/

## Question 5: External Forces

What are the big trends that you and the Board and other campus executives discuss most often?

What important changes in the world outside this campus are going to be the most powerful forces on the choices you make in the next few years?

### Websites of interest

Trends in science and technology

http://sustsci.aaas.org/content.html?contentid=628

Socially responsible investing

http://www.socialfunds.com/news/article.cgi/2465.html

US EPA maps it out:

www.afcee.brooks.af.mil/eq/programs/summary.asp?rscID=1203

Public opinion is shifting:

http://www.allacademic.com/meta/p_mla_apa_research_citation/1/1/6/0/9/p116098_index.html

# Module 2: Energy

Prepared by Rich Caban and David McGarvey

## U.S. Green Building Council

Leadership in Energy & Environmental Design

- USGBC system to define building metrics, rating systems and measure "green buildings"
- Originally designated for new construction and major renovations
- LEED for Existing Buildings, LEED-EB, for building operations, system upgrades and use changes
- Goals: maximize operational efficiencies and minimize environmental impact

## Incentive Programs

New Jersey SMARTSTART Buildings

- New Jersey SmartStart Buildings programs provides incentives for design and integration of high efficiency equipment.
- Program requires registration and pre approval.
- Financial incentives may be limited to a maximum of $200,000 per customer utility account.

## Energy Saving Opportunities

Lighting

- T-8 lamps and Hi-Bay Fixtures with electronic ballast in existing facilities
- Lighting controls including occupancy sensors, dimmers, High Intensity Discharge, HID, fluorescent Hi-Bay controls
- LED traffic and pedestrian signal lamps
- LED architectural pedestrian lighting

## Lighting Comparison

Incandescent light bulb

- Anticipated life 900 hours
- Power consumption 75 Watts
- Approximate cost $1 each

Compact fluorescent tube, CFT

- Anticipated life 10,000 hours
- Power consumption 14 Watts
- Approximate cost $3 each

**Operational life cycle cost** (includes cost of bulbs and assuming $0.10 per kWh)

- One man year 2,080 hours

Incandescent light bulb

- Anticipated total cost $18.60

Compact fluorescent tube, CFT

- Anticipated total cost $5.92

## Energy Saving Opportunities

### T-8 Lighting Analysis

- Replacement of 11 conventional fluorescent lighting fixtures
- Reduction in total watts consumed by 11 new T-8 fixtures: 1,892 to 924 watts
- Increase in total foot-candles: 190 to 395
- Aproximate total operating cost savings of $200 assuming 2080 hours operation and $0.10/kWh
- Five to seven year pay back

### NJ SmartStart Building Lighting Incentives

- T-8 lamps $10 – $30 per fixture
- T-8 Hi-Bay fixtures $16 - $284 per fixture
- Lighting controls $25 - $35 per fixture or control
- HID fluorescent Hi-Bay controls $75 per fixture
- LED traffic lamps: $20-$35 per lamp or fixture

### Variable Frequency Drives, VFD

- Compressors, VAV (fan) and pump applications
- Supplied by OEM with new packaged systems
- Retrofit of existing equipment requires motor replacement with premium efficient type

### NJ SmartStart Building Incentives

- Compressors $5,250 – $12,500 per drive
- VAVs $65 - $155 per hp
- Chilled water pumps $60 per hp

### Premium Efficient Motors

- Provided by OEM with new equipment
- Retrofit existing systems
- NJ SmartStart Building incentives $45 - $700 per poly-phase motor depending on horsepower

### Alternative Fuels

- Non-petroleum-based BioFuels reduce carbon footprint
- NJ Office of Clean Energy alternative fuel vehicle program

- Incentives: $4,000 - $12,000 towards the incremental cost per alternative fuel vehicle or hybrid electric

### 1.5 mWatt Cogeneration Plant

- Will meet majority of current campus needs of steam and electricity
- Flexible fuel options for boilers and cogeneration plant including natural gas, diesel and biodiesel blends

  Scalable to meet future needs

  Existing boilers provide redundancy
- $1M rebate from NJ Office of Clean Energy

### Conclusions

- Areas for potential savings are numerous:
  - LEED, LEED-EB, lighting, motors, drives, alternate fuels
- Benefits: reduced operating costs, financial incentives, reduced carbon footprint, favorable recognition
- Renewable energy locally produced or purchased

