Jay Parker
College of Southern Maryland Green Symposium
Session 2 | Sustainable Development for the Built Environment
Experience with LEED

Whitman, Requardt & Associates

- Multi-Discipline A/E Firm
- USGBC Member Company
- 13 LEED Accredited Professionals
- 9 LEED Certified Projects
- 10 LEED Projects Pending
- First GSA LEED Certified Building
- Local LEED Gold Certified Project
• Evergreen Elementary School
  – 644 Student School
  – 18 Bus Parking Loop
  – 105 Parking Spaces
  – 55 Acre Environmentally Constrained Site
• 75,000 SF, 2-story Building
• 15,000 Gallon Rain Cisterns
• Geothermal System
• Photovoltaic Cells
• Wind Turbine
• Green Roof
• Sun Shades
• Natural Lighting
• Environmental Kiosk

Photo Credits: Maxwell MacKenzie
GREEN SITE DESIGN ELEMENTS

- Compact Site
- Solar Orientation
- Native Vegetation
- No Irrigation
- Pervious Playground Surfacing
- Green Parking
- Connectivity to Community
- Human Sundial
- Toad Crossing
SUSTAINABILITY SUMMARY

• > 20% Recycled Construction Materials
• Over 75% Construction Debris Recycled

• Total Cost  $21,000,000
• Green Construction  $1.5 M
• 80% Reduction in Water Use
• 10-20% Reduction in Electricity
• Estimated Savings: $100,000/year
GREEN TRANSPORTATION PROJECTS

- “Complete Streets” Program
- Green Streets
- Pedestrian / Vehicle Safety
- Urban Revitalization
The Role of the Architect in Sustainable Development

LEED
or
NAHB Designer?
MACRO VS. MICRO Perspective
Definition

“Sustainable” Development is most often that definition that is most favorable to the users point of view.
Word Congress of Architects defines

Sustainable meets our needs today without compromising the ability of future generations to meet their own needs
Population and Energy Consumption by Country

<table>
<thead>
<tr>
<th>Country</th>
<th>Population</th>
<th>Energy Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>20%</td>
<td>15%</td>
</tr>
<tr>
<td>India</td>
<td>15%</td>
<td>5%</td>
</tr>
<tr>
<td>USA</td>
<td>25%</td>
<td>20%</td>
</tr>
<tr>
<td>Indonesia</td>
<td>5%</td>
<td>2%</td>
</tr>
<tr>
<td>Brazil</td>
<td>3%</td>
<td>2%</td>
</tr>
<tr>
<td>Pakistan</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Russian Federation</td>
<td>5%</td>
<td>4%</td>
</tr>
<tr>
<td>Japan</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>Mexico</td>
<td>4%</td>
<td>3%</td>
</tr>
</tbody>
</table>
## Top World Oil Producers, Exporters, Consumers, and Importers, 2006
(millions of barrels per day)

