5.92 Potential Projects

MIT Campus Wind Study

The aim of the project is to perform a feasibility study, and possibly initial planning for a number of wind options at MIT. Some specific possibilities include:

- Feasibility study for installation of a medium-sized wind turbine (on a mast) on the MIT Sailing Pavilion (the pavilion has been the focus of a feasibility study on a major renovation that includes the possibility of a mast-mounted turbine and a ground-source heat pump, though these two elements have not been studied in detail)
- Siting and economic assessment for AeroVironment's "Architectural Wind" building-mounted turbines on one or more MIT buildings, particularly including Pierce Boathouse

A large part of the project will deal with wind measurement. We could attempt a broad wind study of the MIT campus (focusing on roofs), and use the study to support the installation of one or a combination of wind harnessing devices. The opportunity to connect site-specific data to regional wind patterns might be interesting for a fluid dynamics study.

Conducting a wind study will require proper instrumentation. Wind speed (but not direction) is measured on W20, and there is some speculation as to whether there is a functional anemometer on the Boathouse, Sailing Pavilion, or the Green Building, but MIT Facilities does not have wind meters waiting to be installed. We would need to pursue the existing instruments noted above, and/or acquire or develop needed instruments. We could:

- work with Second Wind in Somerville – they are interested in lending expertise, perhaps equipment
- purchase and install a wind meter (approximately $5000 expense, rough estimate)
- develop our own sensors (likely a headache, but could be interesting for the build-types in the class if there are any)

The measurement portion of this project is solid. The analysis component can be concretized by specifying the desired end product, e.g. a formal wind study, financial analysis, etc.

MIT Fleet Study

This project centers around a study of the different fleets operated on MIT campus by various entities (including Facilities, Libraries, Media Lab, EHS, IS&T, Police, Parking and Transportation). The students would work to identify those entities, and work with them to assess existing data available on fleet activities, including fleet characteristics such as vehicle technology and age, fuel type, average fuel economy, etc, as well as operational parameters such as driving range, operation frequency, total fuel use, etc. This could involve designing a monitoring tool if one is not in place (e.g. log book, electronic instrument, etc). Benchmarking against other institutions, as well as making cross-fleet comparisons within MIT, would also be useful.

The students would make recommendations on possible ways of improving energy efficiency of the fleets via alternative vehicle technologies and fuel options that might be applicable for the different job requirements and usage patterns (i.e. large heavy trucks that serve as a mobile workstation vs. shuttles that move constantly). This project report could evaluate whether there is a systematic way to move MIT's diverse fleet to a single fuel (diesel/gasoline/compressed natural gas/biodiesel), and could also examine ridership patterns and various impacts of fleet growth. In short, they could make recommendations for the Institute's fleet of the future.

MIT Building Technology Assessment (Solar thermal/GS Heat Pump)

This project would investigate the economic and technical feasibility of green building technologies for one or several existing or planned buildings on campus. Some concrete technologies include:

- Solar water heating, especially in the context of an MIT dorm or recreational facility (swimming pool) or food facility – collect data on available solar capacity, water use patterns, correlate; this would be appropriate and useful for big or small buildings, retrofit existing building or plan for new construction
- Ground source heat pump – for a new building or retrofit – establish energy use patterns, GS technical feasibility at the site, establish operating procedure, estimate savings; the Sailing Pavilion would be an ideal site for this, as would future lower intensity buildings in the NW part of campus

The students would make recommendations on the most cost-effective way of using these technologies to reduce operating costs/energy use/CO2 output.

Nuclear Reactor Energy Recovery

The MIT research nuclear reactor operates at a capacity of 5MW, but all of the fission heat is currently expelled through the cooling towers and no useful energy is recovered. The project would assess various ways to utilize the low-grade heat produced by the nuclear reactor (high-flow 50C water) for the benefit of the MIT Energy Management system, or the City of Cambridge. We will focus on engineering and financial feasibility aspects.

MIT Dorm Energy Profiling (Usage and Envelope Analysis)

The goal of the project is to investigate to what degree we can effectively meter and/or monitor, and report on energy usage in MIT dorms. The final report would inform MIT Facilities on strategies for monitoring the energy performance of the dormitories, develop baseline dorm energy profiles, and serve as a starting base for educating students about their energy footprint.

Some sample of MIT's 19 dormitories would be analyzed to determine where specific measurements can be made of electricity, heat, water (hot/cold) and steam usage for rooms, halls and common areas. Pilot data gathering protocol (i.e. building-scale electricity metering, monitoring lighting use, measuring common area temperatures, calculations of expected energy use based on envelope characteristics, etc) will be developed and tested. Analysis of these data would lead to concrete recommendations for priority areas for building improvements (including where the best paybacks can be found) as well as recommendations for improving data collection capabilities and encouraging resident behavior change.

The opportunity exists to gather larger amounts of data though the use of data loggers and sensors, which could be purchased, or customized in-house.

One outcome of this project would be building profiles for one or more of MIT's dorms to inform Facilities and Housing planning and operations, and to add detail to the developing online Campus Energy Map. Another could be a mechanism to make existing information available through the web.

Cambridge Rindge and Latin School (CRLS) green options

CRLS is planning a complete roof overhaul of the main school buildings in 2008-2009. As part of their commitment to greening the high school facilities, the school is considering a renewable energy system

installation on their new roof. In order to include provisions for an installation in the new roof specifications, the school is interested in an assessment of the different renewable energy options at their location. The class would pursue a feasibility study for one or several of the proposed systems:

- large scale PV array – integrated into the roof, or mounted atop
- small-scale roof-mounted wind generators, such as the AeroVironment "Architectural Wind" system
- roof-mounted solar water heating system
- transmissive PV elements on the connecting bridge

Dorchester Bay Community Center

Dorchester Bay Development Corporation (DBDC), together with Federated Dorchester Neighborhood Houses and Bird Street Community Center, are developing a new community center on Bowdoin Street. The building will house many green features, among them a 70 kW solar PV array. The current plans call for the building to match the LEED Silver certification, but several funders are pressing for an increase in standards to LEED Gold.

DBDC is interested in being able to match that requirement, but has limited funding available. As such, they are interested in an assessment of the most cost-effective strategies for attaining a LEED Gold certification.

DBDC currently has an architect under contract, and an initial building design. The final design of the building will start in January, and the intent is to start construction by September 2007.

The students would assess the feasibility of a number of green-building technologies in the context of the community center, paying particular attention to initial cost, operational savings and pertinence to LEED requirements.