Presentation by: Thom Bohlen, CTO; Architect; LEED AP; ESTIDAMA PQP

MIDDLE EAST CENTRE FOR SUSTAINABLE DEVELOPMENT (MECSD)

OCTOBER 24, 2011
Middle East Centre For Sustainable Development (MECSD)

- 200 USGBC LEED and ESTIDAMA PEARL Green Building projects in U.A.E.– Certifying over 40 million square feet of development

- Guiding stakeholders through the USGBC LEED Rating System and the ESTIDAMA Pearl Rating System for certification of Green Buildings

- MECSD has LEED certified Twenty Four (24) projects in U.A.E. including (2-Platinum; 11- Gold and 11- Silver)

- Architects, energy engineers, construction managers, environmentalists, including ESTIDAMA PBQP’s; PCQP; and USGBC LEED AP’s, working with your team in an integrated process

- Working from Pacific Controls’ “Platinum” LEED Rated Facility, and from 403 Al Zubara Towers, Abu Dhabi Office (off of Salam Street)
<table>
<thead>
<tr>
<th>Sl No:</th>
<th>Q no:</th>
<th>Project</th>
<th>Version</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>195</td>
<td>Walls &amp; Floors</td>
<td>LEED NCv2.2</td>
<td>Gold</td>
</tr>
<tr>
<td>2</td>
<td>186</td>
<td>DCT Logistics</td>
<td>LEED NCv2.2</td>
<td>Silver</td>
</tr>
<tr>
<td>3</td>
<td>33</td>
<td>Sapin Can Factory</td>
<td>LEED NCv2.2</td>
<td>Silver</td>
</tr>
<tr>
<td>4</td>
<td>97</td>
<td>Scania</td>
<td>LEED NCv2.2</td>
<td>Gold</td>
</tr>
<tr>
<td>5</td>
<td>718</td>
<td>Cruise Terminal</td>
<td>LEED NCv2.2</td>
<td>Silver</td>
</tr>
<tr>
<td>6</td>
<td>275</td>
<td>Modern Emirates Heavy Crane</td>
<td>LEED NCv2.2</td>
<td>Gold</td>
</tr>
<tr>
<td>7</td>
<td>459</td>
<td>Schaeffler</td>
<td>LEED NCv2.2</td>
<td>Gold</td>
</tr>
<tr>
<td>8</td>
<td>73</td>
<td>Euroleaf</td>
<td>LEED NCv2.2</td>
<td>Silver</td>
</tr>
<tr>
<td>9</td>
<td>152</td>
<td>Simba Toys</td>
<td>LEED NCv2.2</td>
<td>Silver</td>
</tr>
<tr>
<td>10</td>
<td>107</td>
<td>AwRostamani</td>
<td>LEED NCv2.2</td>
<td>Silver</td>
</tr>
<tr>
<td>11</td>
<td>34</td>
<td>ESAB</td>
<td>LEED NCv2.2</td>
<td>Platinum</td>
</tr>
<tr>
<td>12</td>
<td>293</td>
<td>ECS Global Wire &amp; Cable</td>
<td>LEED NCv2.2</td>
<td>Silver</td>
</tr>
<tr>
<td>13</td>
<td>3</td>
<td>easy Hotel</td>
<td>LEED NCv2.2</td>
<td>Gold</td>
</tr>
<tr>
<td>14</td>
<td>215</td>
<td>Pultron Composites</td>
<td>LEED NCv2.2</td>
<td>Gold</td>
</tr>
<tr>
<td>15</td>
<td>742</td>
<td>PCI New Jersey</td>
<td>LEEDv3 CI</td>
<td>Gold</td>
</tr>
<tr>
<td>16</td>
<td>413</td>
<td>Nestle</td>
<td>LEED NCv2.2</td>
<td>Gold</td>
</tr>
<tr>
<td>17</td>
<td>330</td>
<td>Steel Plates</td>
<td>LEED NCv2.2</td>
<td>Silver</td>
</tr>
<tr>
<td>18</td>
<td>654</td>
<td>LG Electronics</td>
<td>LEED NCv2.2</td>
<td>Gold</td>
</tr>
<tr>
<td>19</td>
<td>118</td>
<td>Akse Power Generation</td>
<td>LEED NCv2.2</td>
<td>Gold</td>
</tr>
<tr>
<td>20</td>
<td>194</td>
<td>Intraco</td>
<td>LEED NCv2.2</td>
<td>Silver</td>
</tr>
<tr>
<td>21</td>
<td>102</td>
<td>Prescott 1</td>
<td>LEED NCv2.2</td>
<td>Silver</td>
</tr>
<tr>
<td>22</td>
<td>238</td>
<td>Woodhouse</td>
<td>LEED NCv2.2</td>
<td>Gold</td>
</tr>
<tr>
<td>23</td>
<td>259</td>
<td>Al Shamali</td>
<td>LEED NCv2.2</td>
<td>Silver</td>
</tr>
<tr>
<td>24</td>
<td>331</td>
<td>TLM International</td>
<td>LEED NCv2.2</td>
<td>Platinum</td>
</tr>
</tbody>
</table>