## Resources

www.njcleanenergy.com/

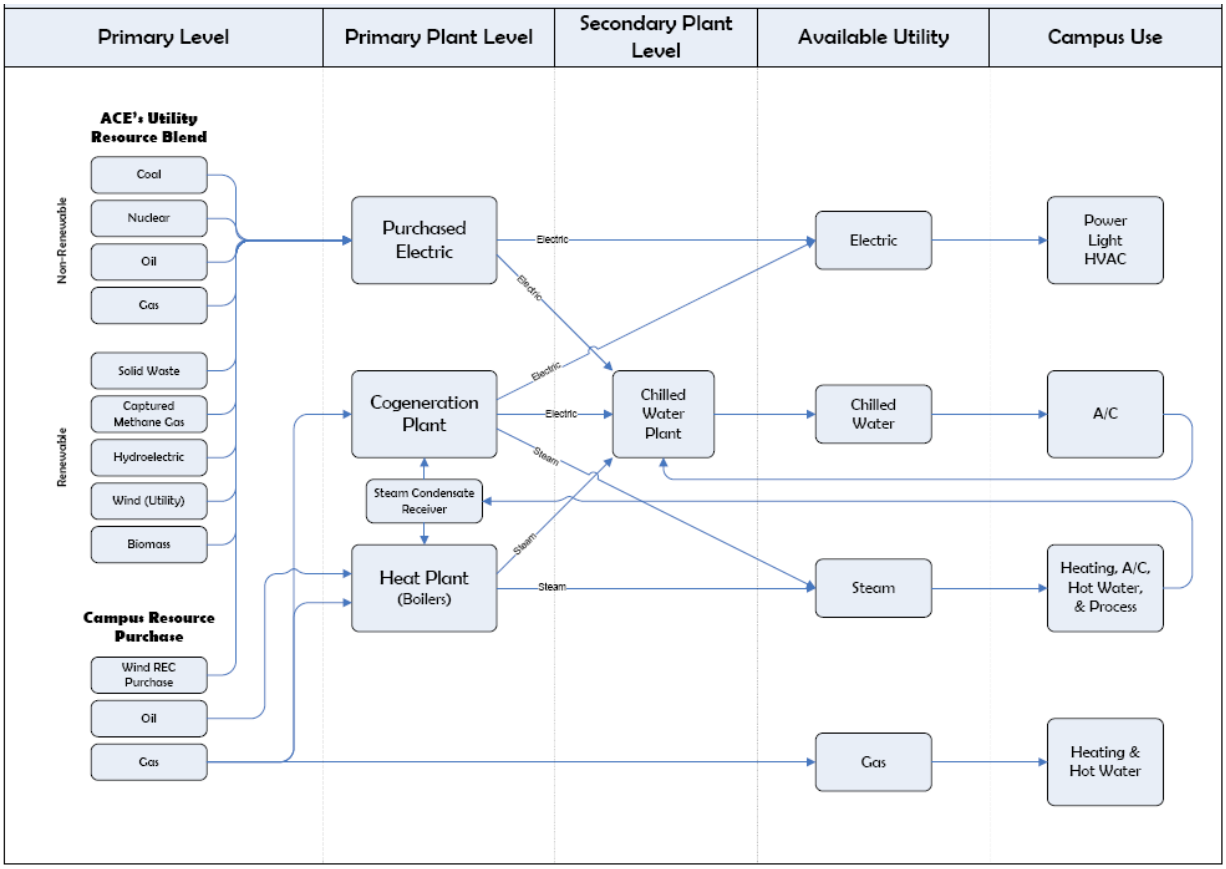
US Green Building Council www.usgbc.org

National Electrical Manufacturers Association
www.nema.org/gov/energy/efficiency/premium/

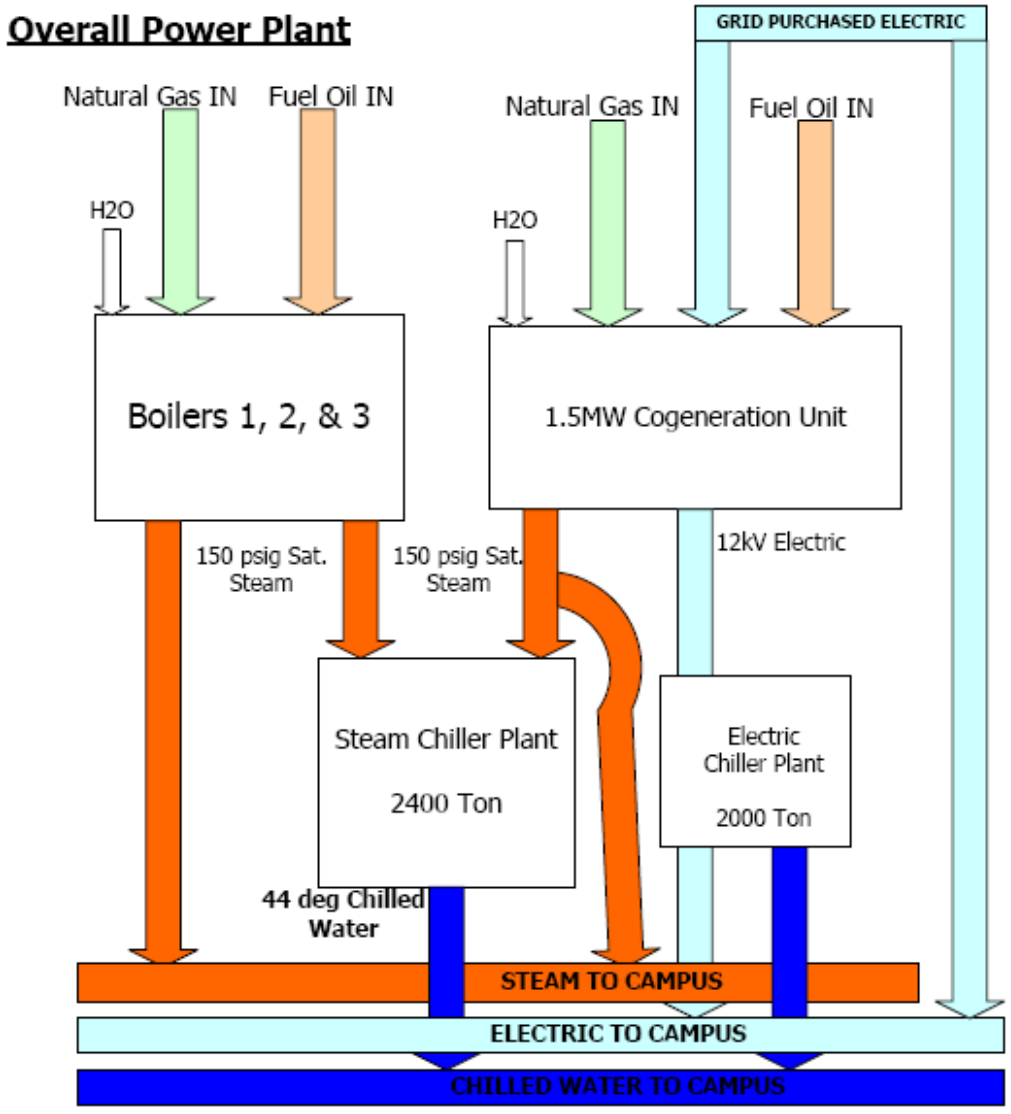
US Department of Energy www.eere.energy.gov/

