SUSTAINABLE REAL ESTATE DEVELOPMENT CONFERENCE 2009

26TH NOV 09

Lotte Hotel Seoul | Seongdong | Crystal Ballroom
November 26, 2009 | 09:00 – 18:00

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A deep knowledge of the local market is always important, but these days the experience of someone who’s seen more than one market cycle is even more valuable. Together, they lead to measured judgment in assessing markets, analyzing opportunities and making smart real estate decisions. When investors choose ING Real Estate Investment Management (REIM) as their investment partner in Asia, they benefit from 13 years of on-the-ground experience in the region.

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For more information, please contact Eduard Wehry, Head of Institutional Clients Asia on +852 2848 8488 or email eduard.wehry@ingrealestate.com

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\[\text{EU Chamber of Commerce in Korea Real Estate Committee}\]

Introduction
Since the opening of the Korean real estate market in 1999, the Korean market grew rapidly especially with foreign investments. In particular, Korea has recently seen increasing real estate investment opportunities from European countries. For that reason the Real Estate Committee was set up within the The European Union Chamber of Commerce in Korea (EUCCSK) to represent and raise awareness of foreign Real Estate companies in Korea.

REAL ESTATE COMMITTEE
The Real Estate Committee (REC) of The European Union Chamber of Commerce in Korea is one out of the 27 industry-specific working committees. REC has become the leading representative body for foreign real estate companies in Korea and was established in November 2006.

Objectives
EUREC's major objectives are to:
- Find reliable local partners for foreign real estate companies.
- Create awareness of foreign real estate companies.
- Improve the business environment for members by facilitating the dialogue between the real estate industry and the different arms of the central government including the Ministry of Land, Transport and Maritime Affairs, Ministry of Strategy and Finance, Financial Supervisory Service, Financial Services Commission and the local governments, etc.
- Provide accurate and better information to foreign Investors.
- Unify and stimulate growth of the industry via the creation of a representative body.

Activities
The Real Estate Committee engages in a variety of activities to reach the Committee’s objectives. The activity scope involves:
- Reviewing and recommending foreign-friendly policies to government departments.
- Arranging meeting with high and middle rank government officials who are in charge of real estate policies from relevant ministries.
- Arranging business meetings for members and hosting monthly luncheons and seminars with industry professionals and high-rank government officials.
- Hosting exclusive social gatherings for excellent networking opportunities.
- Providing monthly Informag Real Estate Magazine to inform about up-to-date changes in regulations, compliance requirements, theories, laws, projects and market trends.

HOSTED BY:

In October 1978, the Korea Research Institute for Human Settlements (KRIHS) was established to address spatial policy issues. With the enactment of the Act on the Establishment, Management and Promotion of Government-Sponsored Research Institutes in 1999, KRIHS has become one of research institutes under the supervision of the Korea Council of Economic and Social Research Institutes (KCESRI) which is a supervisory body specially created to oversee these research institutes involved in the fields of economics and social studies under the Prime Minister. The main tasks of KRIHS are to develop long-term and short-term plans and policies to lead to more efficient use of land resources and to restructure imbalanced spatial structures. KRIHS carries out various research projects in the areas of national territorial development, environment, regional and urban development, infrastructure, land use, transportation and geographical information system. As of June 2008, KRIHS has 133 professional research staff members including 81 senior researchers holding doctorate degrees or equivalent degrees, 52 researchers along with 19 administrative personnel.
SESSION 1: PROSPECTS OF KOREA

Moderator: MR. SANG-HOON LEE
Director, International Cooperation Division, Ministry of Land, Transport and Maritime Affairs

9:45 – 10:05
Introduction to the Concept of the Important Urban Development
MR. BRIAN NEWMAN
Co-Founder & CEO Green Cities Asia Ltd

10:05 – 10:25
Sustainable Urban Development Policy & Practice in Korea
MR. IL-HONG CHOE
Ph. D., Senior Research Fellow, Korea Land & Housing Corporation (LH)

10:25 – 10:45
Climate Positive Development Program – Why Climate Positive?
MR. HEE-SONG LEE
City Director – Seoul, Clinton Foundation

10:45 – 10:55 Q&A

SESSION 2: MEASURING SUSTAINABILITY

Moderator: MR. KWON LEE
Co-Chairman of EUCK Real Estate Committee

10:55 – 11:15
Green Building Promotion and Certification System
MR. SEOUNGHO KIM
Senior Deputy Director, Architecture Planning Division, Ministry of Land, Transport and Maritime Affairs

11:15 – 11:35
Benchmarking Green Building Certification Systems

MR. SEASON JOHNSON
RA, LEED AP, LEED Program Director, Perkins Will, Korea

SESSION 3: INVESTING IN GREEN

Moderator: MR. JIN YOUNG CHOI
Managing Partner, Dragon Asia

12:50 – 13:50
Panel Session: Return on Sustainability (ROS)

Moderator: MR. JIN YOUNG CHOI
Managing Partner, Dragon Asia

Panelist:
MR. BRIAN AHN
Country Manager, ING Real Estate Investment Management
MR. BRIAN NEWMAN
CEO, Green Cities Asia Ltd
MR. SEASON JOHNSON
RA, LEED AP, LEED Program Director, Perkins Will, Korea
MR. SEASON JOHNSON
RA, LEED AP, LEED Program Director, Perkins Will, Korea

SESSION 4: SMART GREEN DESIGN

Moderator: MR. STEPHEN SAUL
Chairman, Jones Lang LaSalle Korea

14:40 – 15:00
The Importance of an Integrated/Holistic Design Approach to Optimizing Sustainability Outcomes

MR. MATTHEW JESSUP
Principal – Group Environmental Leader, WSF Lincoln Scott Pty Ltd

15:00 – 15:20
Green Building Design – Implications & Future Trends

MR. YOUNGO CHOI
Ph.D., Senior Architect, Samoo Architects

15:20 – 15:40
Retrofitting Buildings – How Green Should You Go?

MR. KE JEEON
Head of Asset Management, ING Real Estate Korea

15:40 – 16:00
Q&A & Wrap-Up
SESSION 1:
PROSPECTS OF KOREA

INTRODUCTION TO THE CONCEPT OF SUSTAINABLE URBAN DEVELOPMENT

Guest Speaker:
MR. BRIAN NEWMAN
Co-Founder & CEO of Green Cities Asia Ltd

Brian Newman has gained over 20 years senior executive experience in the field of large scale urban development having worked for industry leading organisations in Australia, North East Asia, South East Asia and the Middle East. His academic qualifications include a degree in Civil Engineering and a Masters Degree in Business Administration.

Mr Newman has held the following positions in his property development career:
- Managing Director - Portman Holdings Korea Development – Atlanta/Seoul
- CEO - Sydney Olympic Park Authority – NSW Government, Sydney
- CEO - Dnax Properties – Dubai
- CEO - Urban Change Corporation - Sydney
- CEO - City West Development Corporation – NSW Government, Sydney
- Managing Director – Nusajaya Development Sdn Bhd – Kuala Lumpur
- State Manager - Land Lease Development – Sydney

Mr. Newman brings a unique blend of private and public sector experience and knowhow to his work. As CEO of the Sydney Olympic Park Authority he led the post-Olympic transformation of Sydney’s Olympic precinct to create a new urban township that embraced the same commitment to sustainability that gave Sydney its international Green Games’ reputation.

Mr. Newman is a former Board Member of the Greater Western Sydney Economic Development Board, the Sydney Convention & Visitors Bureau (SCVBI) and Sports Knowledge Australia. He is currently Chair of the European Union Chamber of Commerce Korea’s Sustainable Development Working Group.
Best Practice in Sustainable Urban Development

"Introduction to the Concept of Sustainable Urban Development"

Brian Newman  BEng MBA
Co-Founder & CEO Green Cities Asia Ltd

SUSTAINABILITY – A CONTEXT FOR OUR INDUSTRY

• CORPORATE LEVEL
  - Global
  - Shareholders
  - Employees
  - Community

• PROJECT LEVEL
  - City/Community Level
  - Private space
  - Building Level

Critical Success Factors
• Sustainability must be embraced within the corporation if it is to be successfully applied at the project level.
• Success requires inspiring and committed leadership from the top to 'make a difference'
• Staff must be engaged in the process – localize a sustainable culture
• Companies must ‘Walk the Talk’!

SUSTAINABLE DEVELOPMENT – THE ACCEPTED DEFINITION

Sustainable development is development that ‘...meets the needs of the present without compromising the ability of future generations to meet their own needs’


THREE PILLARS OF SUSTAINABILITY

Environmental
- Energy management
- Waste management
- Traffic/transport
- Water management
- Green space
- High performance green buildings
- Materials selection
- Bio-integration
- Eco-effectiveness (LEED/BCMRD)
- Design by Disassembly (DBD)

Social/Cultural
- Public health
- Sense of place
- Social diversity
- Housing diversity
- Community structures
- Security
- Social services
- Recreation facilities
- Education
- Smart community

Economic
- Economic development strategy
- Mixed-use activities
- Natural competitive advantage (reason for being)
- Commercial/financial viability
- Governance
- Construction jobs & training
- Skills match
- Green infrastructure
- Technology - Connectivity
SUSTAINABILITY & CSR
— A CONTEXT FOR OUR INDUSTRY’S SOCIAL RESPONSIBILITY

The CSR Framework:

- 50% of humanity now live in urban areas
- This figure expected to reach 70% by end of century
- Cities produce 80% of all global GHG
- 44% of the world’s energy consumption relates to buildings
- Co2 emissions have risen nine-fold since 1963
- Climate scientists believe we must cut emissions by 60% by 2050

LOW CARBON GREEN GROWTH

- Mainly environmental agenda
- Energy focused – CO2 reductions
- “Green” generally means green space — parks, green roofs etc
- Mainly measured in CO2 terms
- Economically driven – planning market driven
- Icons: wind turbines & solar panels

SUSTAINABILITY

- Broadly bases agenda of social, environmental and economic objectives
- New paradigm in approach/thinking
- Holistic, integrated approach
- Clear, multiple measures
- Planning framework critical
- Icons: quality of life; better future

‘ONE PLANET LIVING’ & the ‘ECOLOGICAL FOOTPRINT’

The premise of One Planet Living is that if everyone in the world depleted its natural resources at the same pace as (say) Europe or the UK, we would require 3 planets (“Earths”) to satisfy the demand.

In the case of North America, this number is 5 planets!!

To live sustainably on this planet alone, the world’s population must achieve an average carbon footprint of about 1.5 global hectares (GHa) per person compared to a current UK average of 5.4 GHa/person.

WE ARE EXPERIENCING A PARADIGM SHIFT IN THE URBAN DEVELOPMENT INDUSTRY AS WE MOVE FROM:

Industrial Age      |      Ecological Age
Biophobic Approach  |      Biolytic Approach

Our approach to urban development today is based on ‘New Urbanism’/’Smart Growth’ thinking with a deep green consciousness that redefines how we intend to balance/integrate the human and built environments to sustain man’s existence on the planet.
BEST PRACTICE IN SUSTAINABLE URBAN DEVELOPMENT

Large scale – cities/towns/urban villages

• Offer the best opportunity for holistic solutions that optimize outcomes.
• Very few executed examples of ‘best practice’ community developments at this scale.
• Northern Europe well ahead in its understanding of sustainability at this scale esp Germany, Sweden, Denmark.
• Globally, there’s a new generation of exciting green projects awaiting implementation or underway.
• Details still sketchy regarding how the 16 Climate+ projects will achieve their energy focused goals.
• Masdar City (Abu Dhabi) clearly the new benchmark, but economics for wider application are still in doubt.
• Performance measurement systems still developing

BEST PRACTICE IN SUSTAINABLE URBAN DEVELOPMENT

Smaller scale – individual buildings – new and refurb

• The most common in type and number
• Revolution in design occurring which is recalibrating our notion of the building’s social, environmental, economic capacity.
• Business case for greening existing buildings becoming ‘easier’ with better cost/benefit data, changing attitudes, empirical evidence on health benefits, market demand, CSR etc.
• Globally, ‘A’ grade buildings will only be green buildings in future.
• Performance measurement systems well developed
• Korea still a slow adopter
The EcoCity – planning & design

Ecomasterplanning strives for a seamless biointegration of the human built environment and the natural environment.

...they are designed as ‘one living system’, not as a composite of the inorganic inert mass of the built environment, disconnected from its organic host (the biosphere).

Ecomasterplanning requires the bio-integration of four infrastructure elements, namely:
- the ‘green’ infrastructure ie. nature’s infrastructure or the ‘eco-infrastructure’
- the ‘blue’ or water infrastructure
- the ‘grey’ or engineering infrastructure (roads, drains etc)
- The ‘red’ infrastructure ie. the built environment, including human activities

ECODESIGN

The fundamental premise of ecodesign is the idea that you are designing in a way that imitates ecosystems – this is called ‘ecomimesis’ or ‘biomimicry’.

Advocates of ecodesign believe that the built environment must imitate ecosystems in all respects.

The outcome of eco-masterplanning is therefore a human-made ecosystem.

BEST PRACTICE PROJECTS – Hammarby Sjostad, Stockholm

Key Features:
- Passive design buildings
- Low energy use
- Low vehicle use – public transport
- Connectivity
- ‘Envac’ waste management - Biogas used to fuel bus transport and domestic stoves
- Solar energy supplementing grid power
- High QoL
- Site decontamination

Quality of Life!
BEST PRACTICE PROJECTS – Western Harbour, Malmo, Sweden

Key Features:

Environmental Sustainability
• High energy efficiency
• High biological quality
• Efforts to build healthy houses

Social Sustainability
• Disabled-friendly solutions
• Housing will be specially designed to make it suitable for all stages of life.
• Safety aspects are also prioritised.
• The urban layout will encourage lively outdoor movement and allow opportunities to look-out from homes onto passages and walkways.

Economic Sustainability
• The City of Malmö and developers will collaborate to keep housing costs down by building a high proportion of rental flats in Flag ghüsen.

BEST PRACTICE PROJECTS – Western Harbour, Malmo, Sweden

13 different projects are underway all of which share common fundamental sustainability features.

Key initiatives include:
• Good architectural design
• High levels of greenery
• Low use of energy that reduces costs for heating (120 kWh/sq.m. BRA temp/year)
• Healthy indoor environment as the buildings are built with moisture control
• The use of hazardous substances in building materials been minimised.

Application of the “Better for Everyone” plan that ensures that the apartments can still be used even when a person’s ability to move has become restricted.