**UAE vs US Certification Projects**

<table>
<thead>
<tr>
<th></th>
<th>UAE</th>
<th>US</th>
</tr>
</thead>
<tbody>
<tr>
<td>Platinum</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Gold</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>Silver</td>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>24</td>
<td>24</td>
</tr>
</tbody>
</table>

**Pie Chart:**
- UAE Platinum
- UAE Gold
- UAE Silver
- US Gold
MECSD Sustainability Services

A. Corporate Sustainability Consulting
B. Carbon Verification & Validation Services
C. Sustainable Building Consulting Development, Including Sustainable Rating System Commissioning Services
D. Sustainable Transportation Services
E. Sustainable Waste Management Services
F. Sustainable Oil and Gas Services
G. Sustainable Manufacturing Services
H. Sustainable Utilities Services
I. Sustainable Finance & Management Services
j. Sustainable Governance Services

“a new species is arising on the planet. It is rising now and you are it “....

Eckhart Tolle
Sustainable Development Strategies for the Middle East Region
Human Development in the Middle East Dependant on Three Basic Elements:

The Sun’s Energy

The Water Source

And The Sand…..
The Sun
Our Thermal Engine
Our Sun-The Source of Planetary Life

• ALL LIFE ON EARTH IS DEPENDENT ON THE SUN FOR ENERGY.

• RESPONSIBLE FOR ALL CHEMICAL AND BIOLOGICAL PROCESSES.

• THE “SOLAR CONSTANT” is $I_0 = 1.367 \text{ w/m}^2$.

• THE AMOUNT OF SOLAR ENERGY AVAILABLE ON EARTH IS VARIABLE, AND DEPENDANT ON LATITUDE, TIME OF DAY AND TIME OF YEAR.

• THE GLOBAL SOLAR RADIANCE FALLING ON A HORIZONTAL SURFACE IS “$G_g = G_{\text{diffuse}} + G_{\text{direct}}$”

• THE SUN RELEASES MORE ENERGY IN 15 MINUTES THAN THE ENTIRE HUMAN RACE CONSUMES IN AN ENTIRE YEAR.
Water
the Substance of Life
Water - The Substance of Planetary Life

- **ALL LIFE ON EARTH IS DEPENDENT ON THE AVAILABILITY OF WATER.**
- **INVOLVED IN ALL CHEMICAL AND BIOLOGICAL PROCESSES.**
- **75% WATER OF THE EARTH’S SURFACE:**
- **3% OF ALL WATER POTABLE:**
- **WATER POSESSES UNIQUE PROPERTIES:**
  - Approximately 97% of all water on our planet is in the oceans.
  - Ocean water contains around 35,000 parts per million dissolved materials, comprised of at least 70 elements.
  - Fresh water (less than 1000 ppm dissolved materials) represents the remaining 3% of water on Earth, 2/3's of which is snow and ice in glaciers and in the polar ice caps. Water in the atmosphere, ground water, lakes and streams comprise the rest of Earth's fresh water. Liquid and solid water covers roughly three-quarters of Earth's surface area.
  - Water can absorb or release more heat than most other substances for every temperature degree of change. This attribute is critical to coolant systems and heat exchangers.
  - Water buffers extreme temperature fluctuations, acting as heat reservoirs, heat exchangers, and an essential element of life. The global and continental water cycles make deserts and rainforests from evaporation and precipitation.
  - The changing states of water (and the energy released) power thunderstorms and hurricanes. Water's changing states help carry the sun's energy and buffer rapid changes across the globe.
The Desert

our Climate and Environment
The Shifting Sands and the sometimes harsh climate of the Arabian Peninsula have been home to many desert dwellers, or Bedouin people, over the past several thousand years, and as such, has had a great impact on how the people live and dress, how their culture has developed, and the nature of their built environment.