**Energy flow charts**: Can you develop a similar model for your campus?

## Example of a Campus Utility Flow Chart (based on Rowan University)



**Example of a Cogen plant flow chart**



# Module 3: Procurement

Prepared by Martin Fern and Chris Swenson

This module of the WebQuest deals with the issues of how – and what – our campus buys. Any educational institution buys lots of stuff. Students, teachers, administrators, landscapers, cleaning staff, engineering, physical plant, etc. – they all buy things they bring onto campus to make the enterprise of education work. In this module we ask questions about what is purchased, how green it is, and how our response to climate change might affect the choice we make in this sphere.

## Question 1 – Define Procurement

http://www.pwgsc.gc.ca/greening/text/proc/pol_faq-e.html#Q1

http://ezinearticles.com/?Procurement-Definition&id=407660

http://www.z-procurement.com/

http://www.gatewayreview.dtf.vic.gov.au/CA256EF40083ACBF/0/E78FAE915EF4B14ECA256F4E0000FB4F?OpenDocument

http://en.wikipedia.org/wiki/Procurement

## Question 2- Why is green procurement important to your campus?

http://www.un.org/esa/sustdev/sdissues/consumption/HendayaniAdiseshapaper.pdf

http://p2ric.org/TopicHubs/subsection.cfm?hub=13&subsec=3&nav=3

http://pprc.org/pubs/newsletter/news1199.html

http://pdf.wri.org/guide_purchase_green.pdf

## Question 3- What resources are available to procurement specialists to further develop their skill sets?

http://ofee.gov/gp/training.asp

http://www.globalpg.com/

http://www.nigp.org/educate/outline/INTRO.htm

http://www.procurement.umich.edu/training.html

## Question 4- What strategies can be used for green procurement?

http://p2ric.org/TopicHubs/subsection.cfm?hub=13&subsec=11&nav=11

http://www.bsdglobal.com/tools/bt_green_pro.asp

http://www.purchasing.com/article/CA6537992.html

http://www.hc-sc.gc.ca/ahc-asc/pubs/sus-dur/strateg/sds2007-2010-sdd/appendix-d-annexe_e.html

http://www.nesea.org/buildings/grnsch-res-NE.pdf

## Question 5- Identify examples of green procurement in higher educational institutions.

http://proquest.umi.com/pqdweb?did=1447651701&sid=3&Fmt=3&clientId=11223&RQT=309&VName=PQD

http://www.ubalt.edu/template.cfm?page=2303

http://www2.montana.edu/policy/purchasing/

http://www.aashe.org/resources/procurement_policies.php

http://www.netregs.gov.uk/netregs/sectors/1844747/1844821/1861436/?version=1&

# Module 4: Recycling & Waste Management

Prepared by Jinbing Wang (David) and Bo Sun (Jerry)

## Define Recycling

http://en.wikipedia.org/wiki/Recycle

http://www.depweb.state.pa.us/justforkids/cwp/view.asp?a=3&q=469934

http://www.dep.state.pa.us/dep/deputate/airwaste/wm/recycle/Recywrks/recywrks1.htm

http://www.pacebutler.com/blog/what-is-recycling-7-reasons-why-we-should/

## Why is Recycling and Waste Management important to our campus?

http://news.siu.edu/windows/121003/recycle.html

http://www.recycle.umich.edu/grounds/recycle/off-campus_recycling.html

http://sustainabilityalliance.ucf.edu/apache2-default/?q=node/2

http://www.oberlin.edu/recycle/oncampus.html

## What resources are available to Recycling specialists to further develop their skill sets?

http://www.eco-artware.com/eco-news/resource-guide.php

http://www.ciwmb.ca.gov/electronics/ReuseRecycle/

http://www.epa.gov/Region4/recycle/householdrecycling.htm

http://www.wasteonline.org.uk/resources/InformationSheets/Plastics.htm

http://www.oberlin.edu/recycle/oncampus.html

http://www.delight.com/Hybrid-Wall-Clock-made-from-recycled-bike-computer-parts

## What strategies can be used for Recycling?

http://www.surfsantamonica.com/ssm_site/the_lookout/news/News-2006/July-2006/07_24_06_Recycling_Strategies.htm

