Sustainability and Net Zero Energy Studies with DoD Clients

New Partners for Smart Growth Conference

Kansas City, Missouri

February 7, 2013

Purpose

- Relating to DoD clients, to inform the audience of techniques and tools for:
  - Sustainability planning
  - Net-zero energy planning

So what's in it for the audience?

- Understand the impact of federal mandates
- Understand where DoD is relative to sustainability planning and net-zero energy planning
- Exposure to techniques and tools used in sustainability and net-zero energy planning on the installation level that may have relevance to other scenarios
- Motivation to use DoD information without re-inventing the wheel

AGENDA

- Sustainability Planning Credentials with DoD Clients
- Current Drivers -Public Laws / Executive Orders / Presidential Memorandums / DoD Service directives
- Past Lessons Learned
- Energy Trends
- How does Sustainability Planning and Net-Zero Planning fit within the context of a Master Plan?
- Example Sustainability Plan
- Example Net-Zero Energy Plan
- Managing Client Expectations
- Energy Tools (separate brief)
- New Partners in Smart Growth Implications

Sustainability Planning Credentials with DoD Clients

- Sustainability Plan, Marine Corps Air Station, Iwakuni Japan (completed)
- Comprehensive Energy and Water Master Plans, at Forts Bragg NC, Bliss TX, Benning GA, Riley KS, Rucker AL and Stewart GA (completed)
- Sustainability Pilot Project, Joint Base Pearl Harbor Hickam (completed)
- Master Plan, Sustainability Plan and Net-Zero Energy Plan at two DLA installations: Susquehanna and San Joaquin

  (one installation completed)
- Comprehensive Energy Plan at Camp Lemonnier, Djibouti

  (on-going)

Current Drivers -> Mandates

- EISA 07
- EPACT 05
- National Defense Authorization Act
- EO 13514
- EO 13423
- Presidential Memorandums
- Service Directives

HDR

Federal Mandates

- Energy Reduction
  - EO 13423, Sec 2(a): 3% annually; 30% total by FY30 (FY15 baseline)
  - EO 13514, Sec 2(a)(i): Reduce energy intensity in buildings
  - High Performance and Sustainable Building MOU: 30% less energy use than ASHRAE and IECC levels
    - EO 13423, Sec 2(f)(i) and (ii): 15% of existing building inventory complies with MOU by 2015
  - EO 13514, Sec 2(g): All new buildings entering planning process in FY20 are designed to achieve NZE by FY30
  - Pres Memo, 2 Dec 2011, Sec. 1(a)(b)(c): Implement ECMs with payback < 10 years consistent with real property and capital improvement programs
  - Pres Memo, 2 Dec 2011, Sec. 1(d): Prioritize projects based on return on investment
  - Pres Memo, 2 Dec 2011, Sec. 2(b): Complete energy and water evaluations and report the conservation measures and associated cost savings via Compliance Tracking System (CTS)

Federal Mandates

- Fossil Fuel Reduction
  - EO 13423, Sec 2(a)(iii): Reduce fossil fuel use by:
    - Using low greenhouse gas (GHG) emitting vehicles, including alternative fuel vehicles
    - Optimizing vehicle fleet
    - Reducing the fleet's total consumption of petroleum products, 2% annually by 2020, relative to 2005
  - EO 13423, Sec 2(g): Reduce total consumption of petroleum products 2% annually through end of 2015
  - EO 13423, Sec 2(g): Increase consumption that is non-petroleum based 10% annually
  - EO 13423, Sec 2(g): Use plug-in hybrids when available
  - Presidential Memorandum: All Light Duty trucks need to be alternatively fueled by Dec 2015.

Federal Mandates

- Renewable Energy
  - EPAct, Sec 203: Minimum contribution of renewable electricity – 3% 2007-2009; 5% by 2012; 7.5% by 2013
  - EISA (not generation goal):
    - 30% domestic hot water to be supply by solar energy
    - All other fossil fuels used in buildings to be displaced by 2030
  - EO 13423: Renewable energy counts toward renewable energy goal
  - EO 13514, Sec 2(a)(ii): Increase agency use of renewable energy and installation of new renewable energy generation projects on agency property

