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Energy Efficiency in an Educational Setting

Soma Ghosh



BACKGROUND

In our modern industrial economy, each time we turn on the computer, each bite we eat, each item we discard, and each trip that we make to the local store entails a conversion of fossil fuel carbon to carbon dioxide. Of the total energy consumed in America, about 39% is used to generate electricity. More than 60% of the electricity in the United States is generated from fossil fuels, such as coal, natural gas and oil (Figure 1). Therefore, electricity consumption contributes significantly towards climate change. The emissions caused by power generation vary depending on the electricity generation technologies used in the region. Table 1 contains two charts; the first chart compares the fuel mix used to generate electricity in the New England region to the national fuel mix and the second compares the average air emissions rates in the region to the national average emissions rates.

Institutions of higher education are poised to play a leading role in developing and implementing carbon-neutral policies and involving students in every aspect of this multi-faceted opportunity is an obligation that can no longer be ignored. The objective is to empower students with knowledge and experience so that they are prepared to address personal, professional, and political choices related to climate change. But how we educate and prepare students depends largely on the initiatives and commitments that the individual institution makes. Hence, this raises the question: what type of cost-benefit analysis do colleges and universities consider while devoting their financial and intellectual resources to fight global warming?

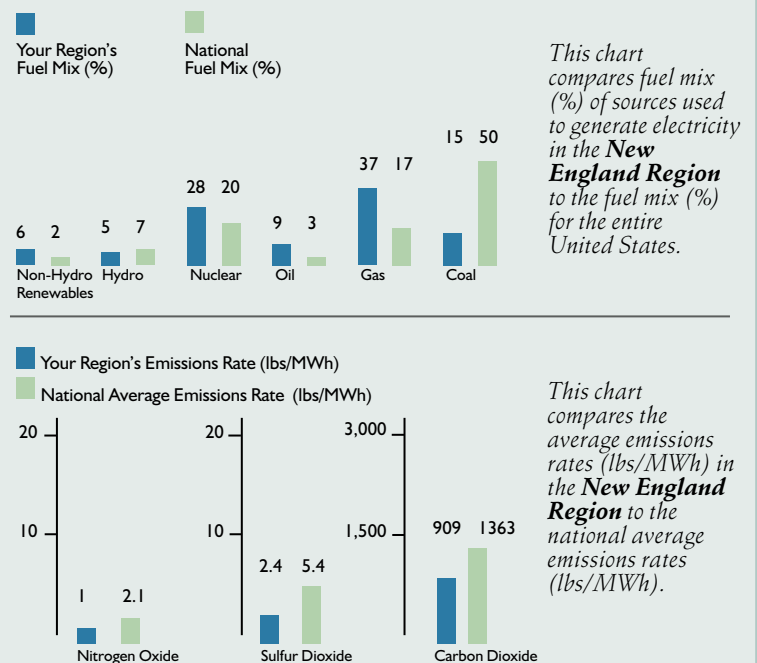
State and local governments and businesses play an important role in meeting the national goal of reducing greenhouse gas intensity by 18% by 2012. An increasing number of higher education institutions are participating in national voluntary programs and initiatives that lead to cost-effective reduction of greenhouse gases, improving air quality and enhancing economic development. Because of the

clear connection between how power is generated and the size of an institution's "carbon footprint," the energy aspect of such programs often takes precedence.

EPA'S GREEN POWER PARTNERSHIP

The Environmental Protection Agency's (EPA) Clean Energy Programs include identifying, designing and implementing clean energy policy and technology solutions such as highly efficient combined heat and power as well as renewable energy sources. The Green Power Partnership (GPP), a voluntary program created in 2001 helps organizations get support from the EPA in lowering the transaction costs of buying green power, reducing their carbon footprint and improving their environmental performance. Green power is a subset of renewable energy and represents those resources and technologies that generate electricity with the highest environmental benefit. EPA defines green power as electricity produced from solar, wind, geothermal, biogas, certain types of biomass, and low-impact small

TABLE 1
COMPARING FUEL MIXES USED TO GENERATE ELECTRICITY AND AIR EMISSIONS RATES



Source: EPA's eGRID database for calendar year 2004

hydroelectric sources. Partners can meet EPA green power purchase requirements using any combination of three different product options: (1) Renewable Energy Certificates, (2) On-site generation, and (3) Utility green power products. An institution can begin to pursue EPA's five-step procedure to becoming a green power partner: (i) Assess the amount of annual electricity use (kilowatt-hours) (ii) Determine the percentage purchase requirement for the organization to be met to qualify as a Green Power Partner (iii) Find and buy green power products (iv) Complete partnership agreements and (v) Work with EPA on identifying products that meet the organization's objectives and goals, making purchases and submitting purchase data to EPA. Participants or so-called partners include a wide variety of leading organizations including Fortune 500 companies, small and medium sized businesses, local, state, and federal governments, and colleges and universities. Currently, there are 86 higher education institutions and 24 other educational institutions participating in this program (<http://www.epa.gov/greenpower/partners/index.htm>).