BEST PRACTICE PROJECTS – Masdar City, Abu Dhabi

Key Initiatives:

• Revolutionary Personal Rapid Transit system that will move people, goods, supplies and solid waste
• Recover and reuse rainwater, condensate and other waste streams
• Maximize indoor air quality
• Carbon neutrality (saving >1 million tonnes pa)
• 100% utilization of bio-solids for energy and/or carbon sequestration
• Cultural/climatic urban design approach
• Decentralized car parking facilitating car free streets

Design Metrics:
- 6 km², walled city
- 40,000 residents, 1,500 companies
- 50,000 commuters per day
SUSTAINABILITY & ARCHITECTURE – THE GREEN FUTURE

‘Green architecture’ plays a vital role in achieving sustainable solutions in the urban environment. In this context, the following concepts will have a pervasive impact on the future of green architecture and green buildings:

• The idea that Architecture is becoming Meteorology – climate design
• The concept of Metabolism & ‘Cradle 2 Cradle’ Design
• The Material Future – the next revolution
• The architectural design philosophy of Ecomimesis – cities as organisms
• The building as an Energy Generator
• Urban acupuncture – incremental social knitting of cities
Sustainable Urban Development Policy & Practice in Korea

**Guest Speaker:**
**MR. IL-HONG CHOE**
PhD, Senior Research Fellow, Korea Land & Housing Corporation (LH)

**Education**
- 1983 B.A. in Landscape Architecture, University of Seoul.
- 1990 M.A. in Landscape Architecture, Graduate School of Environmental Studies, Seoul National University.
- 1999, PhD in Landscape Architecture, University of Seoul (Ph.D)

**Experience**
- A Lecturer at University of Seoul, Seoul National University of Technology
- Master Architect of Incheon Seochang Urban Development Project, etc.
- Project Manager of A Study on government guidelines for landscape plan, etc.
- Consultant, Environmental Planning and Design

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The current situation of urban development in Korea

**1960s**
- Industrialization and urban development started.
- The ‘Mapo’ apartment complex was completed for the first time.

**1970s**
- Serious housing shortages occurred in Seoul Metropolitan Area.
- Apartments became very popular as soon as it introduced.
- At the end of 1970s Gwacheon new town was planned which was the first one in Korea.

**1980s**
- In 1980 ‘Land Development Promotion Act’ was enacted.
  - Prescribed rapid acquisition and provision of land.
  - Many new towns were developed under the Act by the public organization such as Korea National Housing Corporation.
01 The current situation of urban development in Korea

1990s
- By the early 1990s, the first stage of 5 new towns were built.
  . located at 20kms away from the downtown.
  . adjacent the outer-ring road of Seoul.
  . They are Bundang, Sanbon, Ilsan, Pyungchon, Bucheon. New towns.

2000s
- The second stage of new towns are under construction now.
  . 30-40kms far from the downtown.
  . Dongtan, Pangyo, Y-eui, Paju, Kimpo, etc.
- About 600,000 housing units were provided every year.

Since 2002
- Focusing on urban regeneration,
  . 26 urban regeneration districts were designated.
  . Now the first stage of Eunpyung new town was completed.

In 2003
- Took actions for revitalizing undeveloped local municipalities.
  . 12 cities and provinces were selected as Innovation City.

  Innovation City is composed of advanced industries, R&D institutes and public organization from Seoul metropolitan area.
01 The current situation of urban development in Korea

- In 2003
  - The Sejong City is also under construction in the middle of the country.

02 An Overview of Korea’s Sustainable Urban Development Policy and Regulations

- 2000s
  - Environmental problems, social conflicts and lack of jobs has intensified due to urban developments.

  - In 2005 ‘Planning Standards for Sustainable New Town’ was issued.
    - It applies for New Towns with the area of 3.3 million m².

02 An Overview of Korea’s Sustainable Urban Development Policy and Regulations

- Korea’s ‘Low-carbon, Green Growth’ Strategy (15 August 2009)

  - President Lee Myung-Bak announced

    - ‘Low-carbon, Green Growth’ as a new vision to guide the nation’s long-term development.

  - 3 key objectives:

    - creating new engines of a higher and sustainable growth by developing low-carbon, environmentally-friendly industries.
    - ensuring climatic and environmental sustainability.
    - contributing to the international negotiations to fight climate change.
• The Presidential Committee on Green Growth (PCGG) (Feb. 2009)

  - drafts Korea’s green growth strategy and management plan.
  - makes major decisions on green growth policies,
    (such as target for reducing carbon emissions, and policy on the supply and demand of energy).
  - coordinates opinion upon green growth policy.

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• ‘Basic Law on Green Growth’ (Feb. 2009)

  - is in the legislative process.
  - is a paradigm shift to eco-friendly, qualitative growth.
  - supports and subsidies green technology and green industry.
  - encompasses tax benefits, the issuance of low-interest green bonds and the creation of a green fund.
  - proposes Korea’s greenhouse gas mitigation target, and it’s action plans.
  - introduces programmes educating about ‘green lifestyle’

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• The Korea’s Green Growth Strategy and Five-Year Green Growth Plan (July 2009)

  - is a concrete and operational policy initiatives from 2009 to 2013.
  - specifies future action plans on investments, target goals for each year.
  - proposes a set of 3 strategies, 10 policy directions and 50 core projects.

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<th>Policy directions</th>
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<td>Creation of new growth engines</td>
<td>2. Decrease energy dependence on oil and enhance energy self-sufficiency</td>
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<td>Improving quality of life and strengthening the status of the country</td>
<td>3. Support adaptation to climate change impact</td>
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<td>3 strategies and 10 policy directions in Korea’s 5-year green growth plan</td>
<td>4. Develop green technologies as future growth engines</td>
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<td>5. Greening of industry</td>
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<td>6. Develop cutting-edge industries</td>
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<td>7. Set up policy infrastructure for green growth</td>
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<td>8. Green city and green transport</td>
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<td>9. Green revolution in Lifestyle</td>
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<td></td>
<td>10. Enhance national status as a global leader in green growth</td>
</tr>
</tbody>
</table>
02 An Overview of Korea’s Sustainable Urban Development Policy and Regulations

- Urban Planning Guidelines for building Green City (July 2009)
  - Urban structure and land use plan to reduce fossil fuel consumption.
  - A paradigm shift to eco-friendly, qualitative growth.
    - expanding public transportation.
    - providing new and renewable energy.
    - promoting green buildings and green homes.
    - secure abundant afforestation to absorb CO₂ gas.

03 Sustainable Urban Development Practice at Korea Land & Housing Corporation (LH)

03 Sustainable Urban Development Practice at LH

  - applies to apartments more than 20 dwelling units.
  - a paradigm shift to eco-friendly, qualitative growth.
    - high heat insulation performance of window and wall.
    - use of high-efficiency products and LED lighting fixtures.
    - installation of new and renewable energy equipments, and rooftop planting.

- New & Renewable Energy Newtown: Pyeongtaek Sosabuel

- Area: 3,032,000 m²
- Population: 45,000 persons
- Dwelling units: 15,000
03 Sustainable Urban Development Practice at LH

- New & Renewable Energy Newtown: Pyeongtaek Sosabuel

New and Renewable Energy

- Fuel Cell
- Heat Pump
- Photovoltaic
- Solar Thermal
- Geothermal
- Wind Power

Detached House

- 759 dwellings
- Photovoltaic power: 20 m²/dwelling (1,518 kW)
- Solar Thermal: 6 m²/dwelling (4,554 kW)
- Annual production:
  - Electric: 1,828 MWh/yr (61%)
  - Heat: 2,040 MWh/yr (61%)

Schools

- 4 Elementary Schools, 3 Middle schools, 2 High schools
- Photovoltaic power: 311 kW (5%)
- Solar Thermal: 736 m² (50%)
- Geothermal: 535 RT (Heating and cooling)
- Annual production:
  - Electric: 375 MWh/yr
  - Heat: 454 MWh/yr

Apartments

- 13,777 dwellings
- Photovoltaic power: 1-2 m²/dwelling (2,271 kW)
- 30% of building coverage
- Annual production of Electric power: 2,735 MWh/yr (5%)
### Sustainable Urban Development Practice at LH

#### New & Renewable Energy Newtown: Pyeongtaek Sosabuel

- **Public Office**
  - 9 buildings, Floor area: 66,521 m²
  - Photovoltaic power: 760kW (5% of electric power)
  - Solar Thermal: 1,445 m² (50% of hot water)
  - Geothermal: 1,484kW (100% of cooling and heating)
  - Annual production
    - Electric power: 919 MWh/yr
    - Heat thermal: 12,473 MWh/yr

#### New & Renewable Energy Newtown: Pyeongtaek Sosabuel

- **Public Information Center**
  - Floor area: 7,070 m²
  - Photovoltaic power: 69 kW
  - Fuel cell: 242 kW
  - Annual production
    - Electric power: 1,141 MWh/yr (50%)
    - Heat thermal: 882 MWh/yr (100%)

#### Sustainable Urban Development Practice at LH

#### Low-Carbon City: The 2nd Dongtan Newtown
- **Location**: Kyunggi-do Hwasung-si Dongtan-myun
- **Area**: 23.9 ha
- **Proposed Population**: 281,981 persons (117 persons/ha)
- **Dwelling units**: 112,792 (47 dwellings/ha)
- **Developer**: LH + Gyeonggi Urban Innovation Corporation
- **Development Period**: 2008.7.11~2015.12

### Expected Electric Power

<table>
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<tr>
<th>Private</th>
<th>Photovoltaic</th>
<th>Solar thermal</th>
<th>Geothermal</th>
<th>Fuel cell</th>
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<tbody>
<tr>
<td>Detached house</td>
<td>3,877</td>
<td>1,828</td>
<td>2,049</td>
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<tr>
<td>Apartments</td>
<td>2,735</td>
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<tr>
<td>Schools</td>
<td>4,571</td>
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<td>Public</td>
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<td>Public office</td>
<td>13,395</td>
<td>916</td>
<td>651</td>
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<td>Information center</td>
<td>2,456</td>
<td>83</td>
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<td>2,375</td>
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<tr>
<td><strong>sum</strong></td>
<td><strong>27,436</strong></td>
<td><strong>5,938</strong></td>
<td><strong>3,031</strong></td>
<td><strong>16,094</strong></td>
</tr>
</tbody>
</table>

(MWh/yr)
Low-Carbon City: The 2nd Dong-tan Newtown

- Ecological Environment
  - Water detention basin, Grey water, Reservoir
  - Network of Park, Afforestation and Water front
  - Microclimate, Wind Corridor
  - Passive solar system
  - Roofing and Wall Greening

- Low-carbon Transportation
  - Bi-modality tram
  - Bicycle, Fuel cell car
  - Multi-transit center, Express bus and Inter-regional Bus

- New & Renewable Energy
  - Photovoltaic power, Solar thermal, Geothermal
  - Small hydro power
  - Refuse derived fuel, Indirect heat, Heat source by sewage sludge

Low-Carbon City: The 2nd Dong-tan Newtown

- Eco-friendly Building
  - Use of passive solar system such as highly insulated, air-tight window
  - Reduction of cooling & heating energy
    - 25% (detached house), 33.5% (apartments)
    - Applies to Model Housing Estate

- New Transportation
  - Bi-modality tram routes
    - Gwanggyo-Dongtan2-Osan
    - Dongtan2-Byonjung
  - Multi transit center

  - Reduce 14% of share rate by car and 22% gas emission of car
03 Sustainable Urban Development Practice at LH

**Low-Carbon City : The 2nd Dong-tan Newtown**

**Bicycle Road Network**
- Bicycle road network along Osan river
- Hwaseong si, Yongin si, Sungnam si, Suwon si
- Total length: 150km, 82 routes
- Bicycle depository:
  - 130 spots, 27,000 bike stands
  - ITS type Public bike (after 2015)
  - 20% of mode share rate by bicycle

**Photovoltaic power and Solar thermal**
- Photovoltaic power:
  - detached house: 3kwp/dwelling
  - apartments: 0.2kwp/dwelling
- Solar thermal:
  - detached house: 12m²/dwelling
- detached houses, schools, community centers are 100% energy independent by using new and renewable energy

**Recycling System of Resource**
- use Refuse Derived Fuel and heat of sewage sludge
- biomass energy as district cooling and heating source
- reuse rainwater by reservoir, underground water basin, and gray water
- photovoltaic power, solar thermal

**Reduction of Electric power and CO₂ emission**

- Area: 695,000 m²
- Houses: 1,624 dwelling units
- Population: 4,060 persons

- 8,024 ton of CO₂ reduction (the amount that 970ha of Afforestation absorbs every year)
- 970ha is equivalent to 50.1% of increase in afforestation from 32.5% to 73.1%.

<table>
<thead>
<tr>
<th>Amount of reduction</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat energy consumption (TOE/year)</td>
<td>4.013</td>
</tr>
<tr>
<td>Power consumption (TOE/year)</td>
<td>1.732</td>
</tr>
<tr>
<td>CO₂ emission (ton/year)</td>
<td>8,024</td>
</tr>
</tbody>
</table>

**Zero Energy Model City**: Guemdan Newtown

- **Location**: Incheon si, seo gu dangha dong
- **Area**: 18.4㎢
- **Proposed population**: 230,000 persons (127 persons/ha)
- **92,000 dwellings** (50 dwellings/ha)
- **Developer**: LH + Incheon Urban Development Corporation
- **Development Period**: 2006-2014

**Environmental Analysis**

- Wind corridor
- Microclimate
- Afforestation and waterway

**Compact City**

- Arranges high-density buildings such as mixed use of residence, commerce and office around a center of public transportation.
- Public transportation is within 10 minutes by walk or bicycle everywhere in the city.

**Bicycle Road Network**

- 20% mode share by bicycle.
- Total length: 170Km, 63 routes.
Zero Energy Model City: Guemdan Newtown

- New and Renewable Energy

- is used as a main electric power, cooling and heating of buildings in the town.