Federal Mandates

- Water
  - Reduce potable water consumption intensity by 2% annually through FY20, relative to FY07, by implementing water management strategies, including water-efficient and low-flow fixtures and efficient cooling towers (EO 13514, DoD SSPP)
  - Install smart meters for water (DLA Policy)
  - Complete all energy and water evaluations and report the conservation measures and associated cost saving opportunities identified through these evaluations to the CTS (Presidential Memorandum, 2 December 2011)
  - Implement and achieve objectives in the stormwater management guidance for facilities exceeding 5,000 GSF and maintaining or restoring predevelopment hydrology characteristics (EO 13514, DoD SSPP)
  - Reduce industrial, landscaping, and agricultural water consumption by 2% annually or 20% by the end of FY20 relative to a baseline of FY10 (EO 13514, DoD SSPP)

Federal Mandates

- Waste
  - Minimize the generation of waste and pollutants through source reduction. (EO 13514)
  - Divert 50% of nonhazardous solid waste, excluding construction and demolition debris, by the end of FY15. (EO 13514, DoD SSPP)
  - Divert 60% of construction and demolition debris from the waste stream by FY15, and thereafter through FY20 (FY12 target: 54%) (DoD SSPP)

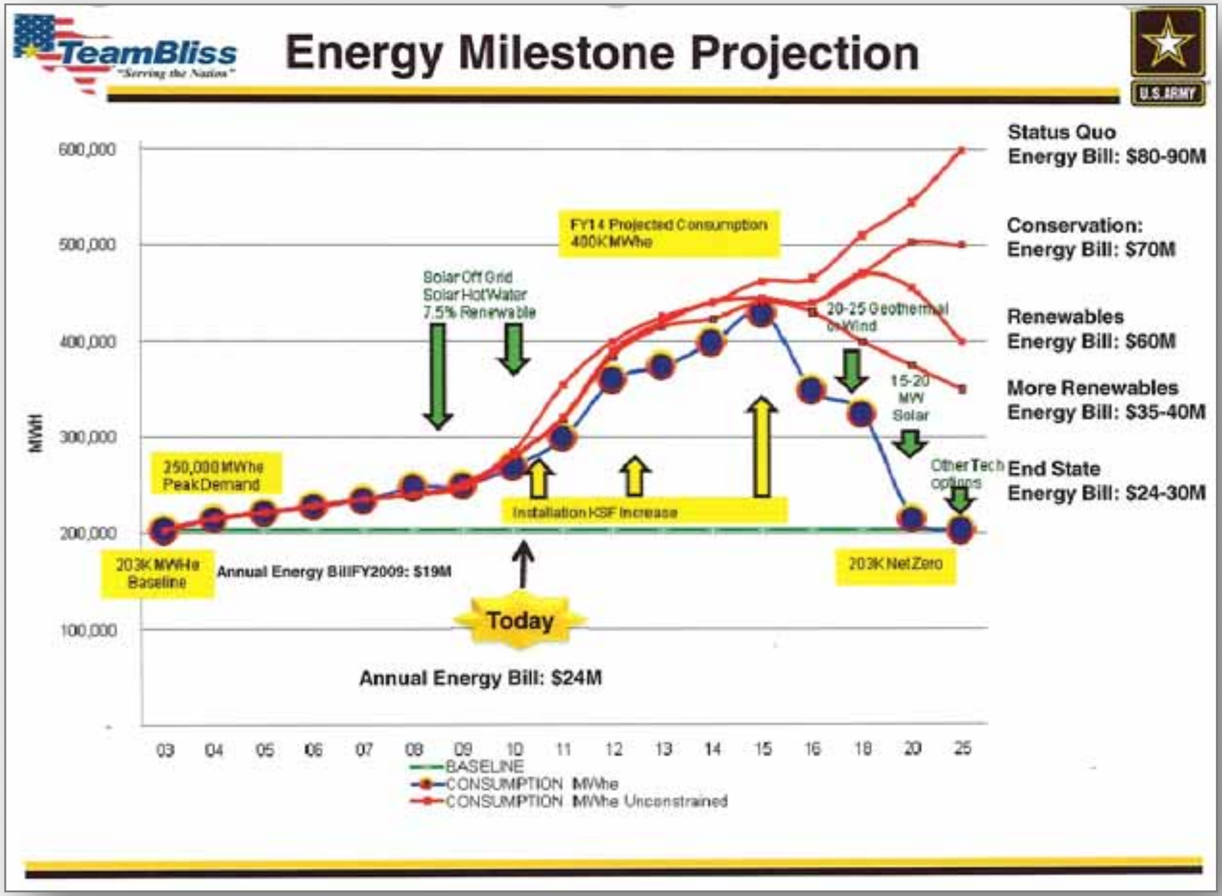
Federal Mandates

- GHG Emissions
  - Reduce GHG Scope 1 and 2 emissions 34% by FY20 (FY08 base) (DoD SSPP)
  - Reduce GHG Scope 3 emissions 13.5% by FY20 (FY08 base) (DoD SSPP)
  - Minimum Reduce GHG emissions from employee air travel 7% from FY11 by FY20 (DoD SSPP)
  - Ensure 30% of eligible employees telework at least once a week on a regular, reoccurring basis by FY20 (DoD SSPP)

Past Lessons Learned

- MCAS Iwakuni: Importance of Vision, Goals and Objectives
- Ft Bragg: Utility Resilience and Security
- Ft Bliss: Net vs Glidepath
- JBPHH: Components and Support Activities
- JBPHH: Crosswalk

Energy Milestones, Fort Bliss



