Bringing Clarity to Complex Problems

The Sustainable Systems Integration Model (SSIM™)

EnergyVision

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Balancing Sustainability with Mission Requirements is a Complex Undertaking

**Cost ($)**
- ROI vs. Simple Payback

**Net Zero**
- Baseline Data
- Silo Organization
- Agency Energy Mandates
- Cyber Security

**Mission**
- Infrastructure Needs
- ESPC, UESC, ECIP, SRM?
- Savings Persistence

**Unfunded Mandates**
- Energy
  - Energy Intensity Reduction per year from 2003 baseline → 30% by 2015
- Renewable Energy
  - Renewable Energy Component at least 7.5% by 2013
  - Reduction of fossil-fuel energy 100% by 2030 63% by 2015
  - 15% of existing buildings upgraded to HPSB by 2015 Leading to 100%
- Water
  - Reducing potable water use intensity 2% annually → 26% by 2020 from 2007 baseline
  - Reducing landscaping, industrial water use → 20% by 2020 from 2010 baseline
- GHG & Waste
  - Reducing scope 1 and 2 GHG → 34% by 2020 from 2008 baseline
  - Divert non-hazardous waste → 50% by 2013
  - Increase Alternative Fuel Use → 10% each Year
- Fuels
  - Reduce petroleum consumption → 20% by 2015 from 2005 baseline

**Color of Money & Funding Options**
- Baseline Data
- Silo Organization
- Agency Energy Mandates
- Cyber Security

**Sustainable Systems Integration Model (SSIM™)**
AECOM’s Integrated Approach to Energy Planning: Six Key Principles

1. Visioning & Goal Setting
   - Identify broad goals & desired outcomes
   - Explore discuss key challenges / needs and explore opportunities
   - Refine goals throughout EnergyVision process

2. Quantification & Metrics
   - Perform compliance & gap analysis against goals
   - Establish performance metrics (% reduction, ROI, etc.)
   - Identify trends, opportunities, and focus areas

3. Whole System Integration & Optimization
   - Whole systems view
   - Integrate available funding streams / options to maximize return on investment
   - “Big-Picture” connection to details
   - Compliance with overarching vision and goals
   - Optimize inter-related system efficiencies & relationships
AECOM’s Integrated Approach to Energy Planning: Six Key Principles

4 Options & Strategies
- Simulations and ‘What If’ scenarios
- Anticipate changing requirements
- Alternatives Evaluation – Game boarding Scenarios

5 Sustainable Economics
- Total ownership cost (TOC)
- Life cycle cost analysis
- Impacts and benefits on operations & maintenance costs, future capital costs, and utility tariffs / rates.
- Integrated cost-benefit analysis by scenario

6 Prioritized Actions, Implementation Strategies & Monitoring Plan
- Projects Prioritization and Phasing
- Funding and Implementation Strategies
- Refine program vision & strategies
- Establish performance and monitoring strategies and metrics

Sustainable Systems Integration Model (SSIM™)
AECOM’s SSIM™ Energy Vision Process: Identifying and Evaluating Scenarios

Interactive Game Board: Selecting Options

- Demolish Buildings
- New Building
- Add Internal Shuttle Bus
- Implement LID Project
- Convert Paved to Natural Area
- Solar Farm EUL

Facility Retrofit Strategy

Options A: 2%  B: 4%  C: 1%  D: 31%  E: 6%  F: 34%

Facility Map

1. Establish Baseline
2. Define Scenario Parameters
3. Define Future (Re)Development Program
4. Calibrate Thematic Sustainability Packages
5. Create Scenarios using Game boards
6. Analyze Scenario (performance + cost-benefit)
7. Summarize Actions

Sustainable Systems Integration Model (SSIM™)
AECOM’s SSIM™ EnergyVision Tool

Simulation Modeling
• Enables client engagement
• Interactive game board
• Scenario Planning “What if”
• Optimized solution sets
• Balances complex/ competing goals
The SSIM™ Approach: Scenario Results: Measuring Performance

Sustainability Performance – What you Get!

