

## LEED IMPLEMENTATION STRATEGY FOR NEW SONGDO CITY INTERNATIONAL BUSINESS DISTRICT DEVELOPMENT, REPUBLIC OF KOREA

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### Abstract

This paper will share the LEED (Leadership in Energy and Environmental Design) implementation strategy for New Songdo City International Business District Development, Republic of Korea, which includes the first LEED-registered projects in Korea.

This 1500 acre private development of 350 buildings is a master-planned new city of commercial, institutional, retail, and residential facilities. It is a LEED-ND (Neighborhood Development) Pilot Project. The introduction of LEED in Korea for this city, schematically designed in the US and constructed by Korean contractors, provides an opportunity to enhance the global market for environmentally sensitive design, construction materials and methods, and building operation.

The implementation strategy addresses LEED documentation, which is new to Korean designers, contractors, and materials manufacturers. Gathering materials data and incorporating a new system into an established construction culture is challenging. The strategy is developed within a framework of goals, organization, communications, education, research, knowledge management and execution, all aimed at client and team success in achieving LEED Certification in concurrence with Korea's Green Building Certification System (GBCS).

**Keywords:** US Green Building Council, LEED, Korean Green Building Certification System, New Songdo City International Business District Development, Gale International, PB

### 1.0 Introduction

Over the last decade many agencies and not-for-profit organizations have moved the design and construction industry closer to sustainable practices by pursuing means and methods to define Sustainable Buildings (SB). In order to get these SB-defining initiatives started, there has been focus on the supporting science, technical issues, and design criteria to create policy, standards, and regulations, which has resulted in programs such as BREEAM, HK-BEAM, Green Star, NABERS, CASBEE, Korea's Green Building Certification System (GBCS), and LEED.

Many conferences over the globe offer a platform for sharing information on SB programs; however, sessions handling the details of implementation of the programs are rare and conferences focused on implementation are even rarer. And it is no wonder; implementation of these systems is not tidy. The systems are often new and undergo change to reflect best practice and improvements based on prior utilization. The systems often leave room for interpretation and misunderstanding, and implementation of systems covering the project from conception to operation is labor intensive.

A private joint venture (JV) between US developer Gale International and Korean contractor POSCO E&C is developing a new city on a blank slate in the Republic of Korea.

New Songdo City International Business District Development (New Songdo City) is a master-planned, high-tech, international business center on 607 hectares (1,500 acres) of reclaimed land along Incheon's waterfront, 64 kilometers (40 miles) south west of Seoul and is to be connected to the Incheon International Airport by a 6-mile bridge, which is under construction as a separate project outside of the JV. New Songdo City, with an estimated cost of 25-30 billion USD, is the largest private development project ever undertaken in the world and a ten-year project. Consisting of a convention center, retail and residential mixed use, international schools, hotels, hospital, offices, retail space, cultural and leisure venues, and neighborhood development facilities, New Songdo City is in an International Free Economic Zone (IFEZ) to attract multi-national corporations and foreign direct investment. Three hundred fifty buildings, a canal, and a central park will comprise the city. The project is in the early stage of construction with six buildings underway.

While best-practice urban planning was utilized for the master plan and high-quality building designs were placed for bid, the JV decided to seek LEED Silver certification for each of the buildings in the city and concurrently achieve GBCS for the residential structures while the first buildings were in early construction. The city is also a LEED for Neighborhood Development Pilot Project which is not covered by this paper.

LEED implementation involves adherence to a specific SB standard across three phases: design, construction, and operation, and must maintain the overall web of connections through each of the phases for documentation and review for certification.

The design and construction effort to build New Songdo City spans two continents and embraces the best practices of the US and Korea. There are three milestones in the process. Design starts in New York, USA with master planning, programming, schematic design and design development. The end of design development is the first milestone as the effort is moved to Korea. Korean architectural and engineering firms transform the design development package into construction documents adequate for tender. Award of the construction contract to a Korean engineering and construction firm is the second milestone. Completion of construction, commissioning and hand-over is the third milestone which starts operation.