http://www.richmond.gov.uk/home/environment/rubbish_waste_and_recycling/recycling_news_events_and_information/waste_reduction_and_recycling_strategy.htm

http://www.northlan.gov.uk/your+council/policies+strategies+and+plans/environment/wms+good+campaign.html

http://www.metrokc.gov/dnrp/swd/greenbuilding/construction-recycling/index.asp

## Identify examples of Recycling in educational institutions

www.villageoflombard.org/DocumentView.asp?DID=951

http://www.emsc.nysed.gov/sss/AltEd/CREATE-ProgramInformation.htm

http://www.apple.com/education/shop/recycle/promo/index.php?event_code_recycle=5539909

http://www.ciwmb.ca.gov/BIZWASTE/Posters/

http://www.staplesrecyclefored.com/

http://www.dep.state.fl.us/waste/categories/recycling/pages/educate.htm

# Module 5: Transportation

Prepared by Philip Mease & John Roszko

Transportation at a campus such as Rowan plays a large role in the greening effort because of the sheer number of commuter students who attend the university. Initial efforts to minimize transportation-related emissions should be initially focused on those avenues that are most significant, easy to implement, and least costly to the university. Long term solutions should also be queued early so that final implementation can occur as early as possible.

## Key Questions

1. What is "sustainable transportation?"
2. In what ways are $CO_2$ emissions harmful to our environment?
3. What alternative forms of transportation exist? What are the environmental impacts of each?
4. What are vehicle manufacturers doing to produce green products?
5. Discuss some of the pros and cons of using alternative fuels?

## Sustainable Transportation

Sustainable transportation has many definitions with varying degrees of detail, but for this paper the following definition is used: Sustainable transportation is the utilization of environmental, social and economical utilities to reduce pollution, increase efficiency of people and cargo movement and maintain safety in an efficient and affordable manner [1,2]. Organizations such as COAST (Coalition for Sustainable Transportation) work towards this ultimate goal by planning communities ahead with sustainable transportation in mind where walking, biking and rail are part of the daily routine [3]. The levels of involvement vary drastically from more efficient vehicles, carpooling and alternative fuels to solely relying on walking and biking.

Certain areas are more capable of sustainable transportation than others. For example, commuting from a suburb, such as Cherry Hill, NJ to work in a nearby city such as Philadelphia, Pa a high speed electric rail is available [4]. In other instances, the access to the train or bus may not be a readily available, which is the concern in much of the United States. In many areas in Europe, public transportation is considered a main artery for moving people where they need to go, especially trains, whereas highways are

the number one choice in the US [5]. However, with the "climate crisis" looking this may change in the near future.

## CO2 Emissions and the Environment

Transportation uses two-thirds of all oil in the US, and emits one-third of all climate changing emissions [6]. In a time when the environment and global warming are becoming household concerns, these numbers are staggering. CO2 emissions are credited with the cause of the climate change. CO2 causes the "greenhouse effect" by not allowing long-wave radiation to escape from the earth's atmosphere [7]. One of the largest concerns of the climate change is the ecosystems that are affected. An ecosystem consists of organisms that are adapted to their respective climates. When the climate changes, the organisms may die, thus ruining the ecosystem [8]. Another common concern of global warming is the rising sea level. Sea levels have shown an accelerated rising rate in the past 100 years, in comparison with the past several thousand years [9].

## Alternative Forms of Transportation

There are a large number of transportation options including walking, cycling, public transportation, carpooling, and so on. These solutions can be implemented very quickly by travelers with a little motivation. Choosing one or a few of these options requires analysis of the needs of the traveler. For example, walking or cycling becomes troublesome for large distances whereas carpooling may require too much overhead in planning for what could be an equivalent 5 minute bike ride. Observing the environmental impacts of each mode of travel is of major importance:

- Walking & Biking: No adverse environmental impacts; by far the cleanest method of travel.

- Public Transportation: Public transportation in the US alone saves 1.4 billion gallons of gasoline and reduces CO2 emissions by 1.5 million tons each year. All of this with only 14 million Americans participating in the program [10]. Public transportation is also over 70 times safer than car and can save the average household over $5000.00 per year.

- Carpooling: Easy solution to partner up with fellow commuters who have close to and from points. If 1000 persons carpool instead of driving separately on an average 20mi round trip, they will save 10000 VMT/year, reduce CO2 emissions by 9,900 lbs, and save ~500 gallons of fuel [11].

## Green Vehicles and the Auto Industry

Auto manufacturers have been developing vehicles that tout increasingly higher fuel economies. The public is now more reactive to the need for the individual to make green choices, further fueling the research and development taking place in the industry.

These vehicles include hybrids (electric/fuel engine), EVs (Electric Vehicles), E85 cars (gasoline/alcohol vehicles), TDI (Turbocharged Direct Injection high-efficiency diesel), among others [12]. Manufacturers are also paying closer attention to make vehicles that are lighter, more aerodynamic, and that use more environmentally friendly polymers and metals.

## Alternative Fuels – Pros and Cons

The demand for alternative fuels is driven by the increase in greenhouse gas concentrations from burning fossil fuels and the rising cost of oil [13]. Some alternative fuels are short-term, providing quick response to the problem while others are still in early development.