With few places to support even a small community for even a short period of time, the Bedouin migrated from one meagerly fertile area to another, with their sheep, goat, and camel herds. Nomadic dwellings tended to be tent structures, easily disassembled and reassembled with ease.
Sand - The Shifting Nature of the Desert Life

Most of the larger populations tended to organize around the coastal areas of the seas, or around desert oasis, where a stable food and water supply was most available. In these settlements, dwellings over time took on form and function as a reaction to the harsh desert climate and cultural and religious characteristics.

Thus, dwellings came to be built with thick walls, utilizing courtyards, fountains, and wind towers to increase the chances of capturing and or creating cooling breezes.
Sand - The Shifting Nature of the Desert Life

The Post World War II era, with the nationalization of the oil industries and the rise in the availability of mechanical air conditioning saw the Middle East countries developing larger buildings and developing cities, with teeming populations. A good portion of the Bedouin culture remains among the Nationals who inhabit these countries.

However, as in other countries across the globe, little consideration has been given to the sustainability of the buildings and infrastructure of these new cities, at least until lately. But that is changing now.
Sustainable Development Issues In The Middle East

1. High Temperature, Humidity, Blowing Sand - Resulting in High energy consumption for cooling loads.

2. Potable Water Resource Shortages, resulting in high water and energy consumption.

3. Extreme Heat Island Effect, resulting in less pedestrian and more vehicle use and congestion and greater energy consumption for cooling.

4. Existing Non-Sustainable Infrastructure, resulting in greater numbers of truck transport of waste and water, in lieu of adequate piping.

5. Iconic, but unsustainable, new architecture-resulting in inefficient buildings.

6. Highly Inefficient Existing Buildings-buildings constructed in the past without much regard to Energy and water consumption reductions.

7. Poor or Little Facility Management – Buildings being operated and maintained without regard to reductions in energy and water consumptions.

8. Lack of Sustainable Development Legislation – Many Countries in the Middle East have no Required Sustainable Development Regulations.

9. Lack of awareness within the Middle East in the Development Industry and in the general population –regarding the need for sustainable development.
Sustainable Development Strategies In The Middle East

1. Integrate Sustainability Into Project Programming.
2. Develop a Highly Integrated Sustainable Development and Operational Team Approach.
3. Utilize an Internationally or Nationally Recognized Green Building Rating System.
5. Sustainable Site Development Strategies.
8. Sustainable Materials and Resources Strategies.
10. Innovative and Historical and Cultural Strategies.
Integrate Sustainability Into Project Programming

Sustainability Programming, or ‘Green Programming” is vital to the success of the entire project, and allows the proactive inclusion of sustainable features and systems to be fully integrated at the outset into the proposed building fabric, and become the benchmark for the remainder of the project.

Steps in Green Programming should include the following:

1. **Meeting with the project programming stakeholders** to identify major sustainable strategies and methodologies that can be successfully incorporated into the project program.

2. **Create initial site building orientation layout and massing studies**, with proposed green features such as fenestration location, shade devices, shade and ventilation effect from adjacent buildings and other significant building parameters affecting the overall solar energy absorption for the building.

3. **Perform macro return on investment calculations** for the major sustainable strategies, and identify any related implementation issues related to cost, availability in the market place and time implications.

4. **Identify any Green Code compliance required and or desired certification rating.**

5. **Include the identified sustainable strategies in the Sustainable Project Program**, Owners Project Requirements and the Basis of Design for project design and construction adherence.
Develop a Highly Integrated Sustainable Development and Operational Team and Approach

Integrated Development Process: Encouraging cross-disciplinary teamwork to deliver environmental and quality management throughout the life of the project with a clear vision, identified sustainability targets, and implementation strategy. The main objective is to achieve significant environmental, social, economic and cultural benefits while ensuring that the costs of the development are minimized.

Integrated process Includes:

- Utilize Building Integrated Management Process (BIM) by all team players;
- establish a more collaborative and interactive design process;
- encourage construction activities that value workers welfare, quality and sound environmental management; and
- prepare the ground work for sustainable operation and maintenance where the user and facilities manager plays an informed active role.
Utilize an Internationally or Nationally Recognized Green Building Rating System.

Programs to stimulate and guide stakeholders in sustainable practices in Development:

• **USGBC LEED Rating Systems** for New and Existing Buildings, Core and Shell, Commercial Interiors, Medical Facilities, Schools, and Neighbourhood Development.

• **ESTIDAMA Pearl Rating System** for New Buildings, Villas, and Communities. One Pearl min. for private developments; Two Pearl for public developments.

• **QSAS Building Rating System**, Qatar.

• **BREAM**, UK System

• Government Adoption of Green Regulations: **Dubai Municipality Green Building Regulations** (Optional).