The U.S. Green Building Council (USGBC), a non-profit organization of industry leaders, has developed the LEED (Leadership in Energy and Environmental Design) Green Building Rating System to define green buildings in a quantifiable manner. There are several LEED programs that cover different building types including Existing Buildings, Core and Shell, Commercial Interiors, Homes, Schools, Retail, Neighborhood Development, and New Construction. Implementation of LEED for New Construction or LEED-NC will be the focus of this paper, although there are some buildings registered with the USGBC as LEED for Core and Shell (LEED-CS). LEED-NC has eight prerequisites, including the most recently membership-approved requirement for 14% improvement in energy efficiency over base-line ASHRAE 90.1-2004. The balance of up to 69 points can be obtained as the project allows covering five main areas of environmental impact: sustainable sites, water efficiency, energy and atmosphere, materials and resources, and indoor environmental quality. The team works together to reach certification on an ascending scale from certification to silver, gold, and platinum.

Buildings seeking LEED certification are first registered with the USGBC by the project's LEED Administrator. For New Songdo City, these US-based designers are called LEED Facilitators. They handle the LEED Administration from registration to certification through USGBC's LEED-Online website, assigning documentation duties to responsible team members. After the project is registered, the project team must document per LEED and submit the documentation to the USGBC using LEED-Online. Designers, contractors and the JV will be involved in the documentation process by either tracking or uploading data directly to LEED-Online or providing documentation to those that upload. When the documentation process is complete, the LEED Administrator submits the application to the USGBC. If approved, the project will be

LEED Certified. By mid-2007, there were nearly 8,000 commercial and more than 6,000 residential LEED-registered buildings. More than 1,000 of those are LEED certified but only 44 are certified platinum, according to the USGBC.

The Korean Green Building Council (KGBC) was founded in 2000 and is a non-profit organization centered on promoting sustainable buildings. By the end of 2000 the Green Building Certification System, (GBCS) was established. Most residential buildings at New Songdo City will be certified under GBCS. GBCS implementation will not be covered by this paper.

PB is one of the world's leading planning, engineering, and program and construction management organizations and is headquartered in New York, New York. PB is contracted to perform combinations of construction management and construction services for four of the six buildings under construction. PB's CM and CS roles will not be discussed in this paper. In spring of 2007, PB was approached by the JV to direct the LEED documentation process for the construction side including researching construction materials and methods and educating the Korean design and construction team on LEED for all projects in New Songdo City.

PB's LEED Project Director joined the regularly occurring LEED coordination meetings at Gale International in New York in April of 2007. Those meetings turned into a focused team called the LEED Advisory Committee whose purpose is to keep the project moving forward on big ideas and identify challenges that need to be addressed through other venues. The LEED Advisory Committee meets bi-weekly via conference call and approximately every month at live meetings.

As the need for focused research and team coordination grew, PB added a LEED In-country Coordinator as full-time staff to the New Songdo City project office. This person supports the LEED Project Director and provides guidance to two support staff, LEED In-country Deputy Coordinators.

## **2.0 Opportunity Comes with Challenges**

The opportunity at hand is to participate on an international team to realize the JV's desire to achieve LEED-ND certification for a new city with all buildings certified by the USGBC. This has not been done before. The combination of LEED-ND and LEED-NC is new to the USGBC, this large-scale LEED-NC registration by one owner is new, and LEED in Korea is new.

The challenges of LEED implementation for New Songdo City are complex. Using LEED for the first time in Korea, concurrent implementation of LEED with three tiers of design and construction, the decision to use LEED after ground breaking, and the intersection of cultures and languages builds upon one another to create a situation that calls for deliberate means and methods for team organization to meet LEED implementation.

*Using LEED for the First Time in Korea.* LEED is not vague in its requirements for materials and methods documentation. Asking a contractor to use an eco-friendly product is not enough to reach LEED certification. The designers must conceive their buildings with available materials in mind, and write the specifications in a way that will procure materials that meet LEED criteria. The team should make certain that there are at least three vendors of each product available in Korea so that a competitive bid is received.

At New Songdo City, the material and methods need to be understood on two levels. First, for the buildings that are in construction, and secondly for buildings that are still in design in the US. This second level ties into the work being done by YRG Sustainability Consultants, commissioned by Gale International, for a LEED guidebook that will be delivered to third-party developers to guide them in reaching LEED certification for their buildings.

When PB's LEED Project Director was brought on board, the challenge of identifying suitable materials was evident. It is customary for LEED projects to procure materials that are extracted, processed and

manufactured within an 804 kilometer (500 mile) radius to support local industries and reduce transportation. It was not known what materials were available in Korea namely with documented data on Solar Reflectance Index, plumbing fixture water flow, refrigerants for HVAC and fire suppression materials, recycled content, materials harvested within a ten-year cycle, and VOC (volatile organic compound) content for adhesives and sealants, paints and coatings, carpet systems, and composite wood and agrifiber products.

