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CASE STUDY -

ACHIEVING LEED PLATINUM AT THE INNOVATION CENTER

HELSINKI, FINLAND

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// ACHIEVING LEED PLATINUM

Showcasing American innovation at the U.S. Embassy in Helsinki

"As U.S. Ambassador to Finland, one of my primary goals was to demonstrate the best in American technology with regard to the upgrade of our diplomatic facilities," stated Bruce J. Oreck, U.S. Ambassador to Finland.

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A MODEL FOR ECO-DIPLOMACY

As the capital city, Helsinki is the most populous municipality in Finland. It is the world's northernmost metro area with over one million people and the hub for Finland's major political, educational, financial, cultural and research centers.

As part of a larger project to improve mission operations, the Innovation Center, an existing office annex at the U.S. Embassy in Helsinki, was recently renovated and modernized to achieve LEED Platinum certification.

The design architect for the project was the Santa Monica, California-based architecture firm Moore Ruble Yudell Architects and Planners. The project architect for the B.L. Harbert International design-build team was Washington, D.C.-based Page.

M&H's engineering team created energy-efficient strategies for this 2563 square meter (sm) facility, originally built in 1915 in a region with a challenging climate and a site with significant bedrock.

The U.S. Department of State, Overseas Buildings Operations goal was to reduce short-term and long-term operating costs for future occupants in a high-performing building. Energy cost reductions of over 46%, exceptional as compared to an average savings of 24% for OBO's 20 LEED certified posts, and water consumption reductions exceeding 30% have made that goal a reality.

This project is a shining example of how eco-diplomacy is also cost effective design. The $20.9 million Innovation Center renovation was completed on budget while also meeting an aggressive 14-month design and construction schedule, and exceeding contract sustainability goals.

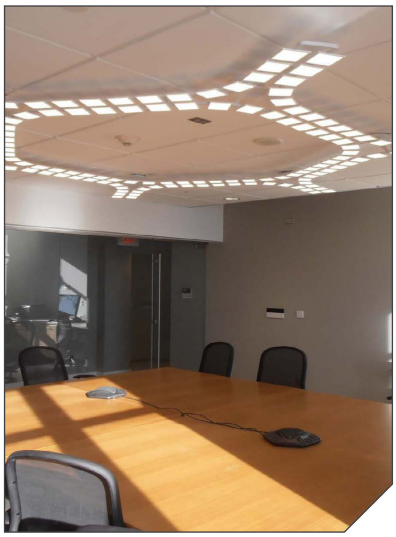
The Innovation Center exemplifies the principles supported by the Department's Greening Diplomacy Initiative and now serves as a model for eco-diplomacy.

THE CULTURE

The ambassador's experience working and living in Helsinki helped shape the project in that he truly understands the high priority the local population places on sustainability, and was able to convey this at the outset of the project. The design team embraced this shared experience and tailored the design in accordance with local customs.

For example, the City of Helsinki has a strict building code regarding site lighting design. They allow no exception to their building code for light spill off the site, and expect for the compound to maintain the look and feel of the surrounding neighborhood.

The client was respectfully willing to make concessions in regard to this point in order to satisfy the City. Detailed analyses informed a lighting solution that meets the needs of US and local governments, as well as the embassy's neighbors, while further reducing energy consumption for site lighting. The result is a creative design that provides sufficient light inside the perimeter wall for proper operation



// Meeting room - interior view

(Images courtesy of Page)

of cameras and security devices, while not exceeding the local building code lighting limits.

The team achieved LEED SSc8 Light Pollution Reduction, a credit other projects typically do not pursue as it directly conflicts with physical security requirements.

Locals are accustomed to natural ventilation, and typically do not use air conditioning. This societal norm was observed in the selection of building systems, specifically the connection to the district energy system and maintaining operable windows to provide both natural ventilation and access to the outdoors.

In an effort to make sure the project fit well within the context of the surrounding community, the architecture of the historic building was respected. Only minimal changes were made for security, and those changes were well disguised to blend with the existing architecture.

Other challenges involved transforming the architecture of a building designed nearly 100 years ago, so that despite the modernization and addition of high-performance strategies, the building maintained its contextual relationship to the neighborhood.

THE CHALLENGE

Given the aggressive pursuit of energy efficiency in Helsinki, Ambassador Bruce J. Oreck pressed the design team to achieve LEED Platinum. The project benefited from the Ambassador's energetic involvement, as he personally met with OBO at the initial stages of the project and suggested ideas based on his experiences living and working at the post.

The Ambassador's vision set the tone and with OBO's leadership the design resulted in the Department's first LEED Platinum certification.

BUILDING REUSE

A goal for the project was to maintain as much of the existing structure as reasonably feasible, with the understanding that the most sustainable building is the one that's already built. From the outset of the project, the design team determined that the building exterior, including its wood-framed, operable windows, would be reused. Upgrades to the façade were identified for improved energy efficiency, though it was understood that the exterior appearance of the building was non-negotiable and needed to be maintained.

The integrity of the existing exterior wall structure soon posed a design challenge when a local consultant performed an analysis of the exterior wall structure to assess the impact of several proposed strategies for insulation to improve building energy efficiency, and ultimately recommended against the use of any insulation on the interior face of the exterior walls. The overwhelming advice was to continue to heat the exterior walls from inside the building using the heating system, in order to prevent the formation of condensation that would breed mold and degrade the wall structure.