Sustainability... the conscious and pro-active management of economic growth that ensures a good quality of life for future generations.
Utilize Sustainable Development Modeling Tools early in Conceptual Design Development

Through the early use of **Energy Modeling**, the project can identify, analyze, and select sustainability measures that will reduce energy consumption in the project. Building site, massing, and glazing, and shading orientation is the first of these to be considered and can have great impact on the buildings total energy consumption. Other important sustainability measures include the Building Envelope Insulation Values; Lighting Power Density Levels; and HVAC Energy Efficiency Ratio’s.

**Fluid Dynamic Modeling** can be used to weigh-in on the building site orientation, fenestration location, and natural ventilation cooling considerations.

**Lighting and Day Lighting Modeling** can assist the project Design Team to attain an efficiency balance between natural day lighting use with optimal artificial lighting, using day light and occupancy lighting controls.

**Water Management Calculations** can predict the effects of utilizing low water use plants and irrigation systems; low water use plumbing fixtures; and recycling of waste water and or the use of an on-site sewage treatment plant.
Sustainable Site Development Strategies.

- **Construction Activity Pollution Prevention**
- **Development of an infill site or rehabilitate an existing building for a new use.**
- **Develop on a site that is formerly polluted by first remediating the pollution.**

- **Providing Alternative Transportation** means by providing parking for car pools, vans and busing system, and bicycle Parking to reduce the travel by individual autos. Provide parking for low fuel / low emission autos

- **Protect and restore habitat** (especially along coast lines) And **protect and restore open space** (landscaped with natural plantings)

- **Provide for stormwater management** to include control of quantity of post construction runoff and quality of runoff

- **Design for reducing the Urban Heat Island Effect** through the use of site materials with high SRI, and with shade techniques.
Sustainable Site Development Strategies

Minimizing the Heat Island Effect

With its extreme summer temperatures, the U.A.E. has unique challenges to pedestrians. High daytime and evening temperatures and humidity combine to raise the temperature of the built environment with little opportunity to lower or “flush-out” the heat during the evening hours, hence the day and night time high use of conventional air conditioning which consumes energy and adds heat to the outdoor environment.

A Successful Integrated Approach requires a wide range of factors including:

- building and street proportions
- architectural and natural shading
- material properties
- air movement
- the appropriate use of water and psychological / physiological considerations.

A successful strategy should provide cooling during the summer months while also allowing the warming effect of the sun during the winter.
Optimizing street / building Proportions to provide maximum shade and Ventilation

A number of factors must be considered in determining the most effective combination of street and building proportions (street canyon) in the U.A.E. These include

• the amount of shade cast onto the street and other surface by buildings,

• the ability of heated building surface to release their heat to the evening sky,

• and the ability of air to move freely through the urban environment.
Sustainable Water Management Strategies.

1. **Efficient Landscape and Irrigation System:**
   (50% reduction in use of potable water or 100% grey water use)
   Zerescape landscaping plant selection (use native plants where possible) Drip irrigation system (for real)

2. **Efficient Plumbing Fixtures:**
   - Dual Flush Water Closets - 4.5 l/fl and 3 l/fl
   - Low Flush Urinals - .8 l/FL
   - Low Flow faucets - 5.6 l/min
   - Low flow Showers – 7.5 l/min

3. **Grey Water Recycling**
   - Vehicle Wash Area Recovery/Recycle
   - Dual piping from showers and lavs
   - Condensate recovery

4. **Sewage Treatment Plant**
   Treated effluent
Sustainable Energy Management Strategies.

ENERGY REDUCTION: TYPICAL GOAL IS 18 TO 25% REDUCTION OVERALL

1. Building Envelope:
   • Good Thermal Resistance of Walls, Roof, Floors, Glazing Units
   • Air and Moisture Tightness (sealants and good detailing of window/door to wall)
   • High SRI Values of Roof and walls and Paving
   • Green Roofs (30%)
   • Building orientation, glazing orientation, and shade over glazed areas
   • Operable Windows

2. Lighting Reduction (Lighting Power Density) 20-30% achievable w/ standard-50% achievable with LED.
   • Exterior Site Lighting PV Solar—either stand alone or panel array with battery storage system, with standard or LED bulbs.
   • LED Lighting On Interior (10 % reduction in wattage and lasts 10 times longer—(usually payback between one to two years)
   • Low Voltage control system, automatic night shut off, and motion sensors.
   • Day Lighting Techniques, including properly orientated and shaded exterior glazing, light shelves, interior glass partitions, light pipes, and clerestory lighting
Sustainable Energy Management Strategies