<table>
<thead>
<tr>
<th>Photovoltaic power</th>
<th>Solar thermal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detached houses</td>
<td></td>
</tr>
<tr>
<td>Photovoltaic cell module:</td>
<td>Solar collector:</td>
</tr>
<tr>
<td>over 3kWp / dwelling</td>
<td>over 12 m² / dwelling</td>
</tr>
<tr>
<td>Over 100% of annual electric power</td>
<td>Over 100% of annual hot water</td>
</tr>
<tr>
<td>needed</td>
<td>consumption</td>
</tr>
<tr>
<td>Over 100% of annual electric power</td>
<td>Over 100% of annual hot water</td>
</tr>
<tr>
<td>needed</td>
<td>consumption</td>
</tr>
<tr>
<td>Parks</td>
<td></td>
</tr>
</tbody>
</table>

Land Use Plan (Model Town)

<table>
<thead>
<tr>
<th>Area (m²)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housing</td>
<td>157,925</td>
</tr>
<tr>
<td>Park</td>
<td>45,941</td>
</tr>
<tr>
<td>Forest</td>
<td>14,729</td>
</tr>
<tr>
<td>River basin</td>
<td>26,738</td>
</tr>
<tr>
<td>Open-space</td>
<td>21,009</td>
</tr>
<tr>
<td>Road</td>
<td>49,133</td>
</tr>
<tr>
<td>sum</td>
<td>315,475</td>
</tr>
</tbody>
</table>

Zero Energy Model Town

- Public transportation along the arterial road
- LNG/CNG bus
- LED traffic signals
- Traffic calming

- Bike zone (radius 1.5Km)
- Pedestrian zone (radius 400m)
- Bicycle parking lots and depository
**Sustainable Urban Development Practice at LH**

- **Zero Energy Model City** : Guemdan Newtown
  - **Zero Energy Model Town**
    - Passive house
    - High efficiency insulation and air-light window.
    - Roof top and wall greening

**New and Renewable Energy**
- Detached houses, schools, public offices, parks

**Area :** 316,000 sq.
- **Houses :** 314 dwelling units
- **Population :** 784 person

-5,100 ton/year,  Expected carbon emission trade : 71,000,000 won/year
-5,100 ton of CO2 is the same amount that 616ha of afforestation absorbs every year

<table>
<thead>
<tr>
<th></th>
<th>Amount of reduction</th>
<th>Amount of charge saved (billion won/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat energy consumption (TOE/year)</td>
<td>162.7 (100%)</td>
<td>1.2</td>
</tr>
<tr>
<td>Power consumption (TOE/year)</td>
<td>121.6 (100%)</td>
<td>0.3</td>
</tr>
<tr>
<td>CO₂ emission (ton/year)</td>
<td>5,100 (100%)</td>
<td>0.1</td>
</tr>
<tr>
<td>Total energy savings</td>
<td></td>
<td>1.6</td>
</tr>
</tbody>
</table>

**Practice in Sustainable New Town**

- Social and Cultural Sustainability.
- Economic Sustainability.
- Environmental Sustainability.
- Landscape and Management.
- Disaster and Crime Prevention.
Sustainable Urban Development Practice at LH

**Social and Cultural Sustainability**

1) Planning Standards for Social Development

   a. Various resident service facilities including a community center, a police box, a library, a hospital, and a fitness center, etc should be built according to the size of a new town strict and its population.
   - For example a sports center should be planned for 25,000-40,000 persons.

   b. Cultural facilities are recommended to be located close to community centers or public buildings.

   d. The park area per a person should be more than 15㎡, and a culture center should be placed in a new town with over 100,000 population.

2) Planning Standards for Social Mix

   a. By the house type
      - 20~30% (detached) : 5~10% (multi-unit) : 60~75% (condominiums)

   b. By the size of house
      - 25~35% (below 60㎡) : 35~45% (60~85㎡) : 25~35% (over 85㎡)
      - A housing complex should include more than 2 types of houses.

   c. By the ownership
      - 70% (owned) : 30% (rental)
      - More than 40% of rental houses should be the National Rental Housing
        - "The National Rental Housing" is a kind of public rental housing with the National Housing Fund, whose rental period is over 30 years, and whose size is below 55㎡.

   d. By the size of rental house
      - 50~60% (less than 60㎡) : 20~30% (60~85㎡) : 10~20% (more than 85㎡).

Land use plan of Pangyo new town

- 23,285 new housing units.
- Multi-family housing and apartments 75%.
- 38% of the multi-family housing and apartment subsidized.
- Environment-friendly houses with low/medium density are in the west.
- Tall buildings locate in the east.
- Detached houses lie near the central park.
Social and Cultural Sustainability

3) Planning Standards for Historical and Cultural Sustainability
   a. The natural, historical and cultural characteristics should be preserved.
   b. A developer can assign a site or a building for a museum or an exhibition hall.
   c. A developer should publish a white-paper containing the history of the site.
   d. A developer should plan and operate the environmental education programs or cultural activities for young people.

Economic Sustainability

   a. The industry to enhance the self-sufficiency of the city should occupy more than 15% of area of a new town over 9,900,000 m² or below 200,000 of population.
   b. For a new town over 9,900,000 m² a reserved land can be secured.
   c. To prevent rainwater outflow a reservoir should be installed.

Environmental Sustainability

1) Environment-friendly development
   a. Grade I of ecologically good nature should be preserved absolutely and Grade II can be developed partially.
   b. Planted area with the slope of over 30° should be absolutely conserved, and the slope of over 20° can be developed partially.
   c. The facilities are installed for residents use in a close-to-nature river, which connect with neighbor parks. And the road adjacent the river bank should be prohibited.
03 Sustainable Urban Development Practice at LH

- Environmental Sustainability
  2) Density of Development
     - Arrangement distance of urban facilities
       a. Urban facilities such as a city hall, a gymnasium, a theater, etc.: 4~10km
       b. Regional facilities such as a library, a hospital, a sport center, etc.: 2~6km
       c. District facilities such as a post office, a community center, a commercial building, etc.: 400m~1km
       d. Neighborhood facilities such as an elementary school, a retail shop, etc.: 150~500m
     - Downtown areas: High density mixed with business, residence, public and commercial use
     - Suburban areas: low in density with a network of mass transportation, pedestrian ways and bicycle roads to downtowns.

03 Sustainable Urban Development Practice at LH

- Environmental Sustainability
  3) Public Transportation
     a. Bus Rapid Transit (BRT) system to a new town of over 100,000 population. And BRT or Automatic Guided Transit (AGT) system to a new town of over 300,000 population.
     b. A pedestrian way or a bicycle road should be networked which reaches to schools, markets and public facilities.
     c. On back alleys the speed limit is 30km/h.
### Planning Standard for Environmental Sustainability

#### 4) Environment-friendly Parking

- A parking is prohibited on an arterial and a subsidiary arterial road.
- A public parking lot should be installed in a site of detached houses.
- A parking building should be provided in a commercial and office area.

#### 5) Energy and Resources Recycling

- Solar panels or solar generators are installed at a school, a public facility, and their rooftops are planted.
- A plan is needed to use a fuel cell, hydrogen electric power, geothermal power generation.
- A natural lighting and ventilation should be considered.
- Rainwater is stored under the ground or at surface not to outflow, and over 30% of pavement in a housing estate should be water permeable.

#### 6) Open space

- Planted area should cover over 1/5 of the area of a new town.
- Damaged nature should be restored.
- The river should be also restored in a manner of a close-to-nature river.
03 Sustainable Urban Development Practice at LH

**Planning Standard for Environmental Sustainability**

7) Clean Environment
   a. A planted buffer should be installed along the road to reduce noise and to air pollution.
   b. Noise should be lowered to below 65dB with planted buffer area
   c. A garbage transportation system is considered to install.

04 Conclusion

04 Conclusions

- Conclusions
  - By committing 2 per cent of GDP (83.6 billion $) over the next 5 years
  - to invest in green technologies, resource and material efficiency, renewable energies, sustainable transport, green buildings and ecosystem restoration,
  - the Republic of Korea could deliver sustainable growth, decent jobs and human well-being for present and future generations.
  - It will make Korea more livable and leave the descendants more sustainable environment.
CLIMATE POSITIVE DEVELOPMENT PROGRAM - WHY CLIMATE POSITIVE?

Guest Speaker:
MR. HEE-SONG LEE
City Director – Seoul, Clinton Foundation

Sustainable Real Estate Development Conference 2009
Seoul, Korea
November 26

The William J. Clinton Foundation

Initiatives:

• Alliance For A Healthier Generation
• Clinton Climate Initiative
• Clinton Economic Opportunity Initiative
• Clinton Foundation HIV / AIDS Initiative
• Clinton Global Initiative
• Clinton-Giustra Sustainable Growth Initiative
• Clinton-Hunter Development Initiative
Clinton Climate Initiative

Cities Initiative
C40, the large cities Climate Leadership Group
Assist Cities to implement large scale environmental projects

Extending Impact
Technical Partners
Corporate Partners
U.S. Conference of Mayors (USCM)
USGBC
ACUPCC

C40: 40 Partner Cities & Affiliate Cities

Programs and Supporting Infrastructure

FOCUS AREAS
- Building Retrofits
- Outdoor Lighting
- Solid Waste Management
- Transportation
- Clean Energy
- Water & Wastewater
- Ports
- Airports
- Developing Countries Initiative
- Climate Positive Development

SUPPORTING INFRASTRUCTURE
- City Teams
- Program Teams
- Technical Assistance
- Purchasing Assistance
- Financing
- Measurement Tools

"Make a difference in the fight against climate change in Practical, measurable, and significant ways"
CLIMATE+
Climate Positive Development Program

Why Climate Positive?

CLIMATE+
DOUBLE CHALLENGE
Rapid Urbanization + Climate Change
Growth of Cities Must More Than Offset Their Emissions

CLIMATE+
The Vision
Reinvent large-scale urban communities to reduce greenhouse gases and redefine cities

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CLIMATE+ STRATEGIES

- Renewable energy production
- High performance buildings
- Interconnected transportation systems
- Waste as a resource
- Maximum water efficiency
- Efficient use of land
- Advanced information systems

CLIMATE+ developments will...

- Network of leading communities reinventing cities
- Integrated, holistic approach to design and development
- Catalyst for leading-edge technology
- Global standard for measuring success

...generate 100% clean energy.
...create high-performance, net-zero green buildings.

...strive for zero waste communities.

...shift transportation to walking, biking, public transit, and clean fuels.

...maximize water efficiency by facilitating integrated water, waste water, and water resource management practices.
...use local materials and optimize environmental performance.

...integrate environmental and ecosystem management.

16 Founding Projects in 10 Countries

Building Retrofit Program
**Energy Efficiency Building Retrofit Program**

**Focus on Existing Buildings**

**Partner with Cities**

**Partner with Public & Private Building owners**

**Partner with Leading Energy Service Companies (ESCOs)**

**Partner with Leading Financial Institution**

**Partner with Suppliers of Energy Efficiency Products**

---

**Benefits of Buildings Retrofit**

**CAPTURE WASTED ENERGY & MONEY**
- Reduce energy use, lowering operating expenses
- Upgrade/renew aging infrastructure & address deferred maintenance
- Improve facility comfort & performance
- Create a market advantage

**DELIVER ON PROMISES**
- Reduce GHG emissions and carbon footprint
- Revive communities & local businesses
- Promote “green collar” jobs

**ENERGY PERFORMANCE CONTRACTING**
- Project Cost and Energy Savings are Guaranteed by ESCOs

---

**Why Existing Buildings?**

- Buildings contribute 50 – 70% of GHG emissions in urban areas
- There is excess energy and savings trapped in existing buildings, typically 20 – 50%
- Existing buildings use an average of 25% more energy than new buildings
- 3/4 of building lifecycle costs occur after construction is complete

---

**Empire State Building Project**

**Addressing specific infrastructure needs**

**Addressing tenant issues**

**Including cutting edge technologies**

**Providing reasonable investment**

**Saving energy costs: $4.4 million / yr, 38% energy reduction**

**105,000 metric tones of CO2 reduction over 15 yrs**

**Providing active team engagement**
Thank You!

Hee-Song (Pino) Lee
City Director-Seoul
Clinton Climate Initiative
William J. Clinton Foundation
hslee@clintonfoundation.org
SESSION 2: MEASURING SUSTAINABILITY

GREEN BUILDING PROMOTION AND CERTIFICATION SYSTEM

Guest Speaker: MR. SEONGHO KIM
Senior Deputy Director, Architecture Planning Division, Ministry of Land, Transport and Maritime Affairs

Education
- Bachelors of Architectural Engineering, Korea University

Experience
- Oct. 2009 – Present: Architecture Planning Division
  - In charge of promoting green buildings, special construction zones, and construction permission
  - In charge of Pangyo and Wiyang new town development projects
- Aug. 2003 – May 2005: Urban Management Division
  - In charge of managing and deregulating RDZs, land purchase

Certification
- 33rd National Technical Exam
Green Building Promotion and Certification System
November 26, 2009
SeongHo Kim

1 Background

Background
GHG mitigation policies are urgently needed to tackle climate change
- Climate change response emerged as the national priority since the adoption of UNFCC in 1992
- Enormous casualty and asset loss due to extreme weather conditions like floods and droughts
- All countries are focusing on energy efficiency and new & renewable energy

Continuous increase in energy consumption of buildings
- As the world’s 10th largest energy consumer, Korea imports 97% of energy
- Need to prepare against the exhaustion of oil
- Buildings account for 22.3% of Korea’s total energy usage
- Must move toward an energy-saving structure
**Direction**

**Vision**

**GREEN BUILDING, GREEN KOREA**

**Goals**

I. Establish a low-carbon social structure
II. Designate green building technology as a new growth engine
III. Increase the number of green homes and buildings

**Strategies**

- Institutional base
  - Energy-saving design standard
  - Korean-style passive houses
  - Green building certification
- Technology development
  - Window system
  - Eco-friendly finish material
  - Low-carbon high-rise building technology
- Social atmosphere
  - Incentives like seeking building standards
  - Experts in green buildings
  - Energy consumption certification
- Green home & building
  - Build million green homes
  - Turn 1 million existing homes into green homes
  - Green building pilot projects

---

**Main challenges**

**1. Institutional basis**

(1) Strengthen energy-saving design standard

- Double the insulation standard of windows by 2012
  - Heat transmission standard: (Past) 3.84 → (08) 3.0 → (10) 2.4 → (12) 1.5 → (17) 0.8
- Expand the usage of energy-saving devices
  - Standby power cut-off system, LED lighting, smart electricity meter.
- Integrate the management of energy-saving records for the whole building instead of managing it separately by different elements
  - Will be applied to large public buildings first, then to private buildings.

**Energy-saving design standard**

- Compliance with guidelines for construction, machines, power facilities, and new and renewable energy facilities
- In the case of 6 energy-intensive facilities, give permission if the result of the evaluation exceeds 60 points
(Reference) Total energy consumption management

**Operation in management**

- A system to permit construction projects that constructs buildings with higher energy efficiency than standard buildings

**Expected benefits**

- Improved energy efficiency for large buildings and easier energy management for the whole nation
- Enhances creativity in design when each part of the building is regulated
- Application of the new technology will promote relevant industries

**SIMULATION**

Energy consumption: Standard vs. Design-based

<(Designation and permission of standard buildings)>

- Input of insulation rules for each part of the building and local standards for facilities
- Designers can freely choose from multiple energy-saving technologies

Continue...

(3) Improve certification system on eco-friendly buildings and energy efficiency standards

- Enhance eco-friendly building certification to strengthen reliability (Jul. 2009–)
  - Similar foreign systems: US LEED, UK BREEAM, Japan CASBEE
- Continuously develop tools to evaluate energy efficiency of buildings
  - Improve the evaluation systems of international standards to suit the Korean environment

**Certification on eco-friendly buildings**

- Assess all elements including material, design, construction, maintenance, and demolition
- Divided into two levels depending on the score
- Multi-unit housing, residential-commercial buildings, offices, retail, schools, hotels
  - The scope of the subject will be expanded to all new buildings by 2010
- Four agencies including LH Research Institute

Continue...