Under PB's direction, the Construction Materials and Methods in Korea (CMMK) research encompass construction and operation methods with respect to LEED such as the proper approach for construction activity pollution prevention and construction waste management and availability of Renewable Energy Certificates (RECs) for green power. A recently added feature of the CMMK spreadsheet is a tab for every LEED credit that captures the lessons learned by the entire team.

The difficulty of a US-based CM team extracting product data from manufacturers for the CMMK was identified early. In Korea, products are certified by the government for use in construction. Once certified, there is no need for product data sheets unlike the US market where all manufacturers have prepared data sheets for use by designers and contractors. An unexpected cultural challenge emerged. The Korean CMMK research team has been ingrained with the idea of certified products and it was very difficult to explain the need for the product data. Researchers were discussing a Memorandum of Understanding (MOU) between a Korean certification organization and international parties as method to reach LEED product certification. It was explained that LEED is a certification process for an entire building system and is not concerned with certification of products. Of course, for every rule there is an exception as found in LEED's requirement for Forest Stewardship Council (FSC) certified wood, the Carpet and Rug Institute Green Label Plus certification program and in Green-e certified RECs.

Korea does have a certification program that is useful in gathering lists of potential products. The Korea Eco-products Institute has established the Eco-Label program. This program identifies criteria used to analyze the qualities of the products. Certified products are added to an online-database. The standards and list of product categories are available in English, but the detailed information required by designers in the US such as product name, contact information, and specifics of the product is in Korean. This led to the clear need for an international effort for the CMMK.

The Korean design and construction teams went into the development with the understanding that the projects would be designed in English in the US and translated in Korea and assigned personnel accordingly. When those teams were brought onto the project, there was no discussion of LEED since it had not yet been embraced by the JV. When the JV started to discuss the implementation of LEED, there was a sense of panic from the Korean team since they perceived that they would be doing more to comply with an unknown SB rating system, and rightfully so; LEED documentation does add to the construction documentation although it is interwoven into the drawings and specifications. In this case, since LEED was adopted after groundbreaking, it is unfortunately viewed as a separate, resource consuming program that competes against the design and construction duties. This challenge required an implementation strategy that is not only physical, but handles the emotional charge of the situation.

*Concurrent Implementation of LEED with Three Tiers of Design and Construction.* There are three tiers of projects: Tier 1 includes buildings that are currently under construction. Tier 2 includes buildings that are currently in the design stage in Korea and will be moving toward the construction stage, and Tier 3 includes buildings that are in the conceptual design stage in the US. The approach for requests for information and documentation of research findings must be clearly understood in relation to the tier structure. For example, a request for an update on available materials from the contractors is typically much more time-sensitive than requests coming from the US design team for buildings that are not expected to reach the construction contract stage within a year. Tier one projects have held LEED kick-off meetings and several full-days of LEED workshops were held in late August 2007 to accelerate the LEED process. These workshops were followed by shorter LEED workshops for each building.

*Using LEED after Ground-breaking.* Most LEED projects are programmed with LEED in mind, providing the design team ample time to integrate LEED requirements into the construction documents. The front end of the specifications contains Section 018113, Sustainable Design Requirements, which describe the submittals

required by the contractor; The LEED Action Plan provides the contractor with a platform to propose how LEED will be achieved and also allows the design team to provide feedback and guidance; the LEED Progress Report updates the Action Plan with each Pay Application; and, woven within the full specifications are LEED Documentation Submittals to cover continuous metering product data, waste haul tickets, recycled content for products, regional materials product data, construction indoor-air-quality management plan, building air flush-out procedures, adhesives and sealants product data, carpet product data, paints and coatings product data, and composite wood or agrifiber products product data. LEED submittals are reviewed under the same process as any other submittal.

The construction at New Songdo City is fast-track and resembles design-build. When the JV decided to have all buildings LEED Certified, it was understood that it would take place in the form of Potential Change Orders (PCOs) because the original contract documents do not contain references to LEED and need to be amended via the implementation process. Fundamental building commissioning is a pre-requisite to LEED. In order to get a commissioning agent (CxA) on board quickly, the JV asked the engineers of record of the commercial buildings to be the CxA of the residential buildings and the engineers of record for the residential buildings to be the CxA of the commercial buildings. The contract for CxA services on the construction side is yet to be determined.

*The Intersection of Cultures and Languages.* It is a serious challenge when an entire city is selected to be LEED certified in a country that has no experience with LEED and has a different construction management system and another language.