Sustainability Plan Table of Contents

- **Introduction**
- **Vision/Goals/Objective**
- **Nine Sustainability Components (Energy, Renewable Energy, Water, Waste, High Performance Buildings, Fossil & Alternative Fuels, Health (Indoor Air Quality/Workability), GHG, Other (EMS, Electronic Stewardship, Procurement/Disposal, Community Planning)**
  - *a. Existing Conditions*
  - *b. Pertinent Mandates*
  - *c. Analysis*
  - *d. Support Activities*
  - *e. Action Plans & Crosswalk*
- **Capital Investment Strategy**
- **Implementation Plan**
- **Measurement & Verification**
- **Recommendations**

Energy: Support Activity Analysis

Support Activity	Typical Elements that Define the Support Activity	Status of the Support Activity Elements at Installation
Organization	Installation has Energy Manager, BEMs, Designers, Construction Manager, Energy O&M, and Installation Support staff	Strong; developing BEM program
Policies and Procedures	Energy Management Plan	Yes; implementation is top-down driven
Process/Protocol	NZE	Could be improved with bottom-up consulting
Parametric Tools	NZE Tool	Need
Training	Training is available for Energy Manager, BEMs, Designers, Construction Manager, Energy O&M and Installation Support	Needs to be consistent and flexible on an annual basis
Metric and Baseline	2003 Energy Consumption Baselines	Good
Awareness	Energy Conservation Program	Good, but can always be improved
Budget/Funding Status	ESPCs, UESCs, and PPAs	Minimal
Occupant Behavior Change	Phantom load (example)	Good, accountability can always be improved
Current SRM/O&M FYDP Plan	Energy portion of current SRM/O&M FYDP Plan	EUL, ESPCs, PPA, and UESC need to be maximized
Historical	Considered appropriately	Not applicable at the Installation
Measurement and Verification	Meter electric – 2012 gas and steam – 2016; 10 percent audits; reduce energy 30 percent by 2015; reduce energy 50 percent by 2020; Consolidate data centers; Annual reporting	Occurring later rather than sooner

