AGENDA

- Opportunity & Challenge
  - Greening Council
  - Eco-Diplomacy
  - Overseas Portfolio
    - OBO’s Design Excellence Initiative
      - Federal Mandates
- Tools
- Results
Greening Council

*Mission:* To improve the Department’s environmental footprint and increase efficiencies, by harnessing expertise in policy, management, and public diplomacy from grassroots to senior management, in order to cultivate and institutionalize sustainability efforts, measure and report progress and challenge others by fulfilling our environmental commitments and highlighting our successes.
OPPORTUNITY  ECO - DIPLOMACY

- Eco-Diplomacy Pillars
  - Policy
  - Green Buildings
  - Results

Eco-diplomacy is the practice of conducting international relations by facilitating and advancing a shared commitment to conserving natural resources through sustainable operations and responsible environmental stewardship.
OPPORTUNITY  ECO - DIPLOMACY

- Eco-Diplomacy:

  FEATURED IN THE APRIL 2014 ISSUE OF THE FOREIGN SERVICE JOURNAL

  FEATURED IN THE APRIL 2014 ISSUE OF STATE MAGAZINE
Moving Staff to Safer Facilities

- Santo Domingo, Dominican Republic: 6/15/2014, 699 employees
- Monterrey, Mexico: 7/7/2014, 217 employees
- Rabat, Morocco: 10/12/2014, 426 employees
- Total: 1,623 employees

Year (CY) | Actual
--- | ---
2000 | 461
2001 | 618
2002 | 1,291
2003 | 3,031
2004 | 3,414
2005 | 7,276
2006 | 11,194
2007 | 16,107
2008 | 19,664
2009 | 20,458
2010 | 22,859
2011 | 25,852
2012 | 27,649
2013 | 30,306
2014 | 31,929

U.S. DEPARTMENT OF STATE OVERSEAS BUILDINGS OPERATIONS
The Department operates 275 missions
- 88,000,000 square feet
- $44B real property assets
- 12,200 culturally significant assets
- $5.8B currently under design and construction
DOS Oversees ~23,000 Properties Overseas
- Owned vs. Leased = 3,860 owned vs. 15,375 leased
- Large vs. Small = 2,200 over 464m² (5,000gsf)
2012 - Excellence in Diplomatic Facilities

- Guiding Principles:
  - Purpose & Function
  - Site
  - Design & Engineering
  - Safety & Security
  - Sustainability
  - Architecture
  - Construction
  - Operations & Maintenance
  - Art
  - Historic Preservation
CHALLENGE SUSTAINABILITY

- **OBO Design Standards:**
  - Comprehensive Sustainability Study
  - Stretch Goals = Net-Zero:
    - Energy
    - Carbon
    - Water
    - Waste
  - LEED® Platinum
CHALLENGE  FEDERAL MANDATES for EXISTING BUILDINGS

- **Executive Order 13514* (2009) and 13635* (2013):**
  - 30% Energy reduction from 2006 levels by 2015
  - 26% Building water reduction from 2007 levels by 2020
  - 20% Irrigation water reduction from 2010 levels by 2020
  - 50% Non-hazardous solid waste diversion by 2015
  - 20% Renewable Energy by 2020
  - Report Greenhouse Gas Emissions

- **Energy Policy Act (2005):**
  - Building Metering by 2012

- **Executive Order 13423* (2006):**
  - 15% of Agency Real Property Assets be Sustainable by 2015

*Limited to domestic facilities, except as implemented overseas in accordance with the policy set forth in Section 1 of EO 13514 and EO 13423.
CHALLENGE  FEDERAL MANDATES for NEW CONSTRUCTION

- **Executive Order 13514** (2009):
  - 30% less energy use than ASHRAE 90.1-2007 by 2015
  - 20% less building water use than EPACT 2005
  - 50% less freshwater use for irrigation
  - Divert 50% of construction waste

- **Energy Independence & Security Act (2007):**
  - Net-Zero-Energy by 2030

*Limited to domestic facilities, except as implemented overseas in accordance with the policy set forth in Section 1 of EO 13514 and EO 13423.*
AGENDA

