Fieldhouse Renovation Project

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Part 1: Introduction:

Recently, people within the Macalester community have expressed a need for renovating the campus fieldhouse because it is outdated and does not serve the overall athletic needs of the school sufficiently. When this renovation takes place, both the actual construction of the building and the best way to meet its energy needs must be addressed.

Such needs are typically realized in the lighting; heating and cooling; and water usage of a building. However, due to recent interest from groups such as Macalester Conservation and Renewable Energy Society, as well as Environmental Funk, sustainable architecture is also being considered by the administration for implementation in the fieldhouse renovation. Given these avenues of potential improvement, it is necessary to explore these options in greater detail.

Part 2: Methods

Our group researched the necessary components of green architecture, and found that our main concerns for energy needs were heating & cooling; lighting; water; and structural design.

In order to find the information we needed to evaluate the current and future possibilities of the fieldhouse's structural design in view of environmental sustainability, we had to utilize a variety of resources around campus. We needed to take into account our construction methods, particularly building for our climate zone, and the actual materials the building would be made up of. To find this information, we concentrated our research both in books and online at sites from various companies that produce innovative environmental technologies.

To learn of the current energy situation, we visited the Macalester Physical Plant. There, we found information on the fieldhouse's energy consumption. We also learned where Macalester obtains its energy and how alternative forms of energy could be used in the fieldhouse. However, we decided to concentrate on the current campus energy source in our plans for the renovation because we felt it was more important to focus on

conservation and efficiency of the current energy supply rather than to create an entirely new source of energy for the building.

Part 3: Energy

Although environmentally sustainable building techniques are desirable, it is impossible to ignore the fact that energy is expensive. According to information obtained from the Macalester Physical Plant, recent energy usage numbers and expenditures reflect gradual declines in energy efficiency. Between June 2002 and May 2003 the total BTU's consumed at the school equaled an unprecedented 91,334,450,000, costing the school $432,449.78. In the same period, the total electricity consumption had climbed to 13,257,600 KWH at a cost of $637,913.

Decreasing these expenses would be in Macalester's best interest, especially in light of the current economic recession. We believe that the college would benefit in the long run from implementing sustainable building techniques in the upcoming renovation of the fieldhouse. Despite the upfront costs of construction, which are much higher than that of traditional building techniques, Macalester will realize a greater energy savings in the future.

Section A: Heating & Cooling

Heating and cooling account for as much as 50-70% of energy consumed in buildings (ORNL URL). This percentage can be decreased by employing a variety of conservation and efficiency techniques.

To begin with, insulation is always a beneficial addition to a building, especially in the ceiling. This is because the greatest amount of heat is lost through the roof of buildings.

Another key addition to the ventilation system is the inclusion of more thermostats. The University of River Falls Wisconsin found that individually controlling the temperature in each room yielded greater energy savings than setting the entirety of the building to one temperature. This measure provides the students and faculty the ability to lower the temperate in unoccupied chambers. (River Falls URL)

For example, keeping higher thermostat settings during the summer and lower settings during the winter saves considerable energy. The same is true for turning the thermostat back by 10% to 15% for eight hours during the night. The savings this produces in residential housing is as much as 10%. (Department of Energy URL)

Public awareness would benefit the heating and cooling expenditures a great deal. Having students dress warmer rather than turning up the thermostat, (River Falls URL) as well as creating shutdown procedures during nights, weekends, holidays, and vacations would further reduce energy use and cost. (Korvela URL)

Section B: Lighting

Lighting costs can be lowered through a variety of methods. These methods range from simple conservation techniques, such as turning of the lights when a room is not in use, to complete changes in lighting systems to save energy.