- Biodiesel fuels are an excellent alternative. Diesel engines are more efficient than their gasoline counterparts. Biodiesel sources include vegetable/peanut oils, frying oil, etc… These fuels have similar BTUs as petrodiesels yet reduce CO emissions by over 75%. Biodiesel fuels can also be used in engines designed for petrodiesel with little or no modification (tank heaters, etc…) and mixed with petrodiesel. Currently, the only major downside for biodiesel fuels is the cost (approx 30% higher than petrodiesel) [14].

- Ethanol, like many biofuels, is a clean burning alternative. The overall higher octane rating allows the use of higher compression ratios (or increase forced induction) for higher energy extraction even though the fuel has lower energy content than gasoline. The fuel requires approximately 1 acre of corn to produce 300 gallons of ethanol fuel per growing season [14]. This detracts from oil import but increases food imports, raising the cost of food for the country, not just for corn.

- Electric vehicles (EVs) utilize 100% electric power by the use of high capacity batteries and AC (or DC although less common) motors. EVs burn no fuel during use so the shallow environmental view makes these alternatives very clean. The downsides are the environmental impacts of charging them since about half of the power plants in the US are coal-burning and only 2.3% are renewable energy types[14]. In addition these vehicles currently have ‘short’ ranges (although plenty for 90% + of daily driving needs) and are costly to purchase.

- Hydrogen fuels are theoretically one of the best solutions for energy needs, but the practical limitations keep this fuel's induction in the future. It requires an extraordinary amount of energy to convert into usable form but the fuel is extremely clean – the byproduct: water.

## Recommendation List for Rowan University

- Online Carpool Database – Online system for networking potential carpoolers. Website displays commuter locations on map with other pertinent information.

- Bike Share Program – Bike stations around campus that can be rented or borrowed for use. Requires dedicated lanes.

- Green the Rowan Fleet – Stop purchasing of low fuel economy vehicles and size accordingly per application.

- Shuttle/Taxi – Shuttle that travels through hotspots of the campus and Glassboro on a periodic schedule.

- Public Transportation – Increase accessibility to/from Glassboro from other popular locations in the region.

- "College-Town" Atmosphere – Develop the locality of key locations surrounding the campus to minimize distance for obtaining necessary and leisurely goods and services.

- Increase on-campus housing – Currently there is a shortage of on-campus housing, making commuting not only a more attractive opportunity, but a necessity.

- Increase parking rates – Most colleges across the nation have much higher parking fees. Rowan charges students $40.

- Safe pedestrian routes – Traveling by foot or bike around Glassboro means dealing with high-traffic areas which are unsafe to pedestrians.

- Raise general awareness – This is an ongoing process to disperse information required for the public to begin making green choices in their daily lives.

- Downplay "Commuter School" Reputation – Decrease any perceptions of Rowan as a 'commuter school.'

## References and Web Resources

[1] Sustainable Transportation, 2007, http://www.wiserearth.org/aof/149

[2] Definition and Vision of Sustainable Transportation, 2002, http://cst.uwinnipeg.ca/documents/Definition_Vision_E.pdf

[3] Coalition for Sustainable Transportation, http://www.coast-santabarbara.org/

[4] Port Authority Transit Corporation, http://www.ridepatco.org/

[5] Rail Europe, http://www.raileurope.com/us/index.htm

[6] Northeast Sustainable Energy Association, http://www.nesea.org/transportation/

[7] Real Climate – The CO2 Problem in 6 Easy Steps, 2007, http://www.realclimate.org/index.php/archives/2007/08/the-co2-problem-in-6-easy-steps/

[8] Climate Change – Ecosystems and Biodiversity, 2007, http://www.epa.gov/climatechange/effects/eco.html

[9] Global Warming FAQ, 2007, http://www.ncdc.noaa.gov/oa/climate/globalwarming.html#q9

[10] Public Transportation: Fast Track to Fewer Emissions and Energy Independence, http://environment.about.com/od/greenlivingdesign/a/public_transit.htm

[11] EPA Carpooling Study, 1995, http://www.epa.gov/rtp/transportation/carpooling/emissions.htm

[12] The Green Car Company, http://www.thegreencarco.com/product_info/

[13] Alternative Fuel Wiki, http://en.wikipedia.org/wiki/Alternative_fuel

[14] Popular Mechanics - Crunching the Numbers on Alternative Fuels, 2006, http://www.popularmechanics.com/science/earth/2690341.html

University of Florida Carpool Program
http://www.parking.ufl.edu/pages/alcar.htm

University of Arizona Carpool Program
http://parking.arizona.edu/alternative/carpool.php

Rideshare: California, San Fran
www.511.org

University of Maine Carpool Program
http://www.umaine.edu/parking/carpooling%20R&R.html

Online Map and Database for Organizing Carpooling
www.carpoolworld.com

University of Maryland Carpool Program
http://www.transportation.umd.edu/alt_trans/carpool.html

University of Minnesota Carpool Program
http://www1.umn.edu/pts/carpool.htm

University of Texas
http://www.utexas.edu/parking/transportation/carpool/

Emory University Carpool Program
http://transportation.emory.edu/carpools.html

University of Colorado Boulder
http://www.colorado.edu/bicycleprogram/buffbikes.html

University of Washington electric bike share program:
http://www.treehugger.com/files/2007/12/university_of_w.php