<table>
<thead>
<tr>
<th>PRODUCERS</th>
<th>Total oil production</th>
<th>EXPORTERS</th>
<th>Net oil exports</th>
<th>CONSUMERS</th>
<th>Total oil consumption</th>
<th>IMPORTERS</th>
<th>Net oil imports</th>
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<tbody>
<tr>
<td>Saudi Arabia</td>
<td>10.72</td>
<td>Saudi Arabia</td>
<td>8.65</td>
<td>United States</td>
<td>20.59</td>
<td>United States</td>
<td>12.22</td>
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<td>Russia</td>
<td>9.67</td>
<td>Russia</td>
<td>6.57</td>
<td>China</td>
<td>7.27</td>
<td>Japan</td>
<td>5.10</td>
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<td>United States</td>
<td>8.37</td>
<td>Norway</td>
<td>2.54</td>
<td>Japan</td>
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<td>Iran</td>
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<td>2.52</td>
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<td>3.71</td>
<td>United Arab Emirates</td>
<td>2.52</td>
<td>Germany</td>
<td>2.63</td>
<td>South Korea</td>
<td>2.15</td>
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<tr>
<td>China</td>
<td>3.84</td>
<td>Venezuela</td>
<td>2.20</td>
<td>India</td>
<td>2.53</td>
<td>France</td>
<td>1.89</td>
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<tr>
<td>Canada</td>
<td>3.23</td>
<td>Kuwait</td>
<td>2.15</td>
<td>Canada</td>
<td>2.22</td>
<td>India</td>
<td>1.69</td>
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<tr>
<td>United Arab Emirates</td>
<td>2.94</td>
<td>Nigeria</td>
<td>2.15</td>
<td>Brazil</td>
<td>2.12</td>
<td>Italy</td>
<td>1.56</td>
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<tr>
<td>Venezuela</td>
<td>2.81</td>
<td>Algeria</td>
<td>1.85</td>
<td>South Korea</td>
<td>2.12</td>
<td>Spain</td>
<td>1.56</td>
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<tr>
<td>Norway</td>
<td>2.79</td>
<td>Mexico</td>
<td>1.68</td>
<td>Saudi Arabia</td>
<td>2.07</td>
<td>Taiwan</td>
<td>0.94</td>
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<tr>
<td>Kuwait</td>
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<td>Libya</td>
<td>1.52</td>
<td>Mexico</td>
<td>2.03</td>
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<tr>
<td>Nigeria</td>
<td>2.44</td>
<td>Iraq</td>
<td>1.43</td>
<td>France</td>
<td>1.97</td>
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<tr>
<td>Brazil</td>
<td>2.16</td>
<td>Angola</td>
<td>1.36</td>
<td>United Kingdom</td>
<td>1.82</td>
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<td></td>
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<tr>
<td>Iraq</td>
<td>2.01</td>
<td>Kazakhstan</td>
<td>1.11</td>
<td>Italy</td>
<td>1.71</td>
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## Greatest Oil Reserves by Country

<table>
<thead>
<tr>
<th>RANK</th>
<th>COUNTRY</th>
<th>PROVED RESERVES (billion barrels)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Saudi Arabia</td>
<td>262.3</td>
</tr>
<tr>
<td>2</td>
<td>Canada</td>
<td>179.21</td>
</tr>
<tr>
<td>3</td>
<td>Iran</td>
<td>136.27</td>
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<tr>
<td>4</td>
<td>Iraq</td>
<td>115.0</td>
</tr>
<tr>
<td>5</td>
<td>Kuwait</td>
<td>101.5</td>
</tr>
<tr>
<td>6</td>
<td>United Arab Emirates</td>
<td>97.8</td>
</tr>
<tr>
<td>7</td>
<td>Venezuela</td>
<td>80.012</td>
</tr>
<tr>
<td>8</td>
<td>Russia</td>
<td>60.0</td>
</tr>
<tr>
<td>9</td>
<td>Libya</td>
<td>41.464</td>
</tr>
<tr>
<td>10</td>
<td>Nigeria</td>
<td>36.22</td>
</tr>
<tr>
<td>11</td>
<td>Kazakhstan</td>
<td>30.0</td>
</tr>
<tr>
<td>12</td>
<td>United States</td>
<td>21.757</td>
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</table>
Sources of US Oil Imports

<table>
<thead>
<tr>
<th>Country</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Canada</td>
<td>11%</td>
</tr>
<tr>
<td>Mexico</td>
<td>11%</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>9%</td>
</tr>
<tr>
<td>Venezuela</td>
<td>8%</td>
</tr>
<tr>
<td>Nigeria</td>
<td>7%</td>
</tr>
<tr>
<td>Iraq</td>
<td>4%</td>
</tr>
<tr>
<td>25 other countries</td>
<td>8%</td>
</tr>
</tbody>
</table>
2007 Year end Wind Power Capacity (MW)

Total: 16,596 MW
(As of 12/31/07)

Wind Power Capacity
Mega watts (MW)
1,000 - 4,300
100 - 1,000
20 - 100
1 - 20

Data from the American Wind Energy Association (AWEA) and Global Energy Concepts (GEC) database.