The team considered adding insulation to the exterior wall structure, but this was not pursued because of the need to maintain the exterior character of the building to the greatest extent possible. The final design included minimal alteration such as repairs to some of the existing ornamentation and the addition of a new integrally colored cement plaster surface.

Mechanical systems were re-engineered to provide for the increased building envelope load without insulation. In the end, the team was able to reuse an impressive 64% of the original structure.

THE TECHNOLOGY

Tying into the District Energy System

The most significant contributor to the project's energy performance was the design team's decision to tie into Helsinki's remarkably efficient district energy system (DES). They have an extensive DES that serves over 90% of the city.

The district heating pipeline is approximately 1,300 kilometers (km) in length with a rated capacity of 3,244 megawatts (MW) and a heat loss of only six percent. The district cooling pipeline is 46 km long with 200 MW of connected load. Both systems make efficient use of the energy available to them.

The cooling system utilizes heat pumps, recycled black water, sea water from the North Sea, snow melt, and waste heat removal. Including fuel transportation losses, the DES produces heating with a COP of 3.33 and cooling with a COP of 5.8. This means that for every unit of energy that goes toward the production of cooling, 5.8 units of cooling are produced and for every unit of energy that goes toward the generation of heating, 3.3 units of heating are produced.

To help put this in perspective, the ASHRAE 90.1-2007 baseline chiller (meaning the acceptable standard efficiency) for a building of similar size has a cooling COP of 2.8 and a boiler heating COP of 0.8. The Finnish have built such a remarkable and well-working DES plant, that only one person monitors it on a day-to-day basis.

Unique Application of Energy Modeling Software

The design included the unique application of energy modeling software to accurately represent the dynamics of the building's natural ventilation system. Energy savings are typically demonstrated through an energy model that simulates how a building responds over the course of a year. Not all energy modeling software packages have the capacity to model bulk airflow in a physically realistic manner.

M&H's Building Sciences Studio modeled each window in the Innovation Center to open and close both independently and proportionally based on indoor temperature, outdoor temperature, and wind speed. The model is based on minute-by-minute data gathered over the course of an entire year. As a result, the model provides a realistic representation of the natural ventilation scheme.

Advanced modeling was used to verify that natural ventilation would be sufficient to maintain occupant comfort criteria throughout the year. It also provided the analysis necessary to verify M&H's compliance with LEED credits such as EAp2 Minimum Energy Performance, EAc1 Optimize Energy Performance, IEQp1 Minimum IAQ Performance, and IEQc7.1 Thermal Comfort – Design.

Use of LED Lighting

Early in the project, the design team identified interior and exterior lighting as an opportunity to reduce energy consumption and address chemicals of concern within the building. Light emitting diode (LED) lighting was chosen for its energy efficiency and because LEDs contain no mercury.

The Innovation Center is now the first U.S. diplomatic building to be fully

The project is the first LEED Platinum certified U.S. embassy in the world.

equipped with LED and organic LED (OLED) interior and exterior lighting. The interior and exterior lighting energy consumption is 40% lower than the baseline building model.

The application of LED lighting contributes to energy savings in support of LEED EAc1 Optimize Energy Performance. Additionally, the project meets the criteria for LEED Operations and Maintenance credit MRc4 Sustainable Purchasing - Reduced Mercury in Lamps.

ADVANCING DESIGN

Successful Application of the Sweden Green Building Council Guidance

M&H was the first U.S. design firm to successfully apply the Sweden Green Building Council (SGBC) guidance document titled "Treatment of Scandinavian District Energy Systems in LEED – Energy Models for EA credit 1." The document provides a clear procedure for capturing the efficiency and environmental benefits of a DES in an energy model using an energy rate differential calculation.

This approach to modeling the DES was approved by the U.S. Green Building Council for use on the project as an alternative to the standard methodology.

LEED Points

The points pursued were carefully coordinated and assessed for cost impact before including them in the final project design. The design earned all 19 possible LEED points for energy conservation (under EAc1 Optimize Energy Performance) and earned two additional LEED points for exemplary performance. This totaled 21 points for the Innovation Center from energy conservation alone, placing it on the path to LEED Platinum certification.

LOCAL RESOURCES AND ECONOMICAL SOLUTIONS

The design team specified locally available mechanical and electrical systems and equipment to the greatest extent possible. This keeps construction, operation, and maintenance costs down, while making the systems serviceable by locals who are familiar with them. The use of the DES is both cost effective and environmentally superior to the alternate fuel and energy sources considered, such as natural gas or electricity.

ACHIEVING PLATINUM

The collaborative efforts of the ambassador and design team led to the achievement of LEED Platinum certification for the Innovation Center under LEED 2009 New Construction, exceeding the contract requirement of LEED Gold and aligning local sustainable practices with the Department's environmental design goals.

As the first overseas U.S. diplomatic facility to achieve LEED Platinum certification, the Innovation Center serves as a model for eco-diplomacy. It represents the U.S. government's commitment to designing environmentally conscious buildings across the globe.

Mason & Hanger has worked with the U.S. Department of State, Overseas Buildings Operations since 1982 and has completed more than 300 international projects in 163 countries.

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