An innovative lighting system to consider for implementation in the fieldhouse is the ASD-600 Advanced Daylighting System. This system is made up of domed skylights fitted with a series of mirrors. The mirrors are programmed to realign themselves every ten minutes to match sun's angle in order to capture the most solar light possible. This technology would provide sunlight to the gymnasium, so that during a sunny day no artificial lighting would be needed for the facility. For example, a company called the Lockheed Corporation was able to save $500,000 per year by installing the system. Daylighting also results in a lowered need for energy and a healthier indoor environment. (So-Luminaire URL)

Another technology that could save energy with the lighting system is the use of motion-sensor lighting. This method was tested in Olin Rice in April of 2000, with significant energy savings. A study comparing the amount of time a room was lit with and without light sensors activated revealed that light sensors save massive amounts of energy for areas that are not in use the entire day. (Korvela URL)

Section C: Water

Water usage is an important issue to examine, as it requires not only the actual water but also electricity. Regarding the field house, there are only a few cases to consider for water savings.

Although it might be thought that the pool uses up a lot of water, the reality is quite different. The pool is only drained when repair to the walls and floor are needed. Otherwise, the water is refilled only to compensate for evaporation. (Lucatelli URL)

Restrooms and showers is the other source of water consumption to consider. In this case, there are a few simple installations that could be done to reduce water usage. For example, low flush toilets could be used in the restrooms, and low-flow showerheads in the showers. Both of these would yield greater savings for the Macalester campus.

Part 4: Construction

Section A: Climate Consideration in Architecture

In renovating the Fieldhouse, it is important that we first consider the Minnesota climate and attempt to create a building which can conserve energy with its structure. This kind of passive energy construction, though expensive is extremely effective.

There are a few important weather factors to consider in Minnesota: the temperature, wind, and amount of sun. The fluctuation of temperatures is extreme, being very cold during the winter and hot in the summer. The wind is strong, which is to our advantage in the summer but contributes to the harsh cold of the winter. Finally, the large amount of sun exposure throughout the year can be utilized to aid in passive heating of buildings.

The most important aspect of heating in the winter is to keep the heat in and the cold and wind out of the building. There are several different strategies to do this. One is to build into the ground, the earth itself providing extra insulation from the cold during the winter, while cooling the building during the summer (AIA 40). Building thick outside walls is another way to increase insulation. This can be accomplished by using

multiple layers of building materials or by using thicker materials to build the outside walls (AIA 42).

A simple addition which increases heat conservation significantly is to build enclosed foyers inside each exterior door. This prevents a great deal of warm air from exiting and cold air from entering (AIA 41).

Passive heating from the sun could also be utilized through use of large, south-facing windows. These could be double-glazed to prevent heat loss and would provide a significant amount of heat when the sun was out. Other ideas are to build greenhouse structures on the southern side of the building, and regulate heat by opening and closing doors to the greenhouse. Overhangs and shutters, along with landscaping could be used in the summer to cool down the building as well (AIA 41). Also, a line of coniferous trees, if placed strategically, could act as a wind screen while adding to the beauty of the campus at the same time.

These are some of the less expensive options for passive heating. Other options, such as building on an east to west angle (AIA 41), are not plausible because of limited space and expenses. When building with heat conservation considerations, it is important that we keep in mind the assets and problems of the Minnesotan climate, but of course consider economics as well.

Section B: Construction Material

For a truly "green" fieldhouse, every element that goes into the building must be considered. This means finding environmentally sound alternatives for products ranging from paints and varnishes to roofing materials and insulation. Both the infrastructure and the finishing touches must be considered.

With any renovation, some building components can be saved from the existing structure if they are in reusable shape and are not damaging to the quality of the indoor environment. It is likely that many objects from the fieldhouse, such as doors and lockers, will be reuseable. However, in case that is not true, we will research eco-friendly alternatives.

Today, eco-friendly alternatives are available for almost any product you can think of. Through using recycled, reused, and biodegradable products that cause minimal environmental damage throughout their lifecycle, we hope to create a fieldhouse that is a model of sustainability.

In constructing a sustainable building requires us to consider what the requirements of the project are. For the fieldhouse, we need to have the same basic components that are currently included, such as the weight room, swimming pool, offices, etc., and perhaps a few new items proposed by the Macalester community, like a lounge area. Since the renovation plans have not been finalized yet, we cannot predict what will and will not be included, so we will focus on the existing parts of the facility.

Next, we had to consider what we have to work with. Because most of the materials used in the original construction were of a typical, non-environmentally friendly nature, the majority will not be reused in this construction. The fieldhouse can safely be stripped down to the concrete and steel framework, which can be added on to if the renovation is going to include additional square footage. Once the framework is in place, flooring and walls can be put in place.