U.S. Department of Energy
National Renewable Energy Laboratory

28-JAN-2008 1.1.27
2007 Year end Wind Power Capacity (MW)

- Penn. 294
- Rhode Island - 1
- New Jersey 8
- West Virginia 66
EU – USA Wind Energy (2007)

The bar chart shows the comparison of wind energy capacity between the EU and USA in 2007. The EU has a significantly higher capacity of 56,535 MW compared to the USA with 16,596 MW.
Solar Photovoltaic (PV) Resource Potential
PV Market Size: Segmentation by Region (GW)

Source: Solarbuzz 2010 Marketbuzz
PV Market Size: Segmentation by Application (GW)

Source: Solarbuzz

<table>
<thead>
<tr>
<th>Year</th>
<th>Off-grid</th>
<th>On-grid</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>0.19</td>
<td>1.55</td>
</tr>
<tr>
<td>2007</td>
<td>0.20</td>
<td>2.63</td>
</tr>
<tr>
<td>2008</td>
<td>0.23</td>
<td>5.85</td>
</tr>
<tr>
<td>2009</td>
<td>0.28</td>
<td>7.31</td>
</tr>
<tr>
<td>2010</td>
<td>0.37</td>
<td>11.86</td>
</tr>
</tbody>
</table>

Source: Solarbuzz 2010 Marketbuzz
### Countries Generating Geothermal Power in 2010

<table>
<thead>
<tr>
<th>Countries</th>
<th>MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>3,086.00</td>
</tr>
<tr>
<td>Philippines</td>
<td>1,904.00</td>
</tr>
<tr>
<td>Indonesia</td>
<td>1,197.00</td>
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<tr>
<td>Mexico</td>
<td>958.00</td>
</tr>
<tr>
<td>Italy</td>
<td>843.00</td>
</tr>
<tr>
<td>New Zealand</td>
<td>628.00</td>
</tr>
<tr>
<td>Iceland</td>
<td>575.00</td>
</tr>
<tr>
<td>Japan</td>
<td>536.00</td>
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<tr>
<td>El Salvador</td>
<td>204.00</td>
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<tr>
<td>Kenya</td>
<td>167.00</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>166.00</td>
</tr>
<tr>
<td>Nicaragua</td>
<td>88.00</td>
</tr>
<tr>
<td>Russia</td>
<td>82.00</td>
</tr>
<tr>
<td>Turkey</td>
<td>82.00</td>
</tr>
<tr>
<td>Papua New Guinea</td>
<td>56.00</td>
</tr>
<tr>
<td>Guatemala</td>
<td>52.00</td>
</tr>
<tr>
<td>Portugal</td>
<td>29.00</td>
</tr>
<tr>
<td>China</td>
<td>24.00</td>
</tr>
<tr>
<td>France</td>
<td>16.00</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>7.30</td>
</tr>
<tr>
<td>Germany</td>
<td>606.00</td>
</tr>
<tr>
<td>Austria</td>
<td>1.40</td>
</tr>
<tr>
<td>Australia</td>
<td>1.10</td>
</tr>
<tr>
<td>Thailand</td>
<td>0.30</td>
</tr>
</tbody>
</table>
Macro Role

1. Education
2. Advocacy
3. Social Political
Micro Role

Two different paths to Sustainable Development

1. Architect is involved at Beginning of Project
2. Architect is retained after “Big Picture Decisions”
Breaking Down Building Energy Use

- Buildings: 40%
  - Industry: 32%
  - Transportation: 28%
  - Commercial: 18%
- Residential: 22%
- Other: 4%

Heating: 31%
- Water Heat: 12%
- Lights: 11%
- Cooling: 12%
- Refrigeration: 8%
- Wet Clean: 5%
- Electronic: 7%
- Cooking: 5%
- Other: 4%

Lights: 26%
- Office Equipment: 6%
- Ventilation: 6%
- Water Heat: 7%
- Cooling: 13%
- Heating: 14%
- Other: 13%
Growth in Buildings Energy Use Relative to Other Sectors
Old Washington Place
Village at Cypresswood
Village at Cypresswood - Clubhouse
Lyon’s Ridge Senior Apartments
Team Approach

1. Owners
2. LEED or NAHB Professional
3. Architect
4. Civil Engineer
5. Landscape Architect
6. Contractor
Sustainable Development

