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Glenn Ching

Director of Finance, Iolani School

Being Cool at Iolani School

My thanks to the State Department of Business, Economic Development & Tourism for this opportunity to share Iolani School's experience with thermal (ice) storage air conditioning systems.

As background information, Iolani School is a K-12 college preparatory independent school with an enrollment of about 1800 students and 260 full-time employees. The 23-acre campus, Iolani's home since the mid-fifties, is located near the Ala Wai Canal.

This afternoon, I would like to expound on a formula which summarizes our experience, i.e. engineering solutions + economic incentives = project feasibility.

Engineering Solutions

We have sought engineering solutions to address operational needs in concert with our long-range plans. Presently, all 125 of our classrooms are air-conditioned. We believe that the overall physical environment of an educational institution affects teaching, student learning, and school pride.

We also recognize that the maintenance of our learning environment must be cost effective as well. The school is willing to invest in long term cost effective solutions. It is important for us to scrutinize costs as tuition is based on costs. With tuition covering about 70% of the cost to educate a student, it is our priority to accomplish our educational mission yet be cognizant of the tuition impact on our parents.

In 1994, about 50% of our Lower School classrooms needed air-conditioning. We were looking for a cost-effective solution to bring cooling relief to 15 classrooms, notably K-1, 5th and 6th grades. Hawaiian Electric (HECO) proposed an ice storage air-conditioning system. We were initially skeptical, as there was only one other ice storage air-conditioning system in existence in the State. It was located at the old Hawaiian Airlines terminal. The technology intrigued us and we pursued the proposal with HECO's project manager, Paul Fetherland.

The key engineering features centered on making ice during off-peak hours (9p.m.-5a.m.) and pumping ice water to the classrooms during the school day. The ice tanks complemented the chiller such that chiller capacity was lower than if we had a conventional one. Ice storage basically shifted a portion of our electrical energy demand. Pumping ice water to the classrooms utilizes less energy than running a chiller compressor.

From HECO's view, more widespread use of ice storage systems which utilizes available off peak capacity would make more peak capacity available. This would alleviate costly buildup of power infrastructure to meet peak demand.

An economic analysis was done to compare the operating costs of a conventional, ice storage, and split system types of air-conditioning. Although conventional and ice storage systems have a higher initial capital cost than split systems, the overall life cycle operational costs were lower for the ice system based on present values of anticipated cash flows.

Economic Incentives

An integral part of the analysis included the economic incentives provided.

Since ice storage shifts part of the energy demand to off peak hours, Iolani qualified under HECO's Rider M tariff which provides an adjustment in billing demand. Consequently electrical operating costs were lower than for conventional and split systems.

The State offered a 50% tax energy credit for thermal (ice) systems. This effectively cut the initial capital costs in half. Since Iolani School is a non-profit corporation, the application of this tax credit was accomplished through leasing. Consequently the Lower School project was financed through First Hawaiian Leasing which utilized the tax and depreciation credits. The resultant lease payments over the five-year lease term totaled less than the initial principal.

As a demonstration project a one-time grant totaling \$200,000 was available from the State Department of Business and Economic Development (DBEDT) and the Electric Power Research Institute (EPRI) and applied to the Lower School project.

Feasible Projects

The Lower School ice storage system was completed in the Fall of 1995. This project received an Excellence Award for the design by HECO's mechanical engineer subcontractor, Cedric Chong and Associates. Here we see where engineering solutions + economic solutions = feasible projects.

This equation was applied again in 1997 and 1998 in the Upper School where ice tanks were retrofitted to existing chillers. The operational need was to replace window air-conditioning units to reduce noise levels, improve reliability, consolidate these individual units to a more "central" plant concept, and to add more chilling capacity to air condition the Student Center and cafeteria.

In the Upper School, off peak tariffs were applied and the leasing through First Hawaiian Leasing was done to realize the tax advantages of the 50% tax energy credit and depreciation.

Presently the school saves about \$24,000 in electrical costs due to the off peak tariff rate. Through HECO's rebate program, the school has received rebates for lighting retrofits, conversion to electronic ballasts in its buildings, occupancy sensors in bathrooms, and use of variable speed drive motors. Windows have been tinted to reduce glare into the classrooms and to keep classrooms cooler. HECO also introduced us to the use of ultraviolet lights in air-conditioning ducts to kill mold. This had led to cleaner condenser coils requiring less maintenance and has increased air-conditioning efficiency. Plant personnel have visited us from hotels and hospitals seeking to adopt this technology. We continue to seek energy related savings through solar and heat recovery systems as the long-term outlook for petroleum is projected in the mid to high twenties per barrel.

Iolani is presently moving forward with Project 1 of its 1997 Campus Master Plan developed by Belt Collins which entails a multi purpose building (housing about four floors of parking and the Maintenance Department) and an adjacent classroom building. Under a Utilities Master Plan prepared by Fukunaga & Associates, the operational long-range goal is to consolidate the current three "regional" air-conditioning plants into a single ice storage system. A phasing plan has been established to pick up air-conditioning loads campus wide over a 20-year period. Besides Project 1, the Campus Plan entails building improvements in Lower School, a new Student Center and Theater, and a library addition. All of these building improvements will be "looped" together with a degree of back-up capacity.

HECO and the design team led by Group 70 (which is the Campus Master Plan Project 1 architect) are designing a chiller plant which would maximize off peak tariff allowances, allowable tax energy credits, and HECO rebate incentives for building day-lighting features and motors. In conjunction with this, engineering reviews are being conducted to streamline the campus electrical grid for metering purposes.

The impact of these economic incentives will weigh heavily in the building decision process which has a projected start date in June 2002 with an estimated completion date in late 2003. The expiration of the energy tax credits on June 30, 2003 will occur during construction.

Conclusion

ENGINEERING SOLUTIONS + ECONOMIC INCENTIVES = FEASIBLE PROJECTS

From an overall view, without economic incentives, the marketability and feasibility of engineering solutions such as ice storage would be in jeopardy especially since the energy tax credits expire on June 30, 2003.

Tax incentives work. Planning an energy efficient plant takes capital funding and years to implement, and in Iolani's case, it needs to be phased in over 20 years. The seemingly short-term nature of expirations and extensions of these tax credits adds uncertainties to companies which want to invest in their future as well as to those whose livelihood depends on supplying the necessary energy saving devices. We encourage the Legislature to take the long-term view so that infrastructure plans can be made without guessing what may happen to tax credits.

Iolani School is appreciative of the efforts of the Legislature and Hawaiian Electric Company in providing such incentives which have helped Iolani School derive cost effectiveness in its educational mission.