GREEN POWER ON CAMPUS

Getting motivated

The economic literature on environmental performance of firms finds that financial performance, stakeholder pressures, regulatory compliance, economic opportunities, ethical concerns, competitive advantage and appeal to consumers motivate participation in energy efficiency programs such as Green Power Partnership and Energy Star. As for educational institutions, benefits lie in stabilizing and reducing their ecological footprint and long-term energy costs, attracting excellent students and faculty, developing new sources of funding, and increasing support of alumni and local communities. In addition, there are some program-specific incentives; for example, EPA has developed the College and University Green Power Challenge and the Green Power Leadership awards that provide publicity and recognition opportunities for institutions and help increase awareness about green power among organizations in the sector.

Therefore an institution's green energy policy can be leveraged to maximize its economic, environmental, social and educational benefits. However, before signing a heavy-load commitment of this nature, it is crucial to weigh the benefits against short- and long-term costs.

Building the framework

In the summer of 2007, Bridgewater State College became one of the 400 charter signatories of the American College and University Presidents Climate Commitment (ACUPCC), a national initiative focused on using the physical and intellectual resources of higher education to reduce greenhouse gas emissions. This commitment will draw upon the talent and creativity of every segment of the campus community as the college continues to construct green buildings, support

climate-friendly purchasing, and infuse sustainability into its curriculum, scholarship and community. It is important to have the basic institutional framework in place before taking the necessary steps toward making any commitments to achieve the goals of a specific program. To be specific, any green program involves five main aspects of the university community—the administration, facilities and operations department, academic departments (students and faculty), the university research effort, and the local community. A committee or council such as the Center for Sustainability at

Bridgewater State College is vital for sharing and understanding the various aspects of this program, developing plans for program initiatives, coordinating projects and monitoring the program's progress in achieving its goals.

However, identifying and adopting energy efficiency programs that will be the "best-fit" for the institution as well as render a competitive-edge over peer-institutions is a challenging task. The success of this endeavor clearly depends on the integrated efforts of the campus community working toward a common goal.

Identifying sources and setting targets

On-campus production of green power accounts for a relatively small fraction of campus green electricity. This is mainly due to the limits to the economies of scale (especially on small and urban campuses) and the large-scale investment in technology. EPA provides a list of green power products available in each state and nationally available renewable energy certificate products (<http://www.epa.gov/greenpower/pubs/gplocator.htm>). Partnerships with green energy producers and suppliers in the local community stimulates the local economy, supports local green energy production and creates a greater sense of connection between the members of the institution and their source of energy. For many institutions, the green energy purchases meets less than 5% of campus electricity needs (e.g., University

**TABLE 2
INSTITUTIONS USING
100% GREEN ELECTRICITY**

*Bainbridge Graduate Institute
Colby College
Concordia U. at Austin
Connecticut College
Evergreen State College
Lander University
New York University
Paul Smiths College of Arts and Sciences
St. Marys College of Maryland
Saint Xavier University
Southern New Hampshire University
Southern Oregon University
Unity College
University of California at Santa Cruz
University of Central Oklahoma
Warren Wilson College
Western Washington U*

*Source: EPA's Green Power Program website
<http://www.epa.gov/greenpower/>*

**FIGURE 1
FUEL MIX FOR
U.S. ELECTRICITY
GENERATION**

Coal **49%**
Natural Gas **20%**
Other Gases **.4%**
Nuclear **19.4%**
Hydroelectric **7%**
Petroleum **1.6%**
Other **.3%**
Other Renewables **2.4%**

Source: Energy Information Administration. 2007. Electric Power Annual 2006. DOE/EIA-0348 (2006). Washington, DC.