(2) Establish design & construction guidelines for Korean-style passive houses

- Promote passive houses that save energy in heating by minimizing heat loss.
- Showcase a model for passive house in KEMKO headquarters (Dec. 2009)

Passive house: Concept & characteristics

- A building where energy consumption for heating is cut by more than 90%
  - For residential buildings, the standard for energy consumption will be strengthened to the level of passive house by 2017
- High-insulation structure without heat bridge
  - Exterior heat transmission 0.15W/m²K,
  - Window heat transmission 0.8W/m²K
- Minimized number of heating facilities

(Reference) Certification system

**Operation committee**

- Overall management of the system
- Designation and management of the certifying agency

**Ministries in charge**

- MLTM, MOE

**Report**

- Monitor the overall system
- Determine the amendment of the standard

**Certifying agency**

- Document and site evaluation
- Draw up results

**Deliberation committee**

- Reassess the evaluation
- Determine the certification level

**End-user**

- Fill-in the application
- Promote the fact that its certified
### (Reference) Evaluation category

<table>
<thead>
<tr>
<th>Category</th>
<th>Area</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land use and transportation</td>
<td>Land use</td>
<td>Ecological value of land, establishment of a systematic plan</td>
</tr>
<tr>
<td></td>
<td>Transportation</td>
<td>Validity of the measure to prevent sunlight exclusion, existence of sidewalk</td>
</tr>
<tr>
<td>Energy, Resource, and environmental impact</td>
<td>Energy</td>
<td>Energy consumption and saving (Use of alternative energy)</td>
</tr>
<tr>
<td></td>
<td>Material and resource</td>
<td>Resource saving, minimization of waste, recycling of resources, waste separation</td>
</tr>
<tr>
<td></td>
<td>Water resource</td>
<td>Water recycling system, water saving</td>
</tr>
<tr>
<td></td>
<td>Environmental pollution</td>
<td>Response to global warming (CO2 mitigation)</td>
</tr>
<tr>
<td></td>
<td>Maintenance</td>
<td>Systematic site management, efficient building and unit management</td>
</tr>
<tr>
<td>Ecological environment</td>
<td>Ecological environment</td>
<td>Linked green axis development, green area ratio. Application of artificial greening techniques, planting of biotope</td>
</tr>
<tr>
<td>Indoor environment</td>
<td>Indoor environment</td>
<td>Air heating, sound, light environment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Special consideration of the elderly and disabled</td>
</tr>
</tbody>
</table>

* Multi-family(44) / commercial-residential (42), non-residential(24) / office (40) / school(43) / retail(36) / hotel(45)

### (Reference) Building certification system

- **Eco-friendliness certification**
  - **Subject**: Multi-family, commercial, residential, non-residential, office, school, retail, hotel
  - **Agency**: LH, LG, KB, KIER, Conbiton, KIER
  - **Level**: Excellent, good (2 levels)
  - **Certified buildings**: Excellent 67, good 1,275
    - Total 1,342
    - Multi-unit 556, school 578

- **Energy efficiency certification**
  - **Subject**: Residential buildings with more than 18 units
  - **Agency**: KEMKO, KICT, KIER
  - **Level**: 1-2, 3 (3 levels)
  - **Certified buildings**: 1-23, 2-199, 3-29
    - Total 250 buildings, 167,709 units

- **Automation certification**
  - **Subject**: Office buildings
  - **Agency**: IBS Korea, KRIEA
  - **Level**: 1, 2, 3 (3 levels)
  - **Certified buildings**: 1-5, 2-4, 3-2

---

### 2. Technological development

#### (1) Low-carbon high-rise building technology

- **Technology**: Advanced exterior system, new and renewable energy optimization, indoor environment control technology etc
  - **Cost**: 2009-2014: 110.8 billion KRW
  - **Designation of companies through subscription (Mar. 2009)**

<table>
<thead>
<tr>
<th>Technology</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind power</td>
<td>Install lightweight vertical wind power generator on the roof</td>
</tr>
<tr>
<td>Solar heating</td>
<td>Collect sunlight on the roof to heat water etc.</td>
</tr>
<tr>
<td>Underground power</td>
<td>Install power generation at the basement etc.</td>
</tr>
<tr>
<td>BPV</td>
<td>Utilize BPV or high-rise buildings</td>
</tr>
<tr>
<td>Waste heat recycling</td>
<td>Process flammable waste including paper into saline fuel for heating</td>
</tr>
<tr>
<td>Geothermal heating</td>
<td>Heat andcool using geothermal energy that is consistent all-year-round from being below the surface</td>
</tr>
<tr>
<td>Site design</td>
<td>Install water circulation system / Maximize utilization of weather</td>
</tr>
<tr>
<td>Energy saving</td>
<td>Minimize transfer of the passive system to respond to surroundings</td>
</tr>
<tr>
<td>Building design</td>
<td>Double-layer system that strengthens insulation, initial ventilation, and service</td>
</tr>
<tr>
<td>System design</td>
<td>Minimize waste, and construction &amp; maintenance cost</td>
</tr>
<tr>
<td></td>
<td>Maximize ventilation that secures proper air quality even during minimal ventilation</td>
</tr>
</tbody>
</table>

---

### Continue...

- **Energy efficiency certification**
  - **Main aspect**: A system that certifies buildings that saves energy to a certain rate in heating, water heating, lighting etc
  - **Levels**: Level 1 (above 33.5%), Level 2 (20.5%), Level 3 (13.5%)
  - **Subjects**: Residential buildings with more than 18 units (Offices will also be subject from 2010)

- **Operation (KEMKO) / Evaluation (KIER, KICT)**
  - **Incentives**: Provide energy-saving loans at low interest, Delegation for floor-area ratio, and height restriction since November 2008, Acquisition and registration tax cut by 15% (Temporary for three years from 2010)
Continue...

(2) Eco-friendly, energy-saving multi-family housing (Green home) construction technology

- Develop new technologies on site-design, energy-saving building and facility to cut 40% to 55% of energy consumption

Energy-saving through the application of source technology

- Site design that controls microclimate utilizing tree, wind, and creating green space on artificial ground -> Cut energy consumption by 5 – 10%
- Energy-saving building technology that enables natural cooling & heating -> 20 – 25%
- Energy-saving facility technology such as high-efficiency cooling and heating, optimal control system -> 10 – 15%
- New and renewable energy system -> 3 – 5%

Reference) Concept and source technology of Green Homes

3. Create a favorable social atmosphere

(1) Incentivize green buildings

- Ease regulation on floor-area ratio and height, provide tax benefit and low interest rate loans to induce voluntary participation from the private sector

(2) Nurture experts on green buildings

- Produce more than 1,000 experts thru government subsidies to two HR centers (2009-2013)
  ※ Designate thru public subscription(Mar. 2009) : Design(KIRA), engineering(KICTE)
(3) Adoption of energy consumption certification system for buildings

- Increase demand for green buildings by utilizing energy consumption data of the building in transaction
  - Stage 1 (Indicate the certification level of the building on the building record, Mar. 2009)
  - Stage 2 (Issue certifications of energy consumption per unit area, 2012)

(4) Others

- Provide smart energy meters(MKE), and develop and disseminate energy management manual (Dec. 2009) to induce energy saving in daily lives.

---

1. Plans to build and supply Green Homes

Construct 1 million new Green Homes

- Build 1 million Bogeumjari Homes (annual average of 100 thousand) by 2018 as Green Homes

<table>
<thead>
<tr>
<th></th>
<th>TUH</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>1 mil</td>
<td>55%</td>
<td>7</td>
<td>6</td>
<td>11</td>
<td>65%</td>
</tr>
<tr>
<td>Public</td>
<td>75%</td>
<td>5.5%</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>45%</td>
</tr>
<tr>
<td>Private</td>
<td>25%</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>10%</td>
</tr>
</tbody>
</table>

- Apply source technology that have larger benefits compared to investment. Gradually apply new and renewable energy technology

Strategies

- Short-term (2009-2010)
  - Energy efficiency
    - Improve insulation etc.
    - Expand penetration of regional heating
    - Develop Passive House technology
  - New & renewable energy
    - Pilot project
    - Utilize heat from waste combustion
  - Site design
    - Water-cycling system
    - Make areas eco-friendly

- Mid-term (2011-2013)
  - Energy efficiency
    - Improve lighting(LED) etc.
    - Utilize small CHP
    - Pilot project for Passive Houses
  - New & renewable energy
    - Expand application
    - Test application of fuel-cells for home usage
  - Site design
    - Expand the application of technologies that can be commercialized

- Long-term (2014+)
  - Full application and continuous improvement

---

4. Green Home and Pilot Projects

Turn 1 million existing homes into Green Homes

- Turn 1 million existing homes into Green Homes by 2018
  - Raise energy efficiency thru partial repairing, overhauling, redevelopment and rebuilding

Strategies

- (Public rental housing) Provide government subsidies to raise energy efficiency
  - permanent and 50-year rental housing
- (Rebuilding) Apply the same energy efficiency standard as newly-built homes and continue strengthening the standard
- (Remodeling) Provide partial subsidies or low-interest rate loans for multi-unit housing
2. Green Home Pilot Projects

- LH is pursuing a pilot project on the Minlak zone 2 in Euljeongbu to cut 40% of energy consumption.
  - 770 households in 1 bloc subjected – To be started from 2010

- Maximize sunlight and natural wind passage in site planning
- Improve insulation by 30% for the front and back walls
  - Thickness of material 50mm(0.43W/m²K) → 80mm(0.33W/m²K)
- Enhance insulation for exterior windows by more than 15%
  - 16mm double layered+22mm double layered → 22mm double layered+22mm Low-e double layered glass
- Develop ways to control heating temperature by hour using home-network technology
- Use ventilation recovering heat and high-efficiency lighting
- Control lighting thru ubiquitous sensor technology
- Use new and renewable energy in public facilities

3. Pilot projects on public agency buildings

- Position the new building as a model for futuristic construction, showcasing it to the public
- Area (12,709m²), Gross floor area (90,410m²)
- 5 floors underground, 13 floors
  (building coverage 59.63%, floor-area ratio 419.1%)
- Design and project time (May 2006–Feb 2011)
- Total cost 228.8 billion KRW, construction cost 156.5 billion KRW
- Design and construction: Samoo and Samsung C&T consortium
- Cut energy usage by 42% compared to the average
  - Energy consumption rate : 48 -> 28kg/m² year

(Reference) A bird’s-eye view of the new Seoul government building

- Rapid solar heating
- Photovoltaic power
- Double layered exterior
- Geothermal heating
- CHP
- Water Recycling

Thank you
BENCHMARKING GREEN BUILDING CERTIFICATION SYSTEMS

Suzanne Johnson is a Senior Professional Associate with PB who serves as a member of the firm’s Global Sustainable Development Task Force. She has served on the Strategic Planning Green Advisory Group, Henry Michel Fellowship sub-Committee, and PB Americas Business Systems Team – Environmental Management System (EMS) as the Development Leader. She has experience with programming, design, construction documents, and construction administration for private, municipal, state, and federal projects. Her familiarity with the United States Green Building Council’s (USGBC) Leadership in Energy and Environmental Design (LEED) Green Building Rating System provides PB with a valuable tool in the design and construction of environmentally sensitive projects. She is the founder and past Coordinator for PB’s Sustainable Development PAN (Practice Area Network), a PB information clearing house on sustainability. She is often called upon to help teams write proposals for projects with sustainable features. The training she received on Environmental Management System (EMS) by PB’s United Kingdom operation gives her another edge on methods to manage the environmental impacts of projects. She was America’s EMS Environmental Coordinator and the Sustainable Development Leader for Architecture and Buildings in the Americas. She is now the Director of Sustainable Development for the PB Korea branch.

She has presented at sustainable development seminars and is active in professional education efforts on sustainable design. Suzanne has developed and delivers PB’s ‘Sustainable Development Workshop for Buildings’ seminars for staff across the company.

What is a Benchmark?

- Evaluation of Aspects of a Process Related to Best Practice
- Tools
  - KGBCS
  - LEED
  - Green Star
  - BREEAM
  - HK-Beam
  - CASBEE
  - CEEQUAL
  - Singapore Green Plan
  - Pearl System
  - ISO 14001
**Why Benchmark?**

- Regulations
- Incentives
- Improve upon Existing Systems
- Marketing
- The Right Thing to Do

**Who Benchmarks?**

- Government
- Developers
- Owners
- Operations and Maintenance

**CO₂ and Energy**

- **CO₂ & Energy reduction target:** CO₂ 50%, Energy 40%

<table>
<thead>
<tr>
<th>Metric</th>
<th>As-is</th>
<th>To-be</th>
<th>Saving Target</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity [kWh]</td>
<td>7,200</td>
<td>4,492</td>
<td>2,708</td>
<td>37%</td>
</tr>
<tr>
<td>Water [1000t/m³]</td>
<td>48</td>
<td>49</td>
<td>1</td>
<td>2%</td>
</tr>
<tr>
<td>Gas [1,000Nm³]</td>
<td>349</td>
<td>314</td>
<td>35</td>
<td>90%</td>
</tr>
<tr>
<td>Energy (Electricity)</td>
<td>3,952</td>
<td>2,181</td>
<td>1,772</td>
<td>45%</td>
</tr>
<tr>
<td>Refrigerant</td>
<td>4,564</td>
<td>2,281</td>
<td>2,283</td>
<td>50%</td>
</tr>
<tr>
<td>CO₂ [tonCO₂]</td>
<td>8,516</td>
<td>4,464</td>
<td>4,053</td>
<td>48%</td>
</tr>
<tr>
<td>Energy Cost [mil KRW]</td>
<td>902</td>
<td>511</td>
<td>391</td>
<td>43%</td>
</tr>
<tr>
<td>[ mil USD]</td>
<td>404</td>
<td>210</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Source: Samsung Tesco Bucheon Green Store*
Key Initiatives

<table>
<thead>
<tr>
<th>Initiative</th>
<th>Investment Increase (KRW/m)</th>
<th>AnnualCost Reduced (KRW/m)</th>
<th>HPReduction</th>
<th>LCO2 Reduced (TonCO2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon &amp; Energy Saving</td>
<td>1,882</td>
<td>393</td>
<td>4.79</td>
<td>1,688</td>
</tr>
<tr>
<td>Green Building Certification</td>
<td>600</td>
<td>3</td>
<td>-</td>
<td>16</td>
</tr>
<tr>
<td>Green &amp; Recycle</td>
<td>573</td>
<td>2</td>
<td>-</td>
<td>9</td>
</tr>
<tr>
<td>Community</td>
<td>300</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total (65 Initiatives)</td>
<td>3,255</td>
<td>398</td>
<td>8.18</td>
<td>1,713</td>
</tr>
</tbody>
</table>

* Source: Samsung Tesco Bucheon Green Store

Approach

Alternative 1: "Standard Korean"
- Standard Korean office tower
- Incorporates typical design and construction metrics and benchmarks

Alternative 2: "State of the Art"
- Incorporating the best design and technology realistically available (approved for the Korean market and easy to source)

Alternative 3: "Best Practice"
- Balanced approach which uses design and buildings materials approach with "positive payback"
- Reiterative approach to test various scenarios - thus limited increase in construction budget