- Opportunity & Challenge
- Tools
  - Existing Buildings: OBO’s Guide to Green Embassies
  - New Construction: Sustainability Studies
  - Energy/Water Audits
  - Utility Data Management
  - Energy Savings Performance Contracts (ESPCs)
- Results
TOOLS GUIDE to GREEN EMBASSIES

- OBO Guide to Green Embassies
  - Self-Help Guide for Posts
  - Focus on Occupant Behavior
# Tools

## Energy / Water Audits

- **Over 20 Audits Cost $2M**

## Audits Performed:

<table>
<thead>
<tr>
<th>1. Santiago</th>
<th>12. Madrid</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. San Salvador</td>
<td>13. New Delhi</td>
</tr>
<tr>
<td>5. Managua</td>
<td>16. Guatemala City</td>
</tr>
<tr>
<td>6. Stockholm</td>
<td>17. San Jose</td>
</tr>
<tr>
<td>7. Munich</td>
<td>18. Bamako</td>
</tr>
<tr>
<td>11. Barcelona</td>
<td></td>
</tr>
</tbody>
</table>

~100 ECMs totaling: $15M

## Common ECMs:

1. Lighting upgrade and controls
2. Weather-stripping
3. HVAC BAS/Set-points/Sensors
4. Low- & no-flow water fixtures
5. Solar hot water heaters
6. Pool Covers
7. Motors/Controllers
8. Chiller replacement
9. Photovoltaics
10. Wind
Energy Savings Performance Contract

- Energy Conservation Measures:
  - 1 megawatt in PV
  - LED Site/Interior Lighting & Controls
  - Night Chiller (220 ton)
  - Wind Turbine in Phase II

- Results:
  - Investment = $15M
  - Total savings = $36M
  - Reduce grid purchase by 54%
Electricity Costs from 2007-2013 by Region

- Data Source GFMS

2013 Total Utility Costs = $279 M

- Diesel 37%
- Electricity 46%

<table>
<thead>
<tr>
<th>Utility</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity</td>
<td>$128 M</td>
</tr>
<tr>
<td>N. Gas</td>
<td>$9 M</td>
</tr>
<tr>
<td>Water</td>
<td>$19 M</td>
</tr>
<tr>
<td>Diesel</td>
<td>$103 M</td>
</tr>
<tr>
<td>D. Heat</td>
<td>$4 M</td>
</tr>
<tr>
<td>Sewage</td>
<td>$10 M</td>
</tr>
<tr>
<td>Trash</td>
<td>$6 M</td>
</tr>
</tbody>
</table>
Dashboard

- Geographical Organizing Structure
- Sustainability Business Subjects
  - Utility Consumption
  - Utility Cost
  - Utility Rate
  - Building Type
  - Building Area
  - Building Age
  - Building Occupants
  - Climate Zone
  - Year on Year Trending

Geographical Organizing Structure

World

Region

Mission

Post

Building
- **World View**
  - Use & Cost
  - Utility Rates

- **Performance**
  - Progress
  - Trends
  - Regional Comparisons
TOOLS UTILITY DATA MANAGEMENT

- Regional View
  - Use & Cost
  - Utility Rates
  - Data Completeness
  - Mission Metrics
  - Post Metrics

- Performance
  - Progress
  - Trends
  - Mission Comparisons
• New Building Energy Performance

- Benchmark with Industry
- Energy Performance
  - Benchmark with Industry
### Building Form & Orientation

- Compare Concepts
  - Daylight Harvesting Potential
  - Solar Gain
  - Envelop Cost
  - Energy Use
TOOLS  SUSTAINABILITY STUDY

- **Solar Analysis**
  - Annual Solar Patterns
  - Direct Solar Gain
  - Optimum Shading Strategies
Wind Feasibility Analysis
- Rose Wind Charts
- Wind Power Potential
- Prevailing Breezes
- Outdoor Thermal Comfort