At this point, environmentally sound materials become the key. Many eco-friendly construction products are on the market that can be used during this step. Depending on what level of sustainability the campus decides on, a variety of materials are available for purchase. Materials can be reused from other demolition projects, rather than being dump in a landfill. Another option is to use components that are made of recycled materials that otherwise would have been disposed of, as oppose to new raw materials which require destruction of the environment to obtain. Building components on the cutting edge of environmental sustainability can be used, such as completely biodegradable items, ones that don't cause harm to the indoor environment by giving of fumes, or a whole host of other technological innovations.

The steel and concrete framework from the original building would be left intact, with additions made as necessary. New interior walls would be made from metal studs and gypsum made of highly recycled content. Wall facings would then be covered with recycled paper and finished with a low Volatile Organic Compound (VOCs) sealant. This type of wall was used with great success at the World Resources Institute (WRI URL).

The wood flooring of the gymnasium can be replaced with an innovative new product made from soybeans and recycled newspaper, two easily renewable resources. The material looks and feels just like wood, but is stronger and much more environmentally sound. Unlike the varnished wood floorings of typical gymnasiums, this product emits no VOCs and is formaldehyde-free (Phenix Biocomposites URL).

The Santana Corporation produces locker benches, vanities, shower stalls, toilet and urinal dividers, and lockers made from a recycled, solid, high-density polyethylene (HDPE). This material is more cost-effective than the traditional plastics, woods, or metals used in the production of these products. Also, HDPE is resistant to mildew, odors, and graffiti, and is available in a wide variety of attractive colors. The long life of the product translates into a reduction in the amount of non-biodegradable plastic deposited in public landfills (Santana Corporation URL).

The fieldhouse contains an office area that could use a wide variety of green materials. Carpeting from Interface Flooring Systems Incorporated is installed in small tiles that can be removed if they become damaged, reducing the amount of carpeting used over the lifetime of the building. The tiles are made from 100% recycled materials and do not give off the fumes associated with typical carpeting (IFSIA URL).

Milk Paint made of milk protein, clay, earth pigments, and lime will not fade in the sun and contain no toxic ingredients. This durable, long-lasting type of paint was used in ancient times but is uncommon today with the synthetic alternatives created over the past century (Milk Paint URL.

Triple paned windows are available from many sources today. They effectively seal the interior of a building from the outside temperature, keeping in heat. This technology also reduces glare and fading of materials from the sun (Pella URL).

Armstrong Ceilings produces ceiling tiles made of 79% recycled industrial wastes and post-consumer recycled paper that are finished with an organic water-based paint. Their high light reflectance returns up to 89% of ambient light, reducing light fixture costs and energy consumption. The tiles are highly durable, washable, and can be recycled when no longer needed (Armstrong URL).

As demonstrated above, innovative new products are available for every area of a building. From paints to shower stalls, environmentally sound alternatives are available to replace the typical eco-unfriendly products used in the facility today. With the renovation of our fieldhouse, Macalester has a unique opportunity to construct a building that requires a miniscule ecological footprint for its creation.

Part V: Conclusion

In order for Macalester College to be a leader in campus environmentalism, creating an environmentally sustainable fieldhouse is key. Many factors must be considered for the facility to both showcase the latest technology in environmental sustainability and save the campus money.

In the actual construction of the building, we decided to use as many new technologies as possible to show how Macalester could update its current methods. We also considered price comparisons, as the college is currently experiencing financial difficulties. However, we were able to justify higher costs in some situations due to the savings the campus would enjoy with our energy plan.

As there are innumerable options available for green construction, it would be impossible to list them all. Instead, we simply chose a few examples of green alternatives for the fieldhouse renovation. The options we list do not need to be used in the renovation; they are simply some of the many ecological friendly choices available.

By following the recommendations above, not only would the college be set apart as a leader in the field of environmentalism, but also the facility would save the school money over its lifetime due to the long-lasting, low-maintenance materials used in its construction and energy saving methods suggested for its use.

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