Cost Analysis

A Sustainable Office Tower for Korea

Results of Joint Simulation Study, September 2009

Energy Usage: Overall Savings Potential

Key Findings

- Significant energy savings potential
- Potential in line with global experience
- Reference: "State of the Art" case suggests 60% savings potential
- Given importance of office buildings as part of total building stock, significant opportunity for energy savings on macro-level
**Key Findings**

**Construction Costs: Increase**

*Construction Costs by Model*  
<table>
<thead>
<tr>
<th></th>
<th>Standard Korean</th>
<th>Best Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Increase</td>
<td>2.1%</td>
<td>3.0%</td>
</tr>
</tbody>
</table>

*Comment*  
- Only slight increase in overall construction budget
- "Smart planning" upfront included as separate cost item — allows for cost reductions
- Key to avoid "black box" syndrome, i.e. allowing construction companies to charge a lump sum — instead, need to work closely with the construction company on a "win-win" way to achieve "best practice" case
- Reinforces need for integrated, outside planning function to unlock the black box

*Source: Joint team calculations*

**Revenue Impact**

*Annual Rental Revenue*  
<table>
<thead>
<tr>
<th></th>
<th>&quot;Standard Korean&quot;</th>
<th>&quot;Best Practice&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>$/yr</td>
<td>23.6</td>
<td>26.3</td>
</tr>
</tbody>
</table>

*Comment*  
- Assumed only increase in rent of 3% as conservative base case (no increase in deposit or management fee)
- Differential should decrease over time as sustainable buildings become more "mainstream"
- Revenue impact significantly larger than cost savings impact - linked to Korea specific circumstances (i.e. high rents and low energy costs)

*Source: Joint team calculations*

**Overall Impact: Cost Savings Only**

*Cumulative Cost Savings and Payback Period*  
<table>
<thead>
<tr>
<th>Year</th>
<th>Additional Construction Cost</th>
<th>Ongoing Positive Impact 1</th>
<th>Ongoing Positive Impact 2</th>
<th>Payback</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>-0.8</td>
<td>-0.6</td>
<td>-0.4</td>
<td>1.4</td>
</tr>
<tr>
<td>Year 2</td>
<td>-0.9</td>
<td>-0.7</td>
<td>-0.5</td>
<td>2.4</td>
</tr>
<tr>
<td>Year 3</td>
<td>-1.0</td>
<td>-0.9</td>
<td>-0.7</td>
<td>3.4</td>
</tr>
<tr>
<td>Year 4</td>
<td>-1.1</td>
<td>-1.0</td>
<td>-0.9</td>
<td>4.4</td>
</tr>
<tr>
<td>Year 5</td>
<td>-1.2</td>
<td>-1.1</td>
<td>-1.0</td>
<td>5.4</td>
</tr>
</tbody>
</table>

*Comment*  
- Represents most conservative base case, i.e. assuming only cost savings and no revenue impact
- Payback in year 5 of operations possible

*Note: assumes that year 2 is first year of full operations; values not discounted over time*  
*Source: Joint team calculations*

**Overall Impact: Cost Savings and Revenue Benefits**

*Cumulative Cost and Revenue Impact*  
<table>
<thead>
<tr>
<th>Year</th>
<th>Additional Construction Cost</th>
<th>Ongoing Positive Impact 1</th>
<th>Ongoing Positive Impact 2</th>
<th>Payback</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
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<td>-0.4</td>
<td>1.4</td>
</tr>
<tr>
<td>Year 2</td>
<td>-0.9</td>
<td>-0.7</td>
<td>-0.5</td>
<td>2.4</td>
</tr>
<tr>
<td>Year 3</td>
<td>-1.0</td>
<td>-0.9</td>
<td>-0.7</td>
<td>3.4</td>
</tr>
<tr>
<td>Year 4</td>
<td>-1.1</td>
<td>-1.0</td>
<td>-0.9</td>
<td>4.4</td>
</tr>
<tr>
<td>Year 5</td>
<td>-1.2</td>
<td>-1.1</td>
<td>-1.0</td>
<td>5.4</td>
</tr>
</tbody>
</table>

*Comment*  
- Faster payback, i.e. in year 2 of operations
- Underlines need for integrated approach — including smart emphasis on marketing and positioning

*Note: assumes that year 2 is first year of full operations; values not discounted over time*  
*Source: Joint team calculations*
Conclusions and Implications

Two Paths to Achieving a Sustainable Showcase

Private Initiative
- Apply "best practice" case - focused on returns based on energy savings
- Ensure follow through on energy savings - measuring and proving impact
- Realize larger revenue upside, in case the concept is well-received by the market
- Potential early application example: HQ building for major company which is partly rented out - maximize PR impact

Public Initiative
- Use government project to set precedent - focusing on proving what's possible (i.e. maximizing energy savings rather than investment returns)
- Subsidize higher upfront costs to encourage implementation
- Maximize public benefits

Outlook
- Build on study results to identify specific benchmark case
- Aim to turn "Best Practice" case into standard Korean practice
- Continuously strive for higher savings
- Thus make good on promise to transform Korea into a leader in "green energy"

Potential early application example: HQ building for major company which is partly rented out - maximize PR impact

Thus make good on promise to transform Korea into a leader in "green energy"
**Korean GBCS**

• Ministry of Land, Transport and Maritime Affairs and Ministry of Environment Affairs

• Ratings: Good (65/100); Excellent (85/100)

• Building Types
  – Office
  – School
  – Retail
  – Hotel
  – Mixed-Use
  – Residential Multi-Family

**Benchmarking Tools in Korea**

• Korean Green Building Certification System

• US Green Building Council LEED

**Korean Requirements**

• New Construction
  – Central Government
    • Building Energy Savings Standard Energy Performance Index (EPI) Score of > 60
  – Seoul Government
    • Korean Green Building Certification System 65/100
    • EPI Score of > 74 or
    • Building Energy Standard Efficiency Rating II

• Options
  – Benchmarking Tools

**Songdo IBD LEED Services**

• 607 Ha
• First Publically LEED Registered Project in Korea
• LEED for New Construction
• LEED for Core & Shell
• LEED for Neighborhood Development
• 72 Registered, 21 Active
KGBC and LEED

<table>
<thead>
<tr>
<th>Section</th>
<th>Contents</th>
<th>Specified contents</th>
<th>LEED Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site use &amp; transport</td>
<td>Site use</td>
<td>Ecological value</td>
<td>SS</td>
</tr>
<tr>
<td></td>
<td>Transportation</td>
<td>Building footprint</td>
<td>SS</td>
</tr>
<tr>
<td>Energy resource &amp; environmental load</td>
<td>Energy</td>
<td>Energy consumption</td>
<td>EA</td>
</tr>
<tr>
<td></td>
<td>Material &amp; Resource</td>
<td>Resource saving</td>
<td>MR</td>
</tr>
<tr>
<td></td>
<td>Water resource</td>
<td>Water circulation system</td>
<td>WE</td>
</tr>
<tr>
<td></td>
<td>Air pollution</td>
<td>Global warming protection</td>
<td>EQ</td>
</tr>
<tr>
<td></td>
<td>Operation &amp; Maintenance</td>
<td>Systematic Site Management</td>
<td>SS</td>
</tr>
<tr>
<td></td>
<td>Maintenance</td>
<td>Effective operation management</td>
<td>EA</td>
</tr>
<tr>
<td>Ecological Environment</td>
<td>Ecological Environment</td>
<td>Green space on the site</td>
<td>SS</td>
</tr>
<tr>
<td>Indoor environment</td>
<td>Indoor environment</td>
<td>Indoor air quality</td>
<td>EQ</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Thermal comfort</td>
<td>EQ</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sound environment</td>
<td>EQ</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Comfortable indoor environment</td>
<td>EQ</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Care for the elderly</td>
<td></td>
</tr>
</tbody>
</table>

Unique Qualities

**Unique to KGBCS**
- M/E system and layout alteration easiness when occupants demand
- Indoor noise environment
- Care for the olds
- High speed communication network
- Prefabricated & environmental new technology adaption
- Selection of construction company that is ISO14001 Certified
- Application of artificial greening technology
- Space for occupants’ comfort

**Unique to LEED**
- Park capacity
- Heat island effect
- Light pollution reduction
- Rapidly renewable materials
- Construction Indoor air quality management plan
Future Requirements
Green Building and the City
- Zero Energy Building by 2025
  - Residential
    - 30% Energy Reduction by 2012
    - 60% Energy Reduction by 2017
    - Passive House
  - Non-Residential
    - 15% Energy Reduction by 2012
    - 30% Energy Reduction by 2017
    - 60% Energy Reduction by 2020
    - Zero Energy Building by 2025

Seoul Government Incentives
- KGBBC Fee per Rating
  - Excellent of > 85 Points is 100% Funded
  - Good of >65 Points is 50% Funded
- Urban Development Projects with Renewable Energy of > 1% Construction Fee Receive Floor Area Ratio Incentive

Central Government Incentives
- KGBCS Buildings Tax cut of 5~15% (2010)
- Energy Savings Rate to Gauge
  - Gross Floor Area
  - Building Height
  - Landscape Area
  - Site Coverage

Future Requirements Green Building and the City
Energy Efficiency
- KGBCS
  - Korean Energy Management Cooperation Provides Standard
  - Energy Use Calculation (New) or Bills (Existing)
- USGBC
  - ASHRAE 90.1 and Energy Model Simulation
    - Base Case
    - Design Case

Announced 5 Nov 2009
Future Requirements
Green Building and the City

• Annual Total Energy Consumption (2010)
• Energy Consumption Verification for Building Sale and Rent (2010)
• Mandatory Green Building Certification
  – Apartments and Large-Scale Buildings for Building Permit (2010)
  – Tax Cut for New Residential Buildings
  – Gross Floor Area and Building Height Incentives for Remodel

Announced 5 Nov 2009

Potential to Save
SESSION 3: INVESTING IN GREEN

GREEN DEVELOPMENT AND CORPORATE SOCIAL RESPONSIBILITY

Guest Speaker: Mr. DAVID TURBERFIELD
Managing Director & Partner, ERM Korea

David Turberfield has seventeen years’ experience providing practical and strategic solutions to corporate and operational management for the private sector and Government throughout Asia. David has an MS in Environmental Impact Assessment and extensive project experience in Environmental Management Systems, Environmental Assessment and Environmental Audit. Mr Turberfield has lived and worked in the Asia Pacific Region for over thirteen years having been based in Korea, Malaysia, Thailand and Singapore and has worked on projects in Australia, Azerbaijan, Brunei, Ethiopia, France, Georgia, China, Germany, India, Indonesia, Japan, Philippines, Portugal, Taiwan, Vietnam, USA and the UK.

Professionally, Mr Turberfield is a business developer and manager having grown and managed teams of up to 25 consultants and managed a number of business start ups and a turn around in Malaysia, Bangkok, London and Singapore. In terms of clients, he has worked in a broad range of sectors including the following:

- General manufacturing - key clients including Nike, Meritor, Syngenta, Unilife, BEMC
- Pharmaceutical and consumer products - key clients including Johnson & Johnson, Baxter, GSK, Pfizer, Unilever
- Wealth - key clients including ABN Amro, Standard Bank, Standard Chartered Bank, Mitsubishi, SMBC, Kessin, Saratoga Capital
- Utilities – key clients including InterGen, Scottish Power, AES, Tusub Power, Power Seraya, Senoko Power
- Oil and gas - key clients including Shell, bp, ExxonMobil, Chevron, Amerada Hess
- Chemical and petrochemical - key clients including Invista, Shell, Landa, S Group, Huntsman, Mitsubishi, Mitsui

As Managing Director of ERM’s office in Korea, and previously Managing Director of ERM’s office in Singapore, Mr Turberfield has responsibility and accountability for financial performance, development strategy and implementation, recruitment and staff development, technical project management and delivery and development of client relationships.
ERM - Who Are We?

Worldwide
- 145 offices in 41 countries
- 3,500 professional staff
- We have worked closely with around 60% of the Global Fortune 500 companies in the past 5 years
- Projects in more than 60 countries
- 70% repeat business
- Annual turnover of US$638.5m (FY08)
- 35 year history

In Korea
- Established in 1999
- Major Business Area:
  - Sustainable Development
  - Energy and Climate Change
  - Green Building Consulting
  - M&A Advisory Services
  - Environmental Impact Assessment
  - Contaminated Site Management
  - Health & Safety and Risk Assessment
- Over 800 projects for global multinational companies
- Annual turnover: 2 Million USD
- 15 consultants based in Seoul

Overview

1. ERM & Green Buildings
2. Today's position
3. Drivers and motivators
4. Sustainability in Business: Setting the Scene
5. Bluewater Development Case Study
6. Concluding thoughts

Green Building Services
**Services Profile**

*Green Building Strategies & Implementation*
Assess and develop green building strategies linking to the client’s wider corporate commitments.

*Design Guidance and Management*
Ensure the client’s green building expectations are met in refurbishment or new build projects.

*Energy and Carbon Management*
Support on strategies to reduce energy demand and explore greener alternatives and approaches.

*Gaps Analysis and/or Feasibility Studies*
Review of current building design and operations to assess the environmental credentials and feasibility of achieving improved performance and/or certification.

*Green Building Certification*
Lead and manage the process and submission to gain a green building certification (eg. Green Star, LEED, BREEAM etc).

*Legislative and Economic Understanding*
Grants, funds, planning issues, legislative requirements etc

*Other Support Work*
Assist clients in understanding their obligations and opportunities with respect to green buildings eg. product analysis, construction monitoring support and associated energy, productivity studies etc.

---

**IT-SEZ, New Delhi, India**

- Major new commercial development
- Masterplan development to maximise LEED scoring opportunities
- Currently on target for LEED Gold

---

**Coed Darcy Urban Village, UK**

- 4,000 homes over 1,300 acres
- Designed to EcoHomes Excellent
- ERM provided green buildings consultancy
- Focussed on energy, materials, transport, water and ecology

---

**United Nations, New York**

- Secretariat Building 840,000 sq ft / 78000 sq m
- General Assembly Building 308,000sq ft / 29000 sq m
- Landscape 17 acres / 6.9 ha
- Conference Building 320,000sq ft / 30,000 sq m
- South Annex Building 42,000 sq ft / 4000 sq m
- Basements/Parking 952,000 sq ft / 88000 sq m

---

Delivering sustainable solutions in a more competitive world
Today's Position

- Buildings are a major source of carbon emissions and environmental impact:
  - Approximately 40% of global energy demand
  - Similar figure of 40% for CO₂ emissions
  - 16% of all water consumption

- The 4th IPCC Assessment Report showed that globally buildings represent the single biggest opportunity for greenhouse gas abatement

Delivering sustainable solutions in a more competitive world

Motivators/Drivers

- Mandatory
- Voluntary

- Legislation
- Future Proofing
- Financial Dividend
- CSR

Energy Availability, Costs & Security
Carbon Management & Climate Change

Delivering sustainable solutions in a more competitive world

Today’s Position

- The social impacts are often overlooked or are not costed:
  - On average we spend in the western world over 70% of our lives in buildings
  - Attitudes, productivity and absenteeism can all be influenced by the buildings we work in

- Markets across the world are adapting and recognising the value of green buildings:
  - In the US over 1 billion ft² of buildings have been certified to the LEED rating scheme
  - In Australia the number of buildings being certified to the local Green Star rating has risen by 350% in one year
  - In the UK over 75,000 properties have been similarly certified

- Cross-cutting and global initiatives in place e.g. Clinton Climate Initiative’s Energy Efficiency Building Retrofit Program, WBCSD Energy Efficiency in Buildings, UNEP SBCI

"The buildings and construction sector is one of the key sectors for sustainable development, both in terms of the important benefits it contributes to society and the considerable negative impacts it may cause if appropriate considerations are not given to the entire life span of buildings."