TABLE 3
THE TOP 10 LARGEST PURCHASERS WITHIN THE GREEN POWER PARTNERSHIP AS OF JULY, 2008

Annual Green Power Usage (kWh)	GP% of Total Electricity Use*	Green Power Resources	Providers	Athletic Conference
1. University of Pennsylvania 192,727,000	46%	Wind	Community Energy	Ivy League
2. New York University 132,000,000	100%	Wind	FPL Energy	University Athletic Association (UAA)
3. Pennsylvania State University 83,600,000	20%	Biomass, Small-hydro, Wind	3Degrees, Community Energy, Sterling Planet	Big 10
4. Oregon State University 66,680,400	74%	Biogas, Biomass, Wind	Bonneville Environmental Foundation	Pacific 10
5. California State University System 66,189,000	9%	Biomass, Geothermal, Solar, Wind	APS Energy Services, On-site Generation	Numerous
6. University of California, Santa Cruz 57,000,000	100%	Small-hydro, Wind	Sterling Planet	Association of Division III Independents
7. Texas A&M University System 43,350,000	15%	Wind	TXU Energy	Numerous
8. (tie) Northwestern University 40,000,000	20%	Wind	3Degrees	Big 10
8. (tie) Western Washington University 40,000,000	100%	Wind	Puget Sound Energy	Great Northwest Athletic Conference GNAC
10. University of Utah 36,666,000	15%	Wind	Sterling Planet	Mountain West

*Reflects the amount of green power as a percentage of total purchased electricity use. Source: <http://www.epa.gov/greenpower/toplists/top10ed.htm>

of Michigan-Flint, American University and University of Rochester) whereas a large number of institutions, particularly smaller schools, have committed to meeting 100% of campus needs with green electricity (Table 2). It is important to recognize, however, that for a large state school, a small percentage can result in a large total purchase. For example, the 9% multi-campus usage of green power by California State University System equates to a 66, 189, 000 kWh annual purchase and makes it the fifth largest user of green power among the higher education institutions in the nation (Table 3).

Choosing among the financing options

Financing green energy purchases using funds from general operating budgets is extremely unpopular. The most common approach is to use savings from conservation efforts to pay for the initial cost of switching to clean energy. Many states across the US now offer tax deductions for projects promoting clean energy production such as through wind and solar devices. As of 2005, the federal government offers an incentive payment under the Renewable Energy Production Incentive (REPI) to municipal, not-for-profit, and cooperatively-owned energy facilities for up to 10 years. Performance contracts through an energy-service company such as *Noresco* has become a popular way for institutions to save energy without incurring upfront costs (e.g., URI

chose *Noresco* to implement its \$18 million initiative in reducing energy consumption). Under the terms of such deals, the energy-service company, or “*esco*,” performs the work and guarantees a certain amount of savings over the course of the contract. The *esco* collects a set annual fee, paid for by the energy savings. Private donors and funds available from the U.S. Department of Energy and state agencies such as the Massachusetts Renewable Energy Trust Fund are used widely. In many instances, students have successfully passed referenda that finance the purchase of green energy and/or RECs through increases in student tuition or fees (e.g., the Student Environmental Initiatives Fee of \$5 per semester for in-state students at University of Tennessee, Knoxville funded the purchase of 3,375 blocks of green power from the TVA/KUB Green Power Switch Program). Long term savings from such programs can be used for future projects that encourage new energy conservation efforts, renewable energy research, carbon sequestration and other activities that will further motivate the green movement on campus and benefit the college and the local community.

Reaping the program-specific benefits

The EPA offers several benefits including expert advice on identifying green power

products that best meets the institution’s goals. It also provides tools and resources for communicating and marketing the achievements of participating in the program. Several awards and rating systems for colleges interested in comparing their conservation efforts with others serve as a source of pride for campuses (e.g., Green Mountain College earned an Energy Star Showcase award from the EPA in 1999). The publicity and recognition provides a competitive advantage and helps in attracting new sources of funding and recruiting students and faculty who have an interest in pursuing their educational and research efforts focused on environmental issues.

Continuing on the green path

There is a lot that can be saved just by eliminating energy waste (energy management) before we get to reducing the level of service and optimizing the use (energy conservation). Proponents of green programs are often criticized for attempting to re-define people’s tastes and preferences and the habits in their day-to-day life. Thus the social-responsibility angle needs lot more emphasis as an integral part of every aspect of the movement of transitioning to a green campus and no one is better equipped to carry out this role than the institutions of higher education.

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