Figure 29: Wind-rose plots by season and time of day
Rainwater Harvesting

- Monthly Precipitation
- Dry Season vs Wet Season
- Tank Sizing
**Water Balance Diagram**

- Supply vs Demand
- Reclaimed Water
- Irrigation Budget
- Rainwater Harvesting
- Stormwater Retention

*Figure 6: Design case (efficient) water balance diagram (annual flows)*
Xeriscaping

- Irrigation Budget
- Irrigation Zones
- Reclaimed Water
Energy Improvements Chart
- Minimum Code
- OBO Standard Base Case
- Base Case vs Design Improvements
- Stretch Goals
Comprehensive Sustainability Strategy

- Life-Cycle-Cost-Analysis
- Bundled Strategy
- Payback

### Energy Systems Combined ECMs

<table>
<thead>
<tr>
<th>Report Section #</th>
<th>ECM</th>
<th>First Cost Increase (Decrease) Over Baseline¹</th>
<th>Total Building Energy Reduction Over Baseline</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1.5</td>
<td>Building Envelope</td>
<td>$14,262</td>
<td>8.6%</td>
</tr>
<tr>
<td>3.1.7</td>
<td>Exterior Paving 4</td>
<td>(787,420)</td>
<td>16.8%</td>
</tr>
<tr>
<td>3.1.9</td>
<td>Evaporative Cooling - Site</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>3.1.10</td>
<td>Stack Ventilation and Wind Catchers</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>3.3.3</td>
<td>Multistack Air-Cooled Chiller (N+1)</td>
<td>$1,107,907</td>
<td>5%</td>
</tr>
<tr>
<td>3.3.3</td>
<td>Modular Chiller with DOA and ERU</td>
<td>$1,147,907</td>
<td>18%</td>
</tr>
<tr>
<td>3.3.6</td>
<td>Solar Thermal Water Heating</td>
<td>$170,000</td>
<td>5.8%</td>
</tr>
<tr>
<td>3.4.1</td>
<td>Official Parking West - 129.86kW</td>
<td>$1,167,092</td>
<td>10.7%</td>
</tr>
<tr>
<td>3.4.1</td>
<td>WHE Roof - 174.37kW</td>
<td>$1,567,238</td>
<td>14.4%</td>
</tr>
<tr>
<td>3.4.1</td>
<td>Utility Building Roof - 140.98kW</td>
<td>$1,267,128</td>
<td>11.6%</td>
</tr>
<tr>
<td>3.4.3</td>
<td>Interior LED Lighting</td>
<td>$45,000</td>
<td>1.7%</td>
</tr>
</tbody>
</table>

First Cost Increase (Combined ECMs) $5,699,114
Annual Energy Cost Savings (Combined ECMs) $584,683

Annual Energy Savings (Combined ECMs), kWh 974,472

Simple Payback (Combined ECMs) 10 years
Expected Building Life 50 years
Payback as Percentage of Building Life 19%

¹ Baseline building is a facility constructed to the minimum requirements of OBO design criteria and International Code Supplement (2012) criteria.
- **LEED® Green Building Rating System**
  - Backcheck Performance
  - Measure Success by Industry Standard
AGENDA

- Opportunity & Challenge
- Tools
- Results
  - Sustainability Projects
  - Solar & Wind Power
  - LEED® Certifications
RESULTS  SUSTAINABILITY PROJECTS
RESULTS  NEW CONSTRUCTION

- **Federal Real Property Profile Requires**
  - 15% of Agency Assets be Sustainable by 2015

- **LEED® Projects Average Performance:**
  - ✓ 25% less energy use
  - ✓ 35% less potable water use
  - ✓ 76% less irrigation water use
  - ✓ 48% less construction waste
RESULTS LEED® CERTIFIED PROJECTS

Sofia LEED Certified
- 30% better energy cost than ASHRAE standard
- 21% better water use than baseline in building
- Brownfield redevelopment
- Bicycle rack and showers
- Occupancy sensor for lights
- Ozone protection
- No chemical water treatment
- Enhanced indoor air quality
- Tree preservation
- Building as educational tool