The Lonely Planet guidebook explains that Korea is a Confucian nation with roots established in 2333 BC. The results of centuries-old behavior based on strict guidelines that call for high-levels of respect to be paid to men and the elderly makes following loose guidelines from outside of the Korean relationship hierarchy difficult. There is no denial that the Koreans take great pride in their strong work ethic and ability to survive against the odds. There is pleasure taken in team success though the risk of making mistakes along the way can often freeze the potential for junior staff to initiative problem solving without a supervisor's direction. The Asian culture of keeping face and not outdoing one's superior is to be found in Korea and from the US point of view is a limiting factor.

US team members are generally less structured and thrive on system flexibility. American slogans such as "Good old American Know-how" and "Necessity is the Mother of Invention" epitomize the US approach to the project. The team moves forward and when an obstacle is found, all are encouraged to offer ideas to overcome the issue at hand. Senior level staff appreciates junior staff taking initiative and generally encourages the spirit of entrepreneurship and rewards accordingly. A team leader of a group of successful individuals looks good in the American system. Pride is found in being a member of the team that reaches success. The work ethic may be characterized by being enticed to participate in projects that make positive changes or provide a personal connection to the worker. The US is considered to be a very young and inexperienced country at just over 200 years old and somewhat of a child compared to ancient cultures such as Korean.

### **3.0 A Successful Implementation Strategy**

A successful implementation strategy transforms challenges into building blocks. Gathering materials data and incorporating a new system into an established construction culture is challenging.

*The LEED Implementation Strategy.* New Songdo City has a long term action plan to achieve LEED certification for 350 buildings. The plan integrates the efforts of teams on two continents to document the LEED criterion during design and construction. The three core elements of the plan are captured in the verbs: Align, Know, and Do.

Align the organization of the team to accomplish the work. Task organization tailors the team to meet the needs of the projects. This framework establishes the line of communication and supervision and is flexible, adaptable, expandable, and customized.

Know how and where collaboration, coordination and communications occur. Tracking and visibility are critical to sustain focus. Focused efforts lead to results and success.

Do the work that needs to be done. Well-defined steps executed consistently in sequence accomplish the work allowing for reproduction of results.

#### 4.0 Discussion

Comparison of measurements and standards brought unforeseen complications. For example, when the CMMK team researched the VOC levels of adhesives there was no equal basis between LEED and Eco-label. LEED measures VOCs in grams per liter, while the Eco-label certification standard *EL251. Adhesives* notes that qualified products have VOC levels at 0.1% of weight or below. This means that for the researchers to be sure about the LEED applicability of an adhesive, they either need to get the g/l information from the manufacturer, or find out what the weight of each Eco-label product is to determine the maximum amount of VOCs to convert to the LEED measurement. The sales staff does not have product data information and referred the CMMK researcher to the manufacturers' research and development (R&D) department. The manufacturers' R&D staff is mostly unwilling to provide data for their proprietary products. In their defense, the products are certified by the Korean government and possibly Eco-label, so there should be no question of the quality of products. The activity of selecting potential products to convert to the LEED measurement is time consumptive, but for instances where inquiries of the team has been fruitless, they have chosen to convert the VOC levels to LEED equivalents to support the JV's goal for LEED certification.

*Align.* In order to inform and invite the engineering and construction (E&C) teams to join the CMMK, PB's LEED Project Director presented *LEED Program Management for Construction* at New Songdo City to representatives of the JV, construction managers, construction supervisors, and contractors. At the end of the meeting, each company selected one person to join the newly founded CMMK team and has since worked to further develop the CMMK spreadsheet started by PB. This research is then a shared resource between the US and Korean teams for all phases of the projects, linked by the LEED Project Director who acts as a bridge.

*Know.* The decision to use LEED after ground breaking raised a challenge concerning low-flow plumbing fixtures. The residential show rooms were constructed before LEED was adopted for the projects. Units have sold with the understanding that the owners would receive what they saw in the show room. Changing the materials of the units would require a change to contract, which is a complex issue that the JV did not want to administer. Tracking and visibility of the CMMK gave the team the understanding that fixture flow was of interest to others, and allows a platform for identifying the conflict for the construction team and recording data on the most efficient fixtures for projects to be designed. Tracking and visibility encourages the team to think clearly and then anticipate, simplify, coordinate, and recommend.