UNEP SBCI

Evolution

- EU
- Australia
- US
- Asia Pacific

Evolution of Green Buildings

Delivering sustainable solutions in a more competitive world
Core Sustainability Questions

- What does sustainability mean for your business?
- How can you use sustainability to create additional business value (and not lose sight of this during these difficult business conditions)?
- Do you have a handle on specific opportunities, the business value they could deliver and, therefore what to prioritize and why?
- How do you integrate sustainability into your core business strategy, culture, and decision-making processes?

Sustainability: How Do External Stakeholders See It?

- What’s missing?
- How do we treat our employees?
- Is our environmental footprint sustainable?
- Are we good/helpful neighbours?

What’s the External Dynamic?

- Peter Drucker: “the best way to predict the future is to create it”
- Donald Sull (LBS): “Be agile. Rather than trying to predict an unknowable future, build an organisation capable of seizing unexpected opportunities as they arise.”

Sustainability & Business Value

Resource Efficiency
- Product Innovation
- Compressed Air
- Investment: <$50k
- Annual savings: $153k
- Project delays?

Employee & Stakeholder Engagement
- Brand Differentiation
- Delivering sustainable solutions in a more competitive world
Blindspots: Asking the Right Questions?

**Threats**
- Access to materials next year – you, your key suppliers?
- Current waste recycling solutions?
- Climate change – flooded networks, competition for water, supply disruption
- Attracting and retaining talent – Gen Y, Millennials, lifestyles & brands

**Opportunities**
- Operation & design efficiencies: resources, process, logistics
- Operation and service innovation
- Differentiating with customers/tenants
- Business partnerships
- Employee motivation
- Leadership

Getting to a Coherent & Focused Sustainable Business Strategy

**Discovery**
- Business lifecycle
- Competitor analysis and sector trends
- Risk analysis
- Stakeholder analysis

**Exploration & Mapping**
- Business strategy
- Sustainability performance baseline
- Sustainability and business management framework
- Specific ideas and opportunities for creating business value

**Strategy & Program Prioritization**
- Ambition level
- Vision
- Goals and objectives
- Prioritized programs and projects

**Detailed Implementation Programs**
- How, When, By Who, and with What Resources?

Sustainability and Business Management: Making it real and specific

- Focus on understanding and managing this space
- Business Strategy
- Sustainability impacts of/on the business
- Sustainability agenda & sector trends

Program & Project Prioritization

<table>
<thead>
<tr>
<th>Strategic &amp; Program Elements, e.g.:</th>
<th>Risk (S-High risk from inaction; 1-Low risk from inaction)</th>
<th>Brand Value/ Competitive Advantage (S-High; 1-None)</th>
<th>Ease of Implementation (S-Easy; 1-Difficult)</th>
<th>Capital/ Resource Investment (S-None; 1-High)</th>
<th>Cost Savings (S-High; 1-None)</th>
<th>Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy and Climate Change</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Life Cycle Management</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Partnerships and External Awareness</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employee Engagement</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Management Framework Programs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Supply- and Demand-side Management
- Transportation and Travel
- Renewable Energy
- GHO Management

- Sustainable Materials
- Reusable Products
- Donations
- Waste Tracking and Reduction
- Recycling and Landfill Diversion
- Supply chain management
Low Hanging Fruit: Resource & Operational Efficiencies that Drive Cost Reductions

<table>
<thead>
<tr>
<th>Function/ Budget</th>
<th>Savings Strategies</th>
<th>Long-Term Impacts</th>
<th>Potential Savings</th>
</tr>
</thead>
</table>
| Corp EHS         | • Reduce or eliminate audit program  
| $5 M             | • Restrict travel and training  
|                  | • Reduce discretionary spending  
|                  | • Headcount reductions | 10%  
|                  | • Less prepared to support future growth  
|                  | • Higher potential for regulatory issue in the future | $500,000 |
| Materials/ Utilities | • Energy efficiency  
| $300 M           | • Process optimization  
|                  | • Life Cycle Assessment/ Service re-design  
|                  | • Packaging re-design  
|                  | • Transportation/distribution optimization  
|                  | • Employee engagement and training | 10%  
|                  | • Lower costs/ higher returns  
|                  | • More competitive pricing  
|                  | • Better marketability/ branding  
|                  | • Continued progress with sustainability program  
|                  | • Positioned to capitalize on market rebound  
|                  | • EHS is viewed as a value-added role | $30,000,000 |

Bluwater Drivers?

- Legislation
- CSR
- Future Proofing
- Financial Dividend

Understanding the drivers are important to selecting a potential rating scheme

Bluwater Development, Malaysia - Case Study

- Best practice design framework
- Innovation
- Certification
- Utility costs
- Branding
- Clearwater corporate strategy
- Future occupiers
- Cost
- Performance

Delivering sustainable solutions in a more competitive world
**Strategy for Blu*water?**

- Benchmark & baseline (certification or beyond?)
- Establishment of development targets?

<table>
<thead>
<tr>
<th>Energy</th>
<th>Carbon</th>
<th>Water</th>
<th>Waste</th>
</tr>
</thead>
<tbody>
<tr>
<td>independent, XX% renewables, Green power?</td>
<td>carbon neutral, zero carbon, offsetting?</td>
<td>reduction of mains, self-reliance, XX% recycled?</td>
<td>zero waste to landfill, recycled material use?</td>
</tr>
</tbody>
</table>

Delivering sustainable solutions in a more competitive world

**Environmental Sustainability Considerations**

- **Energy**
  - Building orientation
  - Massing and materials
  - Envelope and façade
  - Internal systems
  - Energy sources

- **Materials**
  - Material sourcing
  - Distances
  - Embodied energy & carbon
  - IEQ performance
  - Life cycle assessment

- **Water**
  - Water sources
  - Water reuse and recycling
  - Water efficiency
  - Irrigation & landscaping
  - Off-site drainage

- **Other Considerations**
  - Transport & connections
  - Waste management
  - Ecology
  - Landscaping
  - Construction approaches

Understanding the drivers is important to defining the design guidance and selection of the potential rating scheme

Delivering sustainable solutions in a more competitive world

**Level of Certification?**

- **Community / Neighbourhood**
  - LEED Neighbourhood Development (P)

- **Signature Buildings**
  - LEED
  - Green Globes New Construction
  - BREEAM

- **Residential Units**
  - LEED Homes (no certification)
  - Ecohomes/CSH (BREEAM Bespoke)
  - Green Star Multi-Unit Residential (Pilot)
  - BREEAM Multi-Unit Residential

Delivering sustainable solutions in a more competitive world

**SBS Engagement Process**

1. **Typical project start**
2. Discovery
3. Exploration & Engagement
4. Strategy & Program Prioritisation
5. Program Implementation

We understand the sustainability drivers & trends for your business. We help you identify the links between sustainability & your business strategy. We define together your ambitions, goals and objectives. You prioritize ideas and projects with our facilitation.

Delivering sustainable solutions in a more competitive world
Conclusion – Approach Overview

Top down commitment to sustainability strategy

“Gap” closure strategy, delivering commercial, transparent, and sustainable solutions

Blueprint for the Future

Bottom up assessment of sustainability footprint

Delivering sustainable solutions in a more competitive world

Thank You
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ERM Korea Ltd
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Tel: +82 2 714 9092
SUSTAINABLE ECONOMICS; THE BALANCE OF CAPITAL COST AND DESIGN

Guest Speaker:
MR. SEAH HSU-MIN EUGENE
DLS Asia Representative,
DLSI Sustainability Group

Eugene is the DLS Asia representative in the DLSI Sustainability Group as well as the Airport group. He is involved in projects and is hands-on with getting value and quality services to his clients and to the project team. Eugene also embraces the project’s work scope with sustainability and green approaches with the views of project efficacy.

Besides core Quantity Surveying work, Eugene researches into Value Management, Risk Management, Sustainability Management, Law and Contracts, Information Technology in Construction as well as Project Management. He also lectures on Green issues and teaches in the National University of Singapore.

Eugene is a registered Mediator in the Singapore Institute of Surveyors and Valuers and is committed to continuous professional development.

Sustainable Economics:
The Balance of Capital Cost and Design

SUSTAINABLE REAL ESTATE DEVELOPMENT CONFERENCE 2009
Eugene Seah, Executive Director of
Davis Langdon and Seah Singapore

Agenda

- Knowing Your Green Building Products and Technologies (GBPTs)
  - Passive Designs
  - Active Designs
  - DLS GBPT Handbook
- Knowing the Green Mark Criteria
- Costing for Green
  - Economic Benefits
  - Green Costing
  - Building Information Modelling (BIM)
  - Life Cycle Costing
- Conclusion
Knowing Your Green Building Products and Technologies (GBPTs)

Different Type of Green Buildings

Passive & Active Designs

**Passive designs elements**
- Site and Orientation
- Building Shape and Mass
- Landscape and Green wall/roof
- Space Planning
- Windows
- Solar Shading
- Thermal Insulation
- Air and Moisture Tightness
- Natural Lighting
- Natural Ventilation

**Active designs elements**
- PV Panels
- LED Lighting
- Pneumatic waste system
- VVVF
- Wind Turbines
- Tri-Generation
- Thermal Energy Storage
- Condensing Boilers
- Solatube
- Building Management Systems
- Rainwater Harvesting

Integrated Design

Passive Designs
Site and Orientation

- Singapore with its tropical climate is for the longer axis of the building to lie along east-west direction.

Building Shape and Mass

- Certain common building shapes greatly increase envelope area to volume ratio (e.g., thin highrise towers), which can decrease building energy performance.

The effect of envelope to volume ratio on energy efficiency

Building Shape and Mass

- Minimize surface and windows on east-west facing façade
- Design Long façade with windows at north-south facing orientation

Landscape and Green wall/roof

- Garden and water features incorporated into building
**Landscape and Green wall/roof**
Reducing solar intensity with a green wall

**Solar Shading**
Effective Design with Sun shading

**Windows**
Low E glass at west facing windows

**Solar Shading**
Trellises as Sun shading
Windows with large overhangs
**Thermal Insulation**

- Rooftop as insulation layer.
- Cavity wall as insulation layer

---

**Natural Ventilation**

---

**Natural Lighting**

- Diffused day lighting to office perimeter
- Open Corridor and staircase

---

**Active designs**
Photovoltaic Panels

Davis Langdon & Seah

PV integrated with Curtain Wall
PV Panels on Roof

ACMV Systems

Table 1: Water-cooled chiller types and recommended efficiencies

<table>
<thead>
<tr>
<th>Chiller Type</th>
<th>Full load efficiency (kW/W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centrifugal</td>
<td>0.95 or less</td>
</tr>
<tr>
<td>Screw</td>
<td>0.84 or less</td>
</tr>
<tr>
<td>Reciprocating</td>
<td>0.92 or less</td>
</tr>
</tbody>
</table>

*Cut load efficiency is measured at peak load conditions, see references in ASHRAE 90.1-2013.

Lighting

LED
SolarTube

Energy Efficient Lifts

- VVVF Lift Motors and Escalators with Motion Sensors
Renewable Energy/ Energy Efficiency Features —

- Solar Energy
- Wind Turbines
- Biomass
- Motion Sensors
- Photo sensors
- Sunpipes
- Heat Recovery System
- Others

Indoor Air Quality Performance —

- CO2 monitoring to ensure delivery of min outside air requirements
- CO monitoring in carpark

Alternative Water Sources —

- Use of suitable systems that utilize alternative water sources for non-potable uses.
  - Alternative sources can include rainwater, greywater, NEWater, AHU condensate and recycled water from approved sources.

DLS GBPT Handbook
### GBPT Handbook

**Attribute:** Motors and Controls for Sun Shading Devices  
**Category:** Energy Efficiency

<table>
<thead>
<tr>
<th>Description</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A reliable and upgradeable solution which optimizes thermal, visual comfort and the energy performance of a building. The sensing and actuating conditions of the occupants are monitored whereas the costs incurred by cooling and artificial lighting are brought down. The system controls all solar protection devices in the building through a central programmable controller that receives data from weather sensors (sun, wind, etc).</td>
<td></td>
</tr>
</tbody>
</table>

**Capital Cost:**  
Initial cost of a medium project with 150 blinds and "VisiOn400" control is about $115,000 (excluding wiring). Cost of a medium project with 300 blinds and "VisiOn 80" control is about $280,000 (excluding wiring). Cost of a large project with 1,000 blinds and "VisiOn 120" control is about $720,000 (excluding wiring). |  |

**Payback Period:**  
Less than one year, based on the scientific paper of "Summary of Benefits of various types of shading and night cooling by vent windows" by Prof. Dr H.C.H. van Paassen. |  |

**Load Time:**  
12-15 weeks for large scale projects. |  |

**Warranty:**  
5 years. |  |

**Applications:**  
1. Can be applied over a wide range of projects mainly for commercial projects. |  |

**Other Information:**  
Each occupant controls a certain level of opening control. The central units are integrated into the building management system and contribute to energy saving measures. |  

---

**Information Source:**  
Davis Langdon & Seah Pte Ltd.

---

### GBPT Handbook

**Attribute:** Automatic Monitoring Device  
**Category:** Energy Efficiency

<table>
<thead>
<tr>
<th>Description</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>This meter is a multi-function power and energy meter. It is a cost effective yet rich feature device which measures power and energy displacement in one compact. It is designed to give average values of measured parameters at every second interval. Therefore, it will give an almost instantaneous recording of power measurements. It will display the following power parameters: Kilowatts, Kilojoules, Kilowatts Amperes, Apparent Kilowatt Hour, Apparent Kilowatt Hour and maximum demand (in Kilowatts, 15 min, 30 min or 60 min average).</td>
<td></td>
</tr>
</tbody>
</table>

**Capital Cost:**  
Project specific. |  |

**Costs:**  
1. High initial cost. |  |

**Applications:**  
1. Electrical power supply system can be monitored with this monitoring device. |  |
2. Useful for commercial projects. |  |
3. Easy maintenance. |  |
4. Encourages the use of energy efficient fixtures which are innovative, and have positive environmental impact in terms of energy saving. |  |