Panama City LEED Certified
- 27% better energy cost than ASHRAE standard
- 32% better water use in building than baseline
- Ozone protection
- Erosion and sedimentation control
- Water efficient landscaping
- Regional materials
- Low-emitting materials
- Enhanced indoor air quality
- Building as educational tool
- Highly reflective hardscape

Johannesburg LEED Certified
- 22% better energy cost than ASHRAE standard
- 31% better water use than baseline in building
- Ozone protection
- Erosion and sedimentation control
- Water efficient landscaping
- Regional materials
- Low-emitting materials
- Enhanced indoor air quality
- Enhanced commissioning
- Pollutant source control
**RESULTS**  
**LEED® SILVER PROJECTS**

<table>
<thead>
<tr>
<th>Location</th>
<th>LEED Silver</th>
<th>Energy Cost Better Than ASHRAE Standard</th>
<th>Water Use Better Than Baseline</th>
<th>Water Management</th>
<th>Other Sustainability Features</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ouagadougou</strong></td>
<td>LEED Silver</td>
<td>17%</td>
<td>39%</td>
<td>Wetlands</td>
<td>Reflective hardscape &amp; roofing</td>
</tr>
<tr>
<td><strong>Lusaka</strong></td>
<td>LEED Silver</td>
<td>15%</td>
<td>31%</td>
<td>Water Efficient</td>
<td>Reflective hardscape &amp; roofing</td>
</tr>
<tr>
<td><strong>Antananarivo</strong></td>
<td>LEED Silver</td>
<td>20%</td>
<td>39%</td>
<td>Reused</td>
<td>Other sustainable materials</td>
</tr>
</tbody>
</table>

- Occupancy and daylight sensors
- Light shelves & sun shades
- Low-emitting materials
- 20% recycled content in base building materials
- Building as educational tool
### RESULTS LEED® GOLD PROJECTS

<table>
<thead>
<tr>
<th>Monrovia LEED Gold</th>
<th>Dubai LEED Gold</th>
<th>Brazzaville LEED Gold</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 28% better energy cost than ASHRAE standard</td>
<td>• 22% better energy cost than ASHRAE standard</td>
<td>• 32% better energy cost than ASHRAE standard</td>
</tr>
<tr>
<td>• 41% better water use than baseline in building</td>
<td>• 41% better water use than baseline in building</td>
<td>• 31% better water use than baseline in building</td>
</tr>
<tr>
<td>• Highly reflective hardscape and roofing</td>
<td>• Highly reflective hardscape and roofing</td>
<td>• Reuse of treated wastewater for irrigation</td>
</tr>
<tr>
<td>• 75% construction waste estimated to be diverted from landfills</td>
<td>• Daylight harvesting</td>
<td>• 75% site area restored using native/adaptive plants</td>
</tr>
<tr>
<td>• Low-emitting materials</td>
<td>• 22% of materials procured regionally</td>
<td>• 95% construction waste diverted from landfills</td>
</tr>
<tr>
<td>• 13% of base building materials contain recycled content</td>
<td>• 82% construction waste diverted from landfills</td>
<td>• Regional materials</td>
</tr>
<tr>
<td></td>
<td>• Enhanced commissioning</td>
<td>• Enhanced indoor air quality</td>
</tr>
<tr>
<td></td>
<td>• Low-emitting materials</td>
<td></td>
</tr>
</tbody>
</table>
Case Study
– GUANGZHOU, CHINA
## CASE STUDY

**U.S. CONSULATE GENERAL GUANGZHOU, CHINA**

### LEED® Silver

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEED - New Construction v2.2</td>
<td></td>
</tr>
<tr>
<td>Irrigation Water Saved</td>
<td>100%</td>
</tr>
<tr>
<td>Building Water Reduced</td>
<td>32%</td>
</tr>
<tr>
<td>Building Energy Reduced</td>
<td>15%</td>
</tr>
<tr>
<td>Construction Waste Diverted</td>
<td>88%</td>
</tr>
</tbody>
</table>
Case Study
– Monrovia, Liberia
CASE STUDY
U.S. EMBASSY MONROVIA, LIBERIA