*Do.* Education is a large part of the implementation plan. On-the-job training is the primary technique for becoming an effective practitioner. "Learn by doing" is the reality of the implementation strategy. LEED Accredited Professionals (AP) are recognized by examination of a defined body of knowledge through the USGBC. The LEED APs know that successful LEED implementation is in parallel to and embedded in existing design and construction protocols. The LEED APs at New Songdo City conducted the LEED workshops to provide a tailored approach including project-specific details and Korean translation.

After the workshop, the Korean team is ready to systematically collect documentation to support verification. LEED credit templates organize the information used in verifying a prerequisite or credit. Additionally, supporting documentation is organized and collected for reference, all using LEED-Online.

Education and application of the criterion eliminate the anxiety of the unknown. Application of the criterion, documentation, submission and verification reinforce the understanding that LEED process implementation techniques are easily embedded in existing design and construction practices.

*Communication.* The team language on both the US and Korean side is English. Contracts are signed in English, but executed via plans, specifications, and submittals in Korean to accommodate the majority of

laborers. Several established forms of electronic communication exist, and some are in flux. There is no central system that allows all team members access across the time frame of the development.

In the US, Gale International has an in-house server that allows knowledge transfer within their organization. Information that is to be shared with and among the LEED Advisory Committee is currently uploaded to a simple FTP site that has a basic folder structure that is pliable by all members of the community. There is no notice application or ability to hold threaded discussions. To answer the call for a more robust system, PB instigated their secure proprietary system, ProjectSolve<sup>2</sup>, which features remote access, group communications, file administration, on-line meetings that share desktops, and notification of uploaded information with direct live links. Gale International made the decision to house the LEED Advisory Committee data on their own system in order to maintain complete ownership. This system is under development and is not complete at the time of delivery of this paper.

The Korean design and construction teams use a sophisticated PMIS managed by Doalltech, which allows for a wide variety of organizational techniques based on a pre-planned documentation and dissemination structure. Attributes include a calendar with meeting invitation and acceptance capabilities, email, mail with pre-set forms, a quick-glance schedule, document upload, document approval processing functions, and project organizational structure that includes names, contact information, and photos of the individuals. PB met with Gale International Korea (GIK) and Doalltec to recommend the incorporation of LEED into the PMIS. A LEED tab was added to the core of the PMIS, which is consistently shown in all applications. The LEED tab hosts a LEED home page that will contain a pull down list of the LEED registered buildings, resource hotlinks to the USGBC, *Introduction to LEED* presentation, standards used by LEED, the LEED programs in English and in Korea, the CMMK research file, and templates for the contractors to streamline the requirements of the specifications.

*CMMK.* The CMMK team sends information to PB's LEED Project Director to include in the spreadsheet. It is currently housed within PB's server, but will be housed on the PMIS once LEED formatting is complete. All parties will be invited to provide updates to the spreadsheet as information is gathered. The results will be copied to the LEED Advisory Committee server for utilization.

*LEED Implementation.* For Tier 1 projects, there are two conditions for LEED implementation. One adds specifications for LEED implementation, and the other involves design changes and the additional specifications for LEED implementation.

For both conditions and for each project, the design team has submitted a draft LEED Checklist for Korean review. Specification Section 018113, Sustainable Design Requirements will be edited to reflect the LEED prerequisites and credits that are to be achieved and provided to the contractors as a PCO. For projects with design changes, the designers will also provide sketches and supplemental information for LEED compliance. For both conditions, the contractors will submit their comments. Under agreement, the contractor will then submit to Section 018113, Sustainable Design Requirements with the LEED Action Plan as a first step for Owner's review for acceptance. Once the LEED Action Plan is accepted, it will be updated as the LEED Progress Report in concurrence with the Interim Payment (IP). As the job progresses, LEED continuous metering product data, waste haul tickets, recycled content for products, regional materials product data, construction indoor-air-quality management plan, building air flush-out procedures, adhesives and sealants product data, carpet product data, paints and coatings product data, and composite wood or agrifiber products product data will be collected.

## **Conclusion**

LEED implementation for New Songdo City is a full-time effort due to magnitude, the introduction of a new SB program in Korea, transfer of US design to Korean construction, and language and cultural challenges. It takes effort to bring obstacles to the attention of the team for quick resolution and to prepare the way for a smoother path for projects yet in design. This 1500 acre private development of 350 buildings is a master-planned new city of commercial, institutional, retail, and residential facilities. The introduction of LEED in Korea for this city, designed in the US and constructed by Korean contractors, provides an

opportunity for the Korean team to enhance the global market for environmentally sensitive design, construction materials and methods, and building operation. LEED is internationally recognized and Korea is getting ready to be leaders in this global program.

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