Key Performance Indicators

Gap Analysis

Synergies and Conflicts between Systems

Priority Strategies

Sustainable Systems Integration Model (SSIM™)
SSIM™ EnergyVision

Benefits of Scenario Based Energy Planning

• **Streamlined whole systems integration** that simplifies complex decision making while maximizing return on investment

• **Enables effective decision making** process through the generation of quantitative and qualitative outputs

• **Integrates project planning and execution strategies** through a project “life cycle” approach

• **Establishes performance metrics** for project measurement and verification and monitoring based commissioning
Case Study: SPAWAR Systems Center, Pacific

• Client Overview
  • SSC PAC is the U.S. Navy’s premier research, development, testing and evaluation, engineering and fleet support center for ocean surveillance, command and control, and communication systems.
  • San Diego facility includes over 225 buildings with a combined workspace of 3,032,000 square feet.
  • SSC PAC spends over $5M per year in utilities and operations and maintenance.

• Energy Program Goals
  • Enables SSCPAC to exceed federally mandated energy / water goals.
  • Leverage project’s cost savings to address critical infrastructure issues.
  • Develop, Finance and Implement a multi-phase ESPC project that when bundled together will fit within a 20 year financing term.
  • Collaborate with the SSCPAC team throughout the development process to ensure the project fully supports mission requirements.
Case Study: SPAWAR Systems Center, Pacific

• Solution
  • Utilized SSIMe Energy Vision process to develop four self-funding task orders that met SSCPAC’s vision and goals.
  • Collaborated over eight month development phase to identify/select projects, evaluate technical and financial options, and to identify optimized project bundles.

• Program Results
  • Implemented $34.5M in energy, water, and infrastructure upgrades over a four year period (four task orders)
  • Secured over $1.7M in utility incentives
  • Reduced annual operating costs by $2.1M
  • Recapitalized critical infrastructure and improved resiliency to meet mission requirements.
  • Reduced installation energy intensity by 35% and exceeded all federal and energy and water reduction mandates
Case Study: SPAWAR Systems Center, Pacific

Over $3.5M in annual energy and operational savings have funded $40.0M in energy and infrastructure upgrades.
SSIM™ Project Example:
Guam Joint Military Base Sustainability Master Program

APA (Federal Division) Outstanding Sustainable Planning Award, 2011
<table>
<thead>
<tr>
<th>Category</th>
<th>Rank</th>
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</thead>
<tbody>
<tr>
<td>Airports</td>
<td>1</td>
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<tr>
<td>Architecture</td>
<td>3</td>
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<tr>
<td>Bridges</td>
<td>2</td>
</tr>
<tr>
<td>Chemical &amp; Soil Remediation</td>
<td>3</td>
</tr>
<tr>
<td>Commercial Offices</td>
<td>1</td>
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<tr>
<td>Correctional Facilities</td>
<td>1</td>
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<tr>
<td>Education</td>
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<tr>
<td>General Building</td>
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<tr>
<td>Government Offices</td>
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<td>Green Design</td>
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<tr>
<td>Health Care Facilities</td>
<td>1</td>
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<td>Highways</td>
<td>1</td>
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<tr>
<td>Hydroplants</td>
<td>1</td>
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<tr>
<td>Mass Transit/Rail</td>
<td>1</td>
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<tr>
<td>Marine and Port Facilities</td>
<td>1</td>
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<tr>
<td>Power</td>
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<td>Pure Design</td>
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<tr>
<td>Retail Facilities</td>
<td>2</td>
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<tr>
<td>Sanitary and Storm Sewers</td>
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<tr>
<td>Solar Power</td>
<td>1</td>
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<tr>
<td>Sports Facilities</td>
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<tr>
<td>Transmission and Distribution</td>
<td>3</td>
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<tr>
<td>Transmission Lines</td>
<td>1</td>
</tr>
<tr>
<td>Transportation</td>
<td>1</td>
</tr>
<tr>
<td>Wastewater Treatment Plants</td>
<td>2</td>
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SSIM™ Project Example:
Guam Joint Military Base Sustainability Master Program

- Program
- Design Specifications
- Implementation Toolkit
<table>
<thead>
<tr>
<th>from</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complex, Opaque Decision Process</td>
<td>Transparent, well organized and documented</td>
</tr>
<tr>
<td>Energy Focus</td>
<td>Holistic multi-system focus</td>
</tr>
<tr>
<td>Single Project</td>
<td>Bundles/Packages; Net Value of multiple efforts; Scalable solutions</td>
</tr>
<tr>
<td>ROI and Payback focus</td>
<td>multi-dimensional criteria – “a new Math”</td>
</tr>
<tr>
<td>Reactive Planning / Monitoring</td>
<td>Strategic Sustainability Planning (Predictive, Scenario based)</td>
</tr>
<tr>
<td>Independent silo-like operations</td>
<td>Collaborative and Integrated across Enterprise</td>
</tr>
</tbody>
</table>
AECOM’s Integrated Approach to Sustainability
Sustainability Decision Modeling Framework