ENERGY REDUCTION: TYPICAL GOAL IS 18 TO 25% REDUCTION OVERALL

3. **Efficient HVAC System:**
   - High Efficiency Units using acceptable refrigerants: EER value = 11 or better.
   - Fresh Air rates to meet ASHRAE 62.1, 2007
   - Air Flow monitoring and CO2 sensors

4. **On-site Renewable Energy System:**
   - Solar Thermal Heating for Domestic Use.(2-3 years ROI)
   - Solar Thermal Cooling- use of chilled core slabs and Solar Chillers (2-3 years ROI)
   - Solar PV lighting system and power systems (15 – 30 year ROI)

5. **Measurement and Verification and Monitoring:**
   - Implement a Building Automation System (BAS) that has the capability of real time monitoring from a remote location over the cloud.
   - Design video Screen Dashboards to express collected data into understandable and meaningful dialog with the building systems, using an integrated software platform that can compute carbon footprint and GHG equivalent emissions.
   - Provides “continuous commissioning “that can provide energy and water reduction over the life of the building.
Sustainable Energy Management Strategies

SMART GRID TO SMART BUILDING TECHNOLOGY:

• Demand Side Management
  • Connect the Technology, i.e. hardware, software, network, for Grid /BAS conversation.
  • String the Technologies together on one IP backbone to create a full menu of BAS.
  • Display the results using universal devices to a Dashboard, accessed from the cloud.

• Renewable Energy
  • Grid connectivity for best ROI
  • Protection of grid from voltage swings
Sustainable Materials and Resources Strategies.

Building Materials constitute about 40% of the natural resources scraped from the earth. Finding methods to recycle and reuse these materials for new construction and other uses is necessary.

• Design into the building the appropriate Locations for sorting and collecting recyclables. - Easily accomplished here.

• Building and Material Reuse – typically not available or financially possible in U.A.E.

• Construction Waste Management-(50% to 75% can be diverted in this country)

• Recycled Content and Regional Materials- Structural Steel – and concrete meet this requirement

• Rapidly Renewable Materials- Typically not used.

• Certified Wood- Can be accomplished here.
Sustainable Indoor Environment Strategies.

Preventing indoor environmental problems from occurring and resulting in the “sick building syndrome” is extremely important, assisted by the following strategies:

• Meeting and exceeding the **Indoor air requirements as defined by ASHRAE 62.1**, including introducing fresh air, either mechanically, naturally, or mixed mode.

• Implementing a **no-smoking policy** for the building.

• Following a **Construction Indoor Air Quality Management Plan** during construction and before occupancy.

• Using building finish materials with **low VOC emissions**, and low or no Formaldehyde emissions.

• **Eliminating or controlling indoor and pollutant source control** with the use of foot cleaning pads at entryways, better filtration media on OAS grilles, and exhausting potentionally dangerous fumes from storage areas.

• **Providing individual control of lighting and thermal control systems.**

• Implementing **daylight and views** to the majority of occupants in regularly occupied spaces.
Innovative, Historical, and Cultural Strategies.

- **Green Education**

- **Passive Solar Techniques:**
  - Wind Towers
  - Venturi Effect
  - Courtyard Cooling
  - Screens and Grill Shading

- **Active Solar Thermal heating and Cooling**

- **Active Solar PV Electric Power**
Sustainable Construction Practices.

• Erosion, Dust Control, and Environmental Protection Methodology

• Waste Management During Construction - Divert Material from Landfills through Recycling

• Purchasing Plumbing Fixtures with Low Water Consumption

• Purchasing HVAC Equipment with High Efficiencies

• Purchasing Sustainable Materials Regionally Sourced, and those with Recycled Content and with Low VOC Content

• Maintaining Indoor air Quality during construction and just before Occupancy

• Providing adequate and humane labor Accommodations for workers
Sustainable Operations and Management Strategies.

- **Exterior and Hardscape Management, Integrated Pest Management, Erosin Control, and Landscape Management**

- **Water Reduction Management**
  Improve Landscape Irrigation; introduce low water use fixtures; add waste water recycling system

- **Energy Reduction Management**
  Retro Commissioning to determine existing operational status
  Use of Energy Audit and analysis to determine potential ECM’s
  Implement the selected ECM’s, re-commission improvements and then measure, verify and Monitor and report in real time reduction and savings

- **Indoor Air Quality Management**

- **Green Cleaning Management**

- **Green Purchasing Management**

- **Waste Stream Management**
Thank you