Drexel to start bike share
http://media.www.thetriangle.org/media/storage/paper689/news/2008/02/15/News/Drexel.To.Implement.Bike.Share-3213458.shtml

http://www.drexel.edu/depts/parking/bikeshare.html

The Commuter Challenge
http://www.resourceconservation.mb.ca/gci/CC/CC2005/CC05pdfs/wcc04_history.pdf

Trip Reduction Performance Program
http://www.wsdot.wa.gov/NR/rdonlyres/6CA89839-928D-451D-93B1-802D20AC04CA/0/2005_TRPP_brochure.pdf

Electric Bike Share WA
http://www.treehugger.com/files/2007/12/university_of_w.php

http://www.evworld.com/news.cfm?newsid=16818

Univ Colorado Bicycle Program
http://www.colorado.edu/bicycleprogram/

How to green your public transportation:
http://www.treehugger.com/files/2006/10/how_to_green_yo_1.php#numbers

# Module 6: Green Design

Prepared by Mary Acciani and Krystyna Bowen

Green design is a synonym for sustainable design. It is the design of buildings and other manmade objects in a way that optimizes ecological, social and economic sustainability. The goal of green design is to minimize the impact of human beings on the earth by reducing environmental impact and the consumption of non-renewable natural resources. By practicing green design we can maintain the ability of the earth to support human life. Without it resources will eventually be completely consumed. The quality of life will decline and eventually the earth will no longer support life.

Green design is a form of sustainability when it can reduce the amount of water needed in a building for non-potable purposes. It is a form of sustainability when it can reduce the amount of fuel needed to heat or cool a building. Green design is a form of sustainability when it can reduce reliance on automobiles and also reduce the amount of waste generated. Green design is a form of sustainability when it can reduce the ecological impact and improve social and economic conditions.

## LEED

LEED is an acronym for Leadership in Energy and Environmental Design and is a voluntary set of standards defining green buildings. It was developed by the United States Green Building Council as a consensus based national standard in order to establish a common standard of measurement for green buildings as well as promote sustainable design practices, recognize environmental leadership in the building industry, promote and stimulate green competition, raise consumer awareness of the benefits of green buildings and essentially to transform the building market. LEED addresses five areas of concern including sustainable sites, water efficiency, energy and atmosphere, materials and resources and indoor environmental policy.

LEED sustainable sites recognizes the value in developing only appropriate sites by reusing existing buildings and sites, protecting natural and agricultural areas, reducing the need for automobile use and appropriate protection and restoration of sites. Selection of building sites in urban redevelopment areas and redevelopment of brownfields are encouraged. Reducing site disturbance and appropriate stormwater management are important as is site design which reduces heat islands and light pollution.

LEED water efficiency goals reduce the amount of water needed for the building and also reduce the waste supply and treatment burden. Providing water efficient landscaping and

innovative measures to reduce water usage and wastewater generation are ways to meet this goal.

LEED energy and atmosphere goals serve to establish energy efficiency and system performance criteria, optimize energy efficiency, encourage renewable and alternative energy sources and support ozone protection protocols. The LEED materials and resources goals aim to reduce the overall amount of materials needed, use materials with less environmental impact and reduce and manage waste. Establishing good indoor air quality by minimizing and managing the source of indoor air pollutants is a goal of LEED indoor environmental quality. Other indoor environmental quality goals include ensuring thermal comfort and HVAC system controllability as well as providing for occupant connection to the outdoor environment.

## Comparison of a Campus Building vs. Green Building

The Linden Hall building on campus serves as an administration office building. It houses the offices of the Vice President of Administration and Finance as well as Human Resources, Facilities Management and the Health Center. It was originally constructed in 1954 as a dormitory. It has been changed very little from its original construction. It differs from a green designed building in many ways.

First and foremost is the water usage of the existing plumbing systems. While some of the faucets have been replaced with the water saving variety, none of the other fixtures have been replaced with less water consuming types. This represents a tremendous waste of water resources.

The building envelope is not very energy efficient due to a minimal amount of insulation and single pane windows that no longer seal very well. This causes the amount of energy needed to heat and cool the building to increase over that of a green building.

Air Conditioning is provided by window air conditioning units which is an energy intensive and very inefficient way of cooling a building. Heating systems lack sufficient controls so that some occupants are too warm while others resort to electric space heaters to stay warm. This is highly energy inefficient as opposed to a green building with adequate Heating and Air Conditioning Controls.

Most lighting is provided by older fluorescent fixtures and some incandescent fixtures which are much more energy intensive than the lighting provided in green buildings.

## Green Design Plan

The following checklists can be used to improve the process and facilitate green design on campus:

**New Building Green Checklist**:

__Site selection

__Building siting to minimize energy usage

__Stormwater management

__Alternative transportation

__Reduced site disturbance

__Heat island reduction

__Light pollution reduction

__Water efficient landscaping

__Reduced wastewater

__Water usage reduction

__Optimize energy efficiency of building envelope

__Optimize energy efficiency of systems

__Renewable energy usage

__Design for longevity of materials

__Reduction of materials for construction

__Use of materials with low environmental impact

__Reduce waste and recycle construction waste

**Existing Building Retrofit Green Checklist:**

__Stormwater Management

__Heat Island Reduction

__Light Pollution Reduction

__Water Efficient Landscaping

__Reduced Wastewater

__Water Usage Reduction

__Optimize Energy Efficiency of building envelope

__Optimize energy efficiency of systems

__Renewable energy usage

__Design for longevity of materials

__Reduction of materials for construction

__Use of materials with low environmental impact

__Reduce waste and recycle construction waste

## Green Campus Buildings are Good Campus Buildings

Green campus buildings are good campus buildings for many reasons. Financially, green buildings cost less to operate and over the life of the building, cost significantly less in repair and replacement costs for systems. If materials are selected which provide the longest useful life possible, then compared to a non-green building, less money will be spent replacing the items multiple times over the life of a building. Energy costs will be less for a green building and water and sewer costs will be less as well. Green buildings are typically more comfortable for occupants than buildings that are not green. Studies show that occupants are more productive in green buildings resulting in overall lower costs of operation.