Portfolio Management / Master Planning

Energy
- Building Energy
- Street Lighting

Renewable Energy

Green Building
- Enhancements & Betterments
- LEED Credits

Socio-Economics
- Telecommuting
- RDO/CBSB

Water
- Whole Systems Water Balance Model

LID
- Low Impact Development

Ecosystem Services
- Carbon Sequestration Model
- Ecosystem Monetization

Transportation
- VMT Reduction Strategies
- Fleet Management

Integration Platform
- Scenario Gaming
- Scenario Optimization

Sustainable Economics

Optimized Strategic Sustainability Performance Plan
The SSIM™ Approach: Scenario Results: Measuring Costs and ROI

**Sustainability Costs**
(What you Pay!)

- MILCON Sustainability: $13.8M
- Building Energy Retrofits: $10.1M
- Water Fixtures Retrofits: $1.7M
- Transportation Improvements: $1.0M
- Ecosystem Enhancements: $0.8M
- Public Realm Energy: $0.5M
- Site Renewable Energy: $0.5M
- Stormwater and LID: $0.5M
- Waste Management: $0.5M

**Total Cost**: $27.4M

**Sustainability Savings**
(What Pays Back!)

- $10.8M
- ($1.1M / Yr)

**24 Yrs**

- Overall Simple Payback
- 30 Year NPV Total Costs
- MILCON Simple Payback
- Third Party Simple Payback
- SRM Simple Payback

**Strategy Prioritization**

**Project Cost Burden by Strategy**

**Project Funding Source**

**Project Phasing**

**Detailed Life-Cycle Costs**

Sustainable Systems Integration Model (SSIM™)
### The SSIM™ Approach:
**Compare Scenarios: Explore the Range of Possibilities**

#### The Optimal Solution is what is Politically & Financially Acceptable

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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Maximum Long-Term Savings</td>
<td>0.1</td>
<td>1.2</td>
<td>16.4</td>
<td>+17.0</td>
<td>82</td>
<td>Relies on low-cost 4-day telework and maximum CBSB and maximum water efficiency. Does not meet energy mandate. Does not include ecology or transportation measures.</td>
</tr>
<tr>
<td>2</td>
<td>10-Year Overall Payback</td>
<td>0.1</td>
<td>1.8</td>
<td>23.7</td>
<td>+4.3</td>
<td>81</td>
<td>Selected by personnel as most probable (realistic) scenario; no PV, 1 day Telework, moderate CBSB, water upgrades. Includes some ecology and transportation measures.</td>
</tr>
<tr>
<td>3</td>
<td>20-Year Overall Payback</td>
<td>0.9</td>
<td>1.5</td>
<td>18.3</td>
<td>+14.0</td>
<td>84</td>
<td>Relies on aggressive telework and CBSB as well as building integrated PV on warehouses. Does not include ecology or transportation improvements.</td>
</tr>
<tr>
<td>4</td>
<td>Meets Energy, Water, partial Carbon targets at Least Cost</td>
<td>0.8</td>
<td>2.4</td>
<td>24.4</td>
<td>-1.7</td>
<td>85</td>
<td>Puts a larger burden on MILCON and site renewable energy. Does not include ecology and transportation measures.</td>
</tr>
<tr>
<td>5</td>
<td>Fixed $4M Annual R&amp;M Funding</td>
<td>0.1</td>
<td>4.5</td>
<td>46.2</td>
<td>-41.2</td>
<td>87</td>
<td>Relies on a variety of measures including building integrated PV on warehouses and offices. Keeps telework to 1 day a week but relies on a large scale CBSB (150 facilities) participation.</td>
</tr>
<tr>
<td>6</td>
<td>Maximizes Performance</td>
<td>10.2</td>
<td>11.5</td>
<td>99.7</td>
<td>-129</td>
<td>92</td>
<td>Most aggressive packages on all systems. Incorporates building and site PV and wind energy.</td>
</tr>
</tbody>
</table>

SRM: Sustainment, Restoration, and Modernization; MILCON: (New) Military Construction; CBSB: Coordinated Building Set-back; PV: Photo-voltaic (solar power)

* 30-year Net Present Value includes SRM, additional MILCON Sustainability and Third Party Renewable Energy Project costs discounted at 3.0%.