**Other Information:**  
Davis Langdon & Seah Pte Ltd.

---

**Information Source:**  
Davis Langdon & Seah Pte Ltd.

---

### GBPT Handbook

**Attribute:** AC Variable Voltage & Variable Frequency (VVVF) for Lifts  
**Category:** Energy Efficiency

<table>
<thead>
<tr>
<th>Description</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>The drive system's motor speed is controlled by varying the frequency and voltage of the applied AC supply. The system allows minimum frequency to produce the desired motion. The advantages of VVVF drive include low starting current (38% of rated current), high power factor and efficiency, and good ride quality and floor leveling.</td>
<td></td>
</tr>
</tbody>
</table>

**Capital Cost:**  
Additional cost is negligible as it is commonly applied in projects. |  |

**Costs:**  
1. High initial cost. |  |
2. Easy maintenance. |  |
3. Encourages the use of energy efficient lifts. |  |
4. Good indoor air quality. |  |
5. Easy maintenance. |  |

**Applications:**  
1. Applications in wide range of projects and new retrofit buildings. |  |

**Other Information:**  
1. Green Mark Point to be attained if VVVF has been incorporated into the lift design. |  |

---

**Information Source:**  
Davis Langdon & Seah Pte Ltd.

---

### GBPT Handbook

**Attribute:** Green Tiles  
**Category:** Environmental Protection

<table>
<thead>
<tr>
<th>Description</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Green tiles are created through glass fusion. This process combines recycled glass and minerals to create an entirely new ceramic material. The body of the tile contains over 50 percent waste glass from windows, mirrors, and post-consumer glass like bottles and jars. The rest of the tile is made of non-metallic materials such as special clay, feldspar, sand, and silica.</td>
<td></td>
</tr>
</tbody>
</table>

**Capital Cost:**  
Indicative cost range of $5.85/m² to $7.89/m². |  |

**Costs:**  
1. High capital cost. |  |

**Applications:**  
1. Can be applied over a wide range of projects. |  |

**Other Information:**  
Davis Langdon & Seah Pte Ltd.

---

**Information Source:**  
Davis Langdon & Seah Pte Ltd.
Knowing the Green Mark Criteria

Sustainable Development

- Reverse the trends in the architectural and engineering communities that focus on first costs and treat each discipline’s contribution to the whole building as separate, independent efforts.

- Integrates all of the design disciplines so that limited resources are efficiently directed toward the goal of meeting user needs without setting one program need against another.

- The precepts for sustainability are that all resources are limited and it is less expensive short and long term to build in harmony with the environment.
**Sustainable Development**

- Quote from the Minister of National Development in Singapore, “Build More with Less…”
- Mandatory Green Mark Certification for all developments more than 2,000 m² GFA
- April 2009, the Inter-Ministerial Committee on Sustainable Development (IMCSD) unveiled a blueprint for sustainable development in Singapore for the next 10 to 20 years.
  - S$1 billion for the next five years to help implement plans in the blueprint.
  - 2nd Green Building Masterplan
    - focus on existing buildings

**BCA’s 2nd Green Building Masterplan**

- 6 strategies thrusts with 3 development areas

**Green Mark Incentives for Existing Building (GMIS-EB) for Private Sector**

- IMCSD targets to get 80% of the existing buildings to be ‘GREEN’ by 2030

S$100 Million

- For private sector to retrofit to improve energy efficiency
- Opportunity for existing buildings to meet new ‘green’ standards
- Accelerate the pace of energy improvement in our buildings
- Key step towards setting minimum environmental sustainability standards

**Objectives**

<table>
<thead>
<tr>
<th>Green Mark</th>
<th>Try Again</th>
<th>Certified</th>
<th>Gold</th>
<th>GoldPlus</th>
<th>Platinum</th>
</tr>
</thead>
<tbody>
<tr>
<td>49</td>
<td>50</td>
<td>74</td>
<td>85</td>
<td>89</td>
<td>90</td>
</tr>
</tbody>
</table>

1. **ENERGY EFFICIENCY (63 Pts)**
   - To achieve a min of 30 GMP up to a max of 63 GMP

2. **WATER EFFICIENCY (18 Pts)**
   - To achieve a min of 20 GMP up to a max of 65 GMP

3. **SUSTAINABLE O&M (19 Pts)**
4. **INDOOR ENV. QUALITY (18 Pts)**
5. **OTHER GREEN FEATURES (10 Pts)**
   - To achieve a min of 50 GMP out of a max of 128 available GMP
   - To attain GM Certified
**BCA Green Mark Award Rating**

<table>
<thead>
<tr>
<th>BCA Green Mark Score</th>
<th>Version BCA 5.0 Non-Residential Building / BCA 1.0 Residential Building / BCA 2.0 Non-Residential Existing Building</th>
<th>Green Mark Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 to 85</td>
<td>85 to &lt; 90</td>
<td>90 and above</td>
</tr>
<tr>
<td>75 to &lt; 85</td>
<td>75 to &lt; 95</td>
<td>90 to &lt; 90</td>
</tr>
<tr>
<td>70 to &lt; 75</td>
<td>70 to &lt; 85</td>
<td>75 to &lt; 90</td>
</tr>
<tr>
<td>60 to &lt; 70</td>
<td>60 to &lt; 75</td>
<td>75 to &lt; 90</td>
</tr>
<tr>
<td>50 to &lt; 60</td>
<td>50 to &lt; 75</td>
<td>80 to &lt; 90</td>
</tr>
</tbody>
</table>

**Economic Benefits**

<table>
<thead>
<tr>
<th>Item</th>
<th>Green Buildings</th>
<th>Conventional Buildings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital Costs</td>
<td>Varied</td>
<td>Varied</td>
</tr>
<tr>
<td>Operating Costs</td>
<td>Lower (10% to 30% savings)*</td>
<td>Higher</td>
</tr>
<tr>
<td>Occupancy rates</td>
<td>Higher (3.6% to 4.1%)</td>
<td>Lower</td>
</tr>
<tr>
<td>Productivity</td>
<td>Higher (2% to 10%) (salaries are 25% higher than energy costs)</td>
<td>Lower</td>
</tr>
<tr>
<td>Rental rates</td>
<td>Higher (US$2.40 to US$11.33/sf)*</td>
<td>Lower</td>
</tr>
<tr>
<td>Sale prices</td>
<td>Higher (US$61 to US$171/sf)*</td>
<td>Lower</td>
</tr>
<tr>
<td>Tenant Retention and Satisfaction</td>
<td>Higher</td>
<td>Lower</td>
</tr>
</tbody>
</table>

* Based on CoStar study

---

**Green Costing**

- Green Costing varies from country to country
- Strength of the QS will be to adjust high level cost models at the feasibility stage to fit the budget

**In Singapore**

<table>
<thead>
<tr>
<th>BCA Green Mark Award Type</th>
<th>Green Cost Premium (%)</th>
<th>Payback Period (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Platinum</td>
<td>2% to 8%</td>
<td>2yrs to 8yrs</td>
</tr>
<tr>
<td>Gold</td>
<td>1% to 3%</td>
<td>2yrs to 5yrs</td>
</tr>
<tr>
<td>Silver</td>
<td>0.9% to 3%</td>
<td>2yrs to 5yrs</td>
</tr>
<tr>
<td>Certified</td>
<td>0%</td>
<td>2yrs to 5yrs</td>
</tr>
</tbody>
</table>

**Initial Impact on construction costs**

<table>
<thead>
<tr>
<th>In Australia</th>
<th>Percentage</th>
<th>Average $/s GFA (precluding development on costs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 Star - Green Star (as PCA Guide)</td>
<td>0%</td>
<td>$0</td>
</tr>
<tr>
<td>4 Star to 5 Star - Green Star</td>
<td>0% to 5%</td>
<td>$0 to $200</td>
</tr>
<tr>
<td>4 Star to 6 Star - Green Star</td>
<td>0% to 11%</td>
<td>$200 to $600</td>
</tr>
</tbody>
</table>

---

**Costing for Green**
**Cost Appraisals**

- What is the cost premium for Green Mark?
  - Experience of design team
  - Design integration is key
  - Wall to Floor ratio
  - Orientation of Building – ETTV (High Cost Impact)
    - Extent of Glazing
    - Type of Glass
    - Type of Sunshade
    - Size of opening
  - Green Plot Ratio

**Conceptual Taking Off With BIM**

Challenges of Construction projects:
- Compressed construction schedule
- Raw materials escalation
- Accurate forecast of construction cost

Generation of conceptual quantity takeoff information from the BIM model can be used to formulate a conceptual cost estimate.

The techniques and methods have been developed in conjunction with the HOK Construction Services Group.

**Cost Plans**

- Specifications for Green Mark
  - Knowing what is required – Design Requirements

- Knowing the cost to cost it right

- Knowing how to value engineer
  - Increase efficiencies and reduce wastage to bring about economic benefits
  - A new paradigm

**Components of Conceptual Estimate**

To begin to construct a conceptual estimate you must have a firm understanding of how it is produced. Because in this phase of a project the variables are so great a small amount of information is used to generate a large variety of cost information.

- Functional Floor Area
- Building Skin Area
- Interior Wall Length (if applicable)
- Ratio of Solid vs Glass
- Ratio of External Wall to Construction Floor area
- Construction Floor Area showing PES, NFA and even efficiencies
**Quantity Taking Off**

<table>
<thead>
<tr>
<th>Assembly Code</th>
<th>Assembly Description</th>
<th>QTO-1 Exterior Wall Schedule</th>
<th>Quantity Types</th>
<th>Total</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>A101300</td>
<td>Foundation Walls</td>
<td>Basic Villa</td>
<td>Total</td>
<td>0.03</td>
<td>258.9 m²</td>
</tr>
<tr>
<td>A101300</td>
<td>Foundation Walls</td>
<td>Basic Villa</td>
<td>Below</td>
<td>0.03</td>
<td>258.9 m²</td>
</tr>
<tr>
<td>A101300</td>
<td>Foundation Walls</td>
<td>Basic Villa</td>
<td>Between</td>
<td>0.03</td>
<td>258.9 m²</td>
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<td>Foundation Walls</td>
<td>Basic Villa</td>
<td>Above</td>
<td>0.03</td>
<td>258.9 m²</td>
</tr>
<tr>
<td>B0109</td>
<td>Exterior Walls</td>
<td>Basic Villa</td>
<td>Total</td>
<td>0.03</td>
<td>258.9 m²</td>
</tr>
<tr>
<td>B0109</td>
<td>Exterior Walls</td>
<td>Basic Villa</td>
<td>Below</td>
<td>0.03</td>
<td>258.9 m²</td>
</tr>
<tr>
<td>B0109</td>
<td>Exterior Walls</td>
<td>Basic Villa</td>
<td>Between</td>
<td>0.03</td>
<td>258.9 m²</td>
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<td>B0109</td>
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<td>Exterior Walls</td>
<td>Basic Villa</td>
<td>Total</td>
<td>0.03</td>
<td>258.9 m²</td>
</tr>
<tr>
<td>B0109</td>
<td>Exterior Walls</td>
<td>Basic Villa</td>
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<td>258.9 m²</td>
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<td>Basic Villa</td>
<td>Above</td>
<td>0.03</td>
<td>258.9 m²</td>
</tr>
</tbody>
</table>

**Methodology**

- **Cost Plan Unit Quantity**
- **Embodied Carbon**
- **Assumptions Made to calculate carbon**
- **Carbon Rates From DL5 UK**

**Carbon Costing**

- **Carbon and Cost Model**

1. Cradle to Gate Approach
2. Library is developed jointly by DL UK and University of Bath based on the Inventory of Carbon & Energy (ICE) Version 1.6 Beta
3. www.bath.ac.uk/mec-eng/sert/embodied/
Knowing the Cost

Having the Green Building Product and Technology Database
- Technical Knowledge
- Supplier Information
- Cost Database

GBPT Database

Card Index

Examples

Comparison for Different Types of Internal Wall

Comparison Building Cost of Wall Panels Per M²

<table>
<thead>
<tr>
<th>Description/Model Size</th>
<th>Material Panel/Block per M²</th>
<th>Installation (Labour)</th>
<th>Finishing (Labour, Paint, etc.)</th>
<th>Total Cost (Approx.)</th>
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</thead>
<tbody>
<tr>
<td>300x150</td>
<td>5.00</td>
<td>1.00</td>
<td>2.00</td>
<td>8.00</td>
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<tr>
<td>600x150</td>
<td>10.00</td>
<td>2.00</td>
<td>4.00</td>
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<tr>
<td>900x150</td>
<td>15.00</td>
<td>3.00</td>
<td>6.00</td>
<td>24.00</td>
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</table>

Comparison of Green Concrete

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<tr>
<th>Description</th>
<th>Concrete Spec</th>
<th>Green Concrete w/ 40% Recycled Coarse</th>
<th>% Difference</th>
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<tbody>
<tr>
<td>Supply Cost</td>
<td>30.00</td>
<td>24.00</td>
<td>-20%</td>
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<tr>
<td>Embedded Carbon (kg)</td>
<td>10,000 kg</td>
<td>9,000 kg</td>
<td>-10%</td>
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Conclusion
CONCLUSION

- How to Cost for Green
  - Need for greater understanding of green building design and integration
    - Passive and Active design principles
  - Database of GBPTs
    - Technical knowledge – value engineering
    - Suppliers’ contacts – procurement
    - Costing – cost control
- Does Green really Cost More?
  - It depends on your definition of “Green”.
SESSION 4: SMART GREEN DESIGN

THE IMPORTANCE OF AN INTEGRATED/HOLISTIC DESIGN APPROACH TO OPTIMIZING SUSTAINABILITY OUTCOMES

Guest Speaker: MR. MATTHEW JESSUP
Principal | Group Environmental Leader, WSP Lincolne Scott Pty Ltd

Matthew is a Principal of Advanced Environmental and WSP Lincolne Scott. As WSP Lincolne Scott Group Environmental leader, Matthew is responsible for Advanced Environmental across its offices in Sydney, San Francisco and Melbourne, as well as WSP Lincolne Scott’s overall environmental sustainability strategy. Matthew sits on WSP Lincolne Scott’s Strategic Committee and global Sustainability Network.