LEED® Gold
LEED - New Construction v2.2
Irrigation Water Saved 100%
Building Water Reduced 32%
Building Energy Reduced 28%
Construction Waste Diverted 83%
LEED® GOLD
GREENING U.S. EMBASSIES

Case Study
– BUJUMBURA, BURUNDI
CASE STUDY U.S. EMBASSY BUJUMBURA, BURUNDI

LEED® Gold
LEED - New Construction v2.2
Irrigation Water Saved 100%
Building Water Reduced 39%
Building Energy Reduced 52%
Construction Waste Diverted 95%

U.S. Embassy Bujumbura, Burundi
LEED® PLATINUM
GREENING U.S. EMBASSIES

- Case Study
  - HELSINKI, FINLAND
CASE STUDY  U.S. EMBASSY HELSINKI, FINLAND

LEED® Platinum

LEED - New Construction v2009
Irrigation Water Saved  100%
Building Water Reduced  30%
Building Energy Reduced  46%
Construction Waste Diverted  88%
CASE STUDY  U.S. EMBASSY HELSINKI, FINLAND

- Connected to District Chilled and Hot Water
  - Third largest cooling system in Europe
  - Buildings require no chillers or large boilers
  - 1/3 of cooling comes from Gulf of Finland - emissions free
  - 1/3 of cooling comes from absorption chillers

District Energy Diagram, Helsinki Energia
### RESULTS SOLAR POWER

- **Executive Order 13514**
  - New target 20% renewable by 2020

<table>
<thead>
<tr>
<th>Country</th>
<th>kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geneva</td>
<td>119</td>
</tr>
<tr>
<td>Abuja</td>
<td>100</td>
</tr>
<tr>
<td>Kigali</td>
<td>251</td>
</tr>
<tr>
<td>Athens</td>
<td>100</td>
</tr>
<tr>
<td>Monrovia</td>
<td>183</td>
</tr>
<tr>
<td>Bujumbura</td>
<td>300</td>
</tr>
<tr>
<td>Dakar</td>
<td>307</td>
</tr>
<tr>
<td>Lisbon</td>
<td>36</td>
</tr>
<tr>
<td>Monterrey</td>
<td>237</td>
</tr>
<tr>
<td>Santo Domingo</td>
<td>456</td>
</tr>
<tr>
<td>Valletta</td>
<td>224</td>
</tr>
<tr>
<td>Port Moresby</td>
<td>100</td>
</tr>
<tr>
<td>Nouakchott</td>
<td>129</td>
</tr>
<tr>
<td>Mbabane</td>
<td>220</td>
</tr>
<tr>
<td>Abuja</td>
<td>290</td>
</tr>
<tr>
<td>Cotonou</td>
<td>200</td>
</tr>
<tr>
<td>Vientiane</td>
<td>18</td>
</tr>
<tr>
<td>Managua</td>
<td>960</td>
</tr>
<tr>
<td>Istanbul</td>
<td>350</td>
</tr>
<tr>
<td>New Delhi</td>
<td>175</td>
</tr>
<tr>
<td>Bangkok</td>
<td>100</td>
</tr>
<tr>
<td>Djibouti</td>
<td>360</td>
</tr>
<tr>
<td>Juba</td>
<td>500</td>
</tr>
<tr>
<td>N'Djamena</td>
<td>445</td>
</tr>
<tr>
<td>Taipei</td>
<td>100</td>
</tr>
</tbody>
</table>

**Total** 6.2MW

**In Construction**

- Garaje Mounted PV at U.S. Embassy Athens

**Completed**

- Roof Mounted PV at U.S. Embassy Monterrey
RESULTS PHOTOVOLTAICS

- Projected Savings (after payback) = $171M
  - Aggregated Payback 2025
QUESTIONS?

http://www.state.gov/green