As a University we need to be a role model for sustainability. Green buildings are one great way to be a good role model.

## Recommendations

While Rowan University has committed to certifying all new construction to LEED standards, there are additional opportunities for achieving a higher level of sustainability. One specific recommendation includes targeting all the toilet rooms in the older buildings on campus for renovation to reduce water usage, energy usage and to provide a more accessible environment for physically challenged individuals. Another recommendation

would be to upgrade HVAC controls in older buildings and commission them to assure optimal control of the systems and therefore improve energy efficiency and human comfort. A third recommendation would be to replace existing light fixtures in older buildings with more energy efficient fixtures and occupancy controls.

## References

Why Green Building Is Important
http://www.djc.com/news/enviro/11113854.html

Checklist for Environmentally Responsible Design and Construction
http://www.buildinggreen.com/ebn/checklist.cfm

USGBC, Leadership in Energy and Environmental Design Green Building Rating System Training Workshop Manual, December 2003

High Performance Campus Design Handbook, Volume II: Sustainable Design Guidelines 2nd edition, March 2007, Sustainable Design Collaborative LLC for NJHEPS

For additional Web resources, see also the Carbon Offsets module.

# Module 7: Carbon Offsets

Several people worked on the materials in this Module. The primary work was done by Tara and Guy Pridy, partners in the company "Carbon Offsets Now," with the Rowan University case study contributed by Melanie Dougherty and Kimberly Laipple.

For a good general background on the issues, see the online interview of Julia Langer by participants in a web interview, posted by the CBC (Canadian Broadcasting Corporation): **http://www.cbc.ca/news/yourinterview/2008/01/post_2.html**

## Background: The Rowan University case

A carbon offset is a financial instrument representing a reduction in greenhouse gas emissions.

In 2006, Rowan purchased 3% of its total energy consumption from wind generated sources.

In 2007, Rowan increased this to 25% which cost $50,000 for 10,453,673 kilowatt hours.

Rates for renewable energy have increased for 2008. $50,000 will only purchase about 15% of wind energy or 6,260,204 kilowatt hours.

## Recommendations

Our recommendation is to help Rowan maintain approximately 25% of wind energy consumption.

If $2.50 is added to Rowan Tuition payments for 10,000 enrollments, this would generate $25,000 which could be used to purchase an additional 12.5% or 3,130,102 kilowatt hours – and Rowan could purchase a total of 22.5% of wind energy for 2008 or 2009.

By positioning this fee in the correct manner, the University could encourage Rowan students to take pride in helping the University reduce its carbon footprint. This approach could also generate very positive public relations.

## SET ONE: What is green design? In what ways is green design a form of sustainability? How much greenhouse gasses does a green building still emit?

www.wikipedia.com -- For definitions

http://citnet.org/wg/energyclimate/default.aspx -- Citizens Network for Sustainable Development

http://www.planning.org/policyguides/sustainability.htm -- American Planning Association, Sustainability

http://earthobservatory.nasa.gov/Laboratory/PlanetEarthScience/GlobalWarming/GW_Movie4.html -- NASA Earth Observatory: Global Warming – Human Activities and Carbon Dioxide, Movie

http://green.nationalgeographic.com/environment/global-warming/wind-power-interactive.html?nav=FEATURES -- National Geographic, Global Warming Solutions

http://www.presidentsclimatecommitment.org/ -- American College and University Presidents' Climate Commitment

http://www.presidentsclimatecommitment.org/html/solutions.php -- ACUPCC Green Solutions

http://www.ecy.wa.gov/beyondwaste/p_gbIntro.html -- Green Building in Washington State

http://www.hopewellproject.org/pages/rd.html
-- Solar home in NJ

http://www.aboutlightingcontrols.org/education/papers/greendesign.shtml -- Lighting Controls Association, Sensors

http://64.233.169.104/search?q=cache:y59ySmJcwToJ:apps.carleton.edu/curricular/ents/assets/Carleton_GHG_emissions_inventory.pdf+How+much+green+house+gasses+does+a+green+building+still+emit%3F&hl=en&ct=clnk&cd=6&gl=us&client=safari -- Green House Gas Emissions at Carleton College, 2005 Study

http://www.plantemoran.com/Industries/RealEstateConstruction/Construction/Resources/Real+Estate+Construction+Advisor/2007+Summer+Issue/ -- Being Green: It's Easy (and Profitable) After All! Plante & Moran Network

http://ecobuilding.org/green_building/fact_sheets --Seattle Public Utilities' Green Home Remodel series PDF files

http://www.guardian.co.uk/environment/2005/dec/23/frontpagenews.climatechange -- Guardian, Tree-planting projects may not be so green

http://www.climatecrisis.net/takeaction/carboncalculator/ -- Calculate Your Carbon Impact