Significant projects where Matthew has led AE’s team include:
- Southern Cross Station, Melbourne, is an iconic public transport facility which relies on natural ventilation for the entire concourse.
- Waterfront City, the target for this development is to meet the Melbourne Docklands Authority’s highest IBD achievement level, recognised as the “Award of Excellence”.
- Melbourne Convention Centre was awarded a 6 Star Green Star environmental rating – a world first for a convention centre.
- 30 The Bond, the first major building in Australia to adopt passive chilled beams.
- City Central Precinct: Adelaide including Towers A1 and A2, the largest building in Australia to receive a 5 star Green Star rating.
- Green Square Town Centre and Energy Feasibility.
- Alameda Point San Francisco
- Parramatta Justice Precinct will target a 5 star Green Star Office Design and 5 Star Office Intensities rating, the first major government facilities to meet this standard.
- Docklands ESD Visioning developed in 2003, the Guide has already set new standards for ecologically sustainable.
- NGAA PRC Honolulu

These projects each address sustainability in a unique way and have required innovative and integrated design solutions in order to ensure that the outcome meets the design requirements, is cost effective and is deliverable within the project constraints. Matthew has also been at the cutting edge of health care and research facilities having led AE’s successful delivery of Auburn Hospital and also being closely involved with the embryonic generation green hospitals including Norrlunga and Lyell McSwain hospitals. Matthew led the development of Green Star’s Health Care Energy Calculator and has also authored a chapter of a book focused on sustainability within research facilities. Matthew is a Green Star Accredited Professional and has presented a number of papers that look at creating sustainable and healthy workplaces.
Smart Green Design
The Importance of an Integrated Design Approach to Optimising Sustainability Outcomes
Green Building Evolution

Green building design has gained rapid acceptance globally.

It has evolved from being part of small boutique facilities to being a key component of global corporate HQ's and highly cost effective commercial office developments.

Truely green development mixes high performance buildings (works above ground) with innovative infrastructure (works below ground).

Green Precincts and Cities are the next step.
Our Values are changing...

1960 Cowboy Culture → Nation First

2020 Spaceship Culture → Planet First

Dependence
Independence
Interdependence

A New Model...
Sustainable
Healthy
Connected
Sustainable
- Water Zero
- Carbon Zero
- Waste Zero

Healthy
- Fresh Air
- Natural Light
- Wellness

Connected
- Outdoor Space
- Shared Working
- Remote Working

The Future Workplace…
Buildings, Precincts, Cities
The Worlds Future Precincts and Cities are Integrating a Broad Range of Initiatives

The New Model Applies Initiatives in Different Ways

Grid
Mesh
Bio
City
Precinct
Building

Green Building – City Central Tower

Location: Adelaide
Stage: Built: Operational, Certified (Design: As built and Operation)
Commissioned by: Aspin Group
Use: Commercial, Retail

ESD Considerations:
- 5 Star Green Star rating
- 5 Star Operational Carbon Rating
- The building performed as it was modelled
- Creative Technology Throughout
- Carbon offset
- The first building in a Green Precinct
Green Precinct - Fraser's Broadway

Location: Sydney
Stage: Concept Stage
Commissioned by: Frasers Property
User: Commercial, Residential, Retail
Details: Commercial +20,000 m², 1999 Apartments +298,991 m² GFA, 38 levels
ESD Considerations:
- 5 Star Passivhaus (PNLT) rating
- 100% Energy Positive
- Passive solar design
- Photovoltaic panels
- Passively cooled, heated, and ventilated
- No underground infrastructure

Healthy Sustainable and Connected Buildings
Precincts and Cities are the New Model for the Future Workplace

Download the Refresh Summary Report:

Green City - Masdar

Project: Masdar City
Location: Abu Dhabi
Stage: Commissioned Date 2015
Commissioned by: Abu Dhabi Future Energy
User: City
Details: 6 million m² built area
6.4 million m² site area
population 50,000 to grow to 100,000
ESD Targets:
- World’s 1st operationally zero carbon city
- Photovoltaic Plant
- Wind Plant
- Concentrating Solar Thermal Power
- Built using zero carbon energy
- Car-free
- Zero waste
- Municipal Solid Waste
- Tree plantations producing biofuel
- Sewage Treatment Plant
- One Planet Living

THANK YOU
Questions?
GREEN BUILDING DESIGN - IMPLICATIONS AND FUTURE TRENDS

Guest Speaker:
MR. CHOI YOUNGHO
PhD, Associate, Samoo Architects

Career
Associate, SAMOO Architects & Engineers
Adjunct Professor of Hankyung National University
Vice Chairman, Green Architecture Subcommittee, KIA
Professor of Sustainable Design Academy

Green Building Design - Implication & Future Trends -

SAMOO
YoungHo Choi

Resources
Exhaustion

why?

Climate change

Global warming

Greenhouse effect

CO₂
**How to realize Green Building**

**Ecology**

**Nature-oriented**

**Harmony with Nature**

California Academy of Sciences - Renzo Piano

There are 1.7 million plants on the 2.5-acre green roof — the plants and soil insulate the building and trap rainwater.

**How to realize Green Building**

**Ecology**

**Nature-oriented**

**Harmony with Nature**

**How to realize Green Building**

**Ecology**

**Nature-oriented**

**Human-oriented**

**Energy Efficiency**

**Energy Saving**

**Renewable Energy**

Active System

Cost

Cost

Passive Design

Building Form and Orientation

Energy efficiency

architectural
How to realize Green Building

Energy Efficiency

Energy Saving

Reduction
- Orientation
- Mass / Envelope
- Insulation
- Air tight con.
- Efficiency MEP
- Lighting
- Ventilation

Optimum orientation

How to realize Green Building

How to realize Green Building

Technology

Human-oriented

Energy Efficiency

Energy Saving

Envelope Design
- Dinamic Skin / Double Skin

RWE Tower (Germany)

How to realize Green Building

Technology

Human-oriented

Energy Efficiency

Energy Saving

Mass Design
- Atrium / Ecological Core / Eco-shaft

Gengyme Center
LEED Platinum / Natural Lighting by prism / air duct, light shaft / 12-story

How to realize Green Building

Technology

Human-oriented

Energy Efficiency

Energy Saving

Insulation
- Super Insulation Material / EIFS

SIP(Neopor) Denim
(Exterior Insulation and Finish System)
How to realize Green Building

**Technology**

- Human-oriented

**Energy Efficiency**

- Energy Saving

**Ventilation**

- Natural ventilation / Heat recovery ventilation unit

- 15 m deep offices allow natural ventilation and maximum daylighting

- Glazed roof heats up to promote stack effect in atrium

- Natural ventilation
- Heat recovery ventilation unit

---

How to realize Green Building

**Technology**

- Human-oriented

**Energy Efficiency**

- Renewable Energy

**Solar Energy**

- Passive / Active / Hybrid

- Clerestory
- PV Panel, Freiburg

---

How to realize Green Building

**Technology**

- Human-oriented

**Energy Efficiency**

- Renewable Energy

**Solar Energy**

- Light Shelf / Light Duct

- Solar energy
- Insolation analysis

- Sidwell middle School, Washington
- Darim 3liter House, Daejeon
How to realize Green Building

**Technology**
Human-oriented

**Energy Efficiency**
Renewable Energy

Solar Energy - Shading / Louver

Le Corbusier, Brise-Soleil
Louver, Freiburg

How to realize Green Building

**Technology**
Human-oriented

**Energy Efficiency**
Renewable Energy

Wind Energy - Active, Hybrid
4m/sec
noise
vibration
Visual Disturbance

Bahrain WTC
BRE, UK

How to realize Green Building

**Technology**
Human-oriented

**Energy Efficiency**
Renewable Energy

Solar Energy - Outdoor Venetian Blind

How to realize Green Building

**Technology**
Human-oriented

**Energy Efficiency**
Renewable Energy

Wind Energy - Wind Cowl
- BedZed
(Beddington ZeroEnergy Development)
- Bill Dunster
How to realize Green Building

Technology

Human-oriented

Energy Efficiency

Renewable Energy

Geothermal Energy - Active, Hybrid

Geothermal Heat Pump System

Cool Tube System

In the Future

Green Building Design

Eco Technical Design

Biomimetic Design

Neo Vernacular Design

How to realize Green Building

Technology

Human-oriented

Material

3R
Reduce
Reuse
Recycle

Embodied Energy
IAQ (Indoor Air Quality)

Eco Technical Design

Living Machine
**Biomimetic Design**

**Lotus Effect**

The facade paint Lotusan launched in 1999.

---

**Neo Vernacular Design**

**Humidity Control System**

High humidity in winter makes air feel warmer, so we can use less heat.

In the summer, low humidity makes air feel cooler, so we can use less air conditioning.

**Natural Ventilation System**

**Wind Tower**

---

**Biomimetic Design**

**Honeycomb Pattern Window**

---

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RETROFITTING BUILDINGS:
HOW GREEN SHOULD YOU GO?

Guest Speaker:
MR. KD JEON
Head of Asset Management, ING Real Estate Investment Management

Kyungdon has been with ING Real Estate since March 2007, when he was appointed director of asset management. Prior to joining ING, Kyungdon worked at the manager of a major shopping centre owned by the ING Real Estate Asia Retail Fund. He has over 14 years experience in the real estate sector including property management and development. During his time with ING he oversaw the divestment of the four Korea Property Investment portfolio assets and The Mall, helping the company achieve significant profits from the sales.

Kyungdon holds a BA from the University of Foreign Studies, and an MA in Real Estate Management from Konkuk University in South Korea.

Sustainable Management Case Study
ING Tower LEED Certification

ING Real Estate Investment Management (Korea), Ltd.

Table of Contents

1. Drivers
2. Process
3. Results
4. Effects
5. Future Plans
6. Recommendations


1. Drivers

- Corporate Social Responsibility (CSR)
  - ING Real Estate Investment Management Initiative (Nov. 2007)
  - Increased investor interest in CSR policy implementation
  - Tightening government regulations

- Improved Marketing
  - Corporate Reputation Enhancement
  - Improved health/productivity in tenant workspaces

- Property Value Enhancement
  - Increased operational efficiency/savings
  - “Green” property marketing
  - Competitive rent and low vacancy levels

1. Drivers (cont.)

- Why ING Tower?
  - Highest-profile asset in ING REIM Korea AuM
  - Landmark building in major Seoul business district
  - Optimal property to show effects of program
  - Staying competitive in softening market
  - Significant office supply increase expected in 2010-11

- Why full pilot program?
  - Small-scale project not meaningful
  - Upgrading management capabilities
  - LEED certification process
  - Holistic review of building operations

2. Process

<table>
<thead>
<tr>
<th>Selection of standard</th>
<th>Performance Data Submission</th>
</tr>
</thead>
<tbody>
<tr>
<td>• LEED for Existing Buildings</td>
<td>• Data submitted to USGBC for review</td>
</tr>
<tr>
<td>• Title 24 leading global standards</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Certification</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Gold-level certification awarded</td>
</tr>
<tr>
<td>• First LEED-EB certified Korean building</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Selection of consultant</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 5 candidates with international experience considered</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Implementation of Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Installation improvements to building facilities</td>
</tr>
<tr>
<td>• Revision of building maintenance operations</td>
</tr>
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</table>

2. Process (cont.)

<table>
<thead>
<tr>
<th>Improvements to Property</th>
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<table>
<thead>
<tr>
<th>Area</th>
<th>Period</th>
<th>Total Cost</th>
<th>“Green” Cost</th>
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</thead>
<tbody>
<tr>
<td>Elevator overhaul</td>
<td>April – October 2006</td>
<td>KRW 136 million</td>
<td>10% KRW 74 million</td>
</tr>
<tr>
<td>Parking garage painting</td>
<td>August 2007</td>
<td>KRW 180 million</td>
<td>20% KRW 36 million</td>
</tr>
<tr>
<td>Façade/landscape renovation</td>
<td>Sept. – Nov. 2008</td>
<td>KRW 1.6 billion</td>
<td>20% KRW 320 million</td>
</tr>
<tr>
<td>Restroom renovation</td>
<td>August – September 2008</td>
<td>KRW 534 million</td>
<td>20% KRW 106 million</td>
</tr>
<tr>
<td>Sensor/BAS Upgrade</td>
<td></td>
<td>KRW 350 million</td>
<td>100% KRW 350 million</td>
</tr>
<tr>
<td>Consultant/Application Fees</td>
<td>December 2008 – March 2009</td>
<td>KRW 238 million</td>
<td>100% KRW 238 million</td>
</tr>
<tr>
<td>Miscellaneous CAPEX/Repair</td>
<td></td>
<td>KRW 212 million</td>
<td>100% KRW 212 million</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>KRW 3.85 billion</td>
<td>KRW 2.48 billion</td>
</tr>
</tbody>
</table>
3. Results

- Operational: Increased efficiency in water/energy use
  - Storm water collection tanks: 100% of landscape irrigation
  - Water-efficient landscaping: Native species only
  - Installation of cooling tower conductivity meters: Optimized cooling tower performance (KRW 10 million annually)
  - Upgraded BAS controls: HVAC system automated
  - Adjusted water fixture flow: 42% below previous levels
  - Tenant “Earth Hour” program: 3,900 kWh per floor X 10 floors
  - Reflective coating on roof: reduced heat island effect

4. Effects

- Upgraded Management
  - Utilities savings
  - Operational improvements

- Impact on Tenants
  - Tenant education
  - Increased tenant satisfaction/retention

- Value Enhancement
  - Certification process coincided with divestment

3. Results (cont.)

- Policies: Green Management and Tenant Education
  - Sustainable procurement: 98.5% all cleaning supplies “green”
  - Increased waste management: 26% → 99% of all waste recycled
  - Tenant tours and newsletters

- Health and Safety
  - Elevator renovation: increased efficiency and air quality
  - Separated smoking zones: improved air quality

4. Effects (cont.)

- Benefits of “Going Green”
  - Energy Savings: 5% total energy cost (projected)
  - Exit Price: KRW 20 million/Pyung
  - Occupancy: 100% occupancy August 2009

Source: USGBC Presentation (Why Build Green?), 2008
4. Effects (cont.)

- Advertising Value

<table>
<thead>
<tr>
<th>Date</th>
<th>Media</th>
<th>Title</th>
<th>PR Value</th>
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</thead>
<tbody>
<tr>
<td>06.08</td>
<td>MBC</td>
<td>한국 정책과 한국</td>
<td>KRW 67,360,000</td>
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<td>08.12</td>
<td>Chosun Ibo</td>
<td>“한국 정책과 한국” by ING Group</td>
<td>KRW 116,836,264</td>
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<td>09.16</td>
<td>JoongAng Ibo</td>
<td>코리아의 패션과 디자인</td>
<td>KRW 43,616,929</td>
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<td>코리아의 정책과 한국</td>
<td>KRW 2,000,000</td>
</tr>
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</table>

- Monthly: KRW 2,000,000

| Total | KRW 320,912,400 |

5. Future Plans

- **ING REIM Asia Regional Policy**
  - Global REIM sustainability policy
  - Regional platform formed to formalize sustainable property investment policy

- **ING REIM Korea**
  - Sustainable factors to be considered in future acquisition/development projects
  - Continued sustainable procurement for current properties

5. Recommendations

- Increased government involvement
  - Tightening environmental regulations
  - Subsidies/incentives for superior performance

- Normalization of sustainable market practices
  - Increased interest in sustainable investment
  - “Green” leasing: Tenant fit-out/restoration clauses

- Changing tenant culture
  - Increased demand for “green” buildings
  - Increased tenant awareness

---

Thank you