1. Requires Innovative Design practices
2. Requires Education & Continuous Education.
3. Environmental Stewardship.
5. Resource Protection
6. Economic Vialability
7. Resourceful Contractors
8. Building Owners
Fairway Manor
Fairway Manor
Bryan’s Road VFD
SmartSite
the right way—the right tools—the right reasons
**Status Quo**

**Impact =** Waste + Consumption

- BIM (CIVIL) Model with IPD & GPS Implementation
- Wood Model
- Sand & Gravel Model
- Recycling Model

**New Equation:**

\[ \text{Impact} = (\text{Waste} + \text{Less Consumption}) - (\text{Recycling} + \text{Extraction}) \]
Industry Productivity

200% Production Increase by others

230% 35 Year GAP

30% Production Decrease by Construction Industry
Categories of Stakeholders

Project Stakeholders

- Prime Engineer
- Project Executive
- Integrated Project Coordinator
- Owner Field Rep.
- Constructor
- *Recycling
- *Extraction
- *Harvestors (Renewable)
- Cost Admin.
- Contractors
- Suppliers
- BIM Designer
- *IT Infrastructure

IPD Team Members

*denotes value added revenue
ACPT’s IPD / Virtual Construction Mgt Team
New Equation:

Impact = (Waste + \textbf{Less} Consumption) - (Recycling + Extraction)
Dual Certification
Forest Mgt

- 3,604 Acres (2,579 Dual Cert., additional 900 Acres SFI only)
- Currently Offsets more than 25% of the wood used for new home construction
- Waste is minimized but used for energy/paper
- Sequesters up to 50,000 tons CO2 p/year
- Leads to other Accreditations (LEED, NHAB)
Sand & Gravel Recovery

- New Development generates 960,000 tons (320K tons p/year)
- New Development uses only 50,500 tons total (10,100 tons p/yr)
- 100 Acres of productive development saves 100 Acres elsewhere
- Improves Water Retention
- Leads to other Accreditations (LEED, NHAB)
### SmartBase compared to Sand & Gravel (1:1)

<table>
<thead>
<tr>
<th>PEOPLE</th>
<th>PLANET</th>
<th>PROFIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>99.14%</td>
<td>76.62%</td>
<td>35.44%</td>
</tr>
</tbody>
</table>

**HTP Reduction**
- HTP: Human Toxicity Potential (cancer - non-cancer)

**CO2 Reduction**
- CO2: Global Warming Potential Equivalent (GWP)

**Cost Reduction**
- Cost: Embodied kilowatt hours from (MJ)

#### SmartPave used to eliminate 1.5" asphalt from paving section (P3)

<table>
<thead>
<tr>
<th>PEOPLE</th>
<th>PLANET</th>
<th>PROFIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>48.55%</td>
<td>76.62%</td>
<td>34.55%</td>
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</tbody>
</table>

**HTP Reduction**
- HTP: Human Toxicity Potential (cancer - non-cancer)

**CO2 Reduction**
- CO2: Global Warming Potential Equivalent (GWP)

**Cost Reduction**
- Cost: Embodied kilowatt hours from (MJ)

The above model assumes that all sub-base materials are transported via dump truck exactly ten miles from a processing facility. Reductions in each category would be greater if compared to non-local materials such as crushed stone.

### Recycled Materials

- **Reduce Use of Aggregates via remediated soils**
- **Reduce Asphalt Paving Thickness with Stronger Base Course**
- **NAHB Green Approved Products**
- **Use Glass Cullet in place of Blue Stone**
- **Leads to other Accreditations (LEED, NHAB)**

---

People: HTP
- Human Toxicity Potential (cancer - non-cancer)

Planet: CO2
- Global Warming Potential Equivalent (GWP)

Profit: Cost
- Embodied kilowatt hours from (MJ)
“BIM Gets It’s Hands Dirty”
Coming Soon June 2011 Edition

“How a 3D model and an integrated project delivery process are saving money at a master-planned community in Maryland.”
By Daniel C. Brown

Pat Hobbs
Partner- SmartSite