## SET TWO: What is LEED, what are its main considerations and how are they important to offsetting carbon? Do some carbon offsetting companies match more of the 69 LEED points than others? Do offset companies qualify for status in any way that can be validated?

http://chapters.usgbc.org/newjersey/ -- US Green Building Council, NJ Chapter

http://www.cleanaircoolplanet.org/ConsumersGuidetoCarbonOffsets.pdf -- Consumers Guide To Carbon Offsets PDF

http://theclimategroup.org/index.php/news_and_events/news_and_comment/top_ten_tips_for_purchasing_carbon_offsets/ -- The Climate Group News and Comment, How to Choose Carbon Offsets

http://www.greenbuildingrutgers.us/calendar.asp?Level2ItemID=28
-- Rutgers Center for Green Building Seminar Calendar

http://www.v-c-s.org/validators.html -- Voluntary Carbon Standard (page in progress as of 1/31/08)

## SET THREE: Compare a present day (non-green) building on campus with an environmentally designed building

http://www.greenbuildingrutgers.us/resources.asp?Level2ItemID=43
-- Rutgers Center for Green Building, Resources

http://www.nrgsystems.com/about/green_building.php
NRG Systems, Tour Our New Green Building

http://www.cofc.edu/sustainability/greenbuilding.htm

-- Implementing Green Building Technology: Utilizing a College of Charleston Historic Building as a Model for the College and Charleston Communities

## SET FOUR: Prepare a green design plan and check list for a new building on campus and retrofit for an existing building. Calculate approximately how much greenhouse gasses are still being output, and choose a method to offset the pollution.

http://www.scottsdaleaz.gov/greenbuilding/ -- Scottsdale, AZ Green Building Program

http://www.yourhomeplanet.com/ecolodgical/index_design.php?content_number=219 -- Ecological Renovations

http://www.redorbit.com/news/science/1221337/experts_discuss_climate_change_at_ursinus_college/index.html?source=r_science – Ursinus Seminar with Presidents' Climate Committee

http://www.climatecrisis.net/takeaction/carboncalculator/ -- Calculate emissions

## SET FIVE: Use your information, including appropriate terms, from working on the previous four sets of questions. Explain the ways that impacts of necessary activities can be offset. What are the highest priorities? What can be done easily? Which offset methods do you think have the greatest long-term benefits?

## General Resources

This section contains resources that apply across all modules of the WebQuest.

# NJHEPS WebQuest #5: The Impacts of Climate Change on Our Campus

*Design for Climate Change WebQuest: Generic questions for the six functional sub-committees, with examples of URLs needed.*

| Q1: Define the subject | Q2: Why is this an important part of Sustainability, especially in the context of Climate Change? | Q3: Who sets the standards in this field? | Q4: Give some examples of the state-of-the-art. | Q5: How does this apply to our campus? |
|---|---|---|---|---|
| Wikipedia | Sustainability discussion at a conference or website of a leading professional association | US government agency, regulatory body | A news feature story in a popular medium | What is our official policy? |
| The leading trade association | The popular press: Wall Street Journal, The Economist; NY Times, Christian Science Monitor, Newark Star-Ledger, etc. | A global regulatory body or non-government organization (NGO) | An Earth Day story | What is our present status? |
| A professional in the field does ____ | An advocacy organization (and perhaps some of its rivals) | A New Jersey agency | The most cited example of excellence | What are our plans? |
| A professor or publisher | | A third party certification and/or consulting organization | The most cited blog on the subject | What positions have the President / Board / responsible executives / leading professors taken? |

Developed in class by ENT506 / BUS600 MBA students with Prof. Tom Bryant, Rowan University, 23 April 2008

## Evaluation Rubric

| | Beginning Standards 1 | Developing Standards 2 | Near Standards 3 | Meets Standards 4 | Exceeds Standards 5 |
|---|---|---|---|---|---|
| **Research & Gather Information** | Does not collect any information that relates to the topic. | Collects very little information--some relates to the topic. | Collects some basic information--most relates to the topic. | Collects detailed information – most relates to the topic | Collects a great deal of information--all relates to the topic. |
| **Organization** | Material of presentation lacks organization | The material to be presented is somewhat organized | The material is fairly well organized | The material shows good organization | The material is well organized |
| **Content** | Little or none of the requirements are met, disorganization is evident, inconsistency is noted in writing, many errors may be noted in conventions. | Some of the requirements are completed, writing maybe missing some parts all together, order maybe inconsistent, writing errors may get in the way of the content. | Most requirements are completed, some errors in writing conventions or presentation materials, persuasive writing is clear. | All requirements are completed information is complete and thorough, writing conventions errors do not interfere with understanding, persuasive writing is clear. | Exceeds standard, all requirements are met, writing conventions do not interfere with material, publishable and extremely persuasive. |
| **Design of Presentation** | Too many fonts and ones used are hard to read. Lack of a consistent format for the project. No graphics | Use of fonts inconsistent. Poor use of format for the project. Poor use of graphics | Good use of fonts but could be easier to read. Good use of format for the project. Fair use of graphics. | Fonts are used in a consistent manner throughout. Very good use of format for the project. Very good use of graphics | Excellent use of fonts. The material is easy to read. Excellent use of format for the project. Excellent use of graphics |