Energy: Action Plan Crosswalk

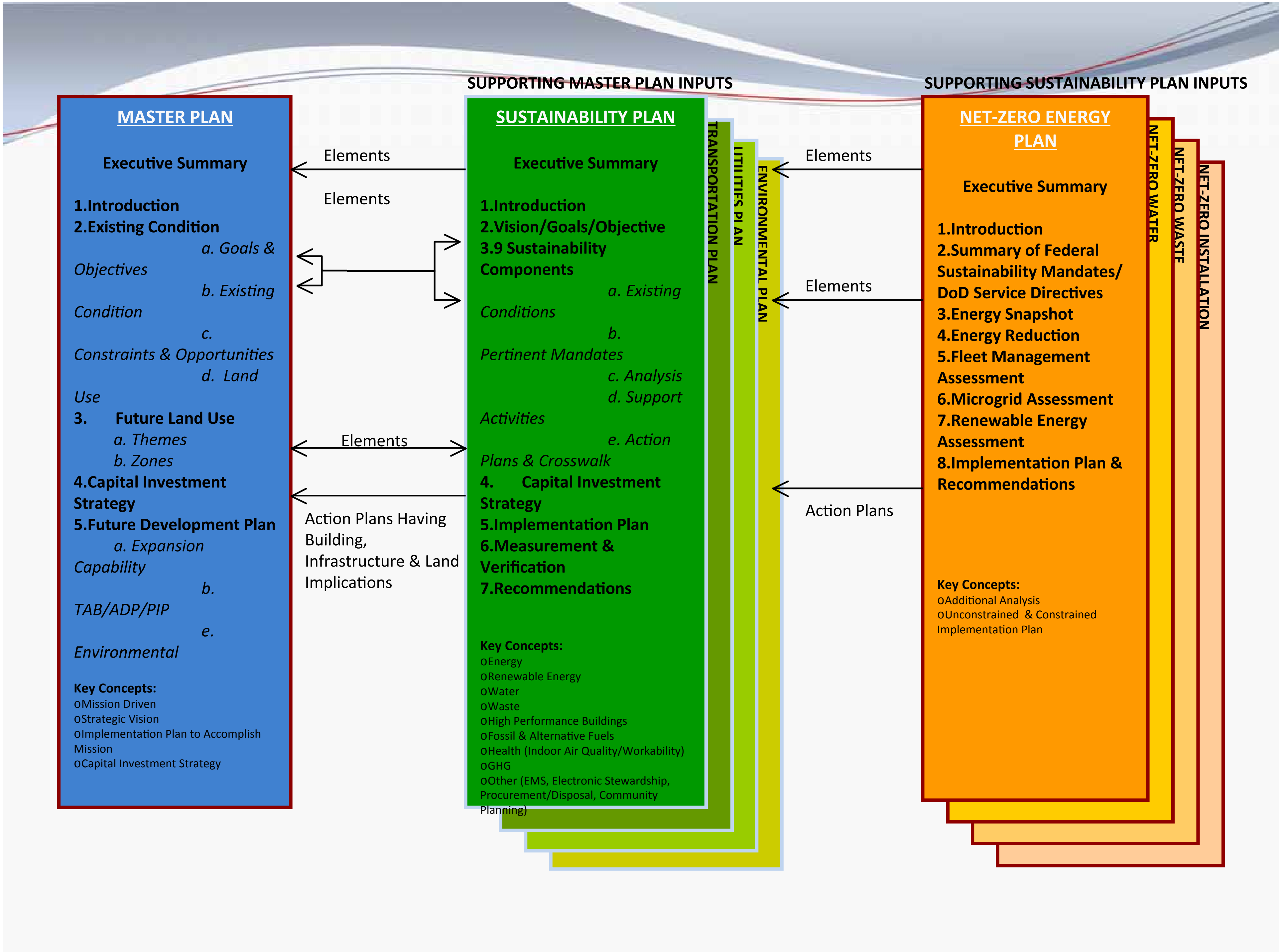
Examples of influences

- Fuel 1, Increase alternative-fuel vehicles and electric cars for GOVs, and Fuel 2, Increase electric charging stations/plug-in stations (GOV): Unless charging stations are powered by renewable energy, additional energy will be required to support the stations, increasing the Installation's overall demand.
- Health/IAQ 2 Develop and implement a mold-reduction plan: Reducing mold may require increased conditioning of spaces, meaning more energy is required to support that building.
- High-Performance Building 3, Develop and implement guidelines for comfort control: Comfort controls can work against a building's energy efficiency
- High-Performance Building 5, Integrate maximum degree of automation: Increased automation has the potential to increase energy required to support the distribution center

Federal Energy Trends/Opportunities

- ARRA money funded many projects over last several years
- Reduced MILCON/ECIP/ SRM funding for energy projects through 2015
- Expect increase use of ESPC, UESC, PPA's, EUL contracting methods
  - PPP, Developer-led opportunities
  - Does not require government funding
- Energy security driving Net-Zero installation focus
- Sustainability Planning
- Focus on Smart Grid technologies

How does Sustainability Planning and Net-Zero Planning fit within the context of a Master Plan?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c. Constraints & Opportunities
d. Land Use
3. Future Land Use
a. Themes
b. Zones
4.Capital Investment Strategy
5.Future Development Plan
a. Expansion Capability
b. TAB/ADP/PIP
e. Environmental
Key Concepts:
oMission Driven
oStrategic Vision
oImplementation Plan to Accomplish Mission
oCapital Investment Strategy
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NET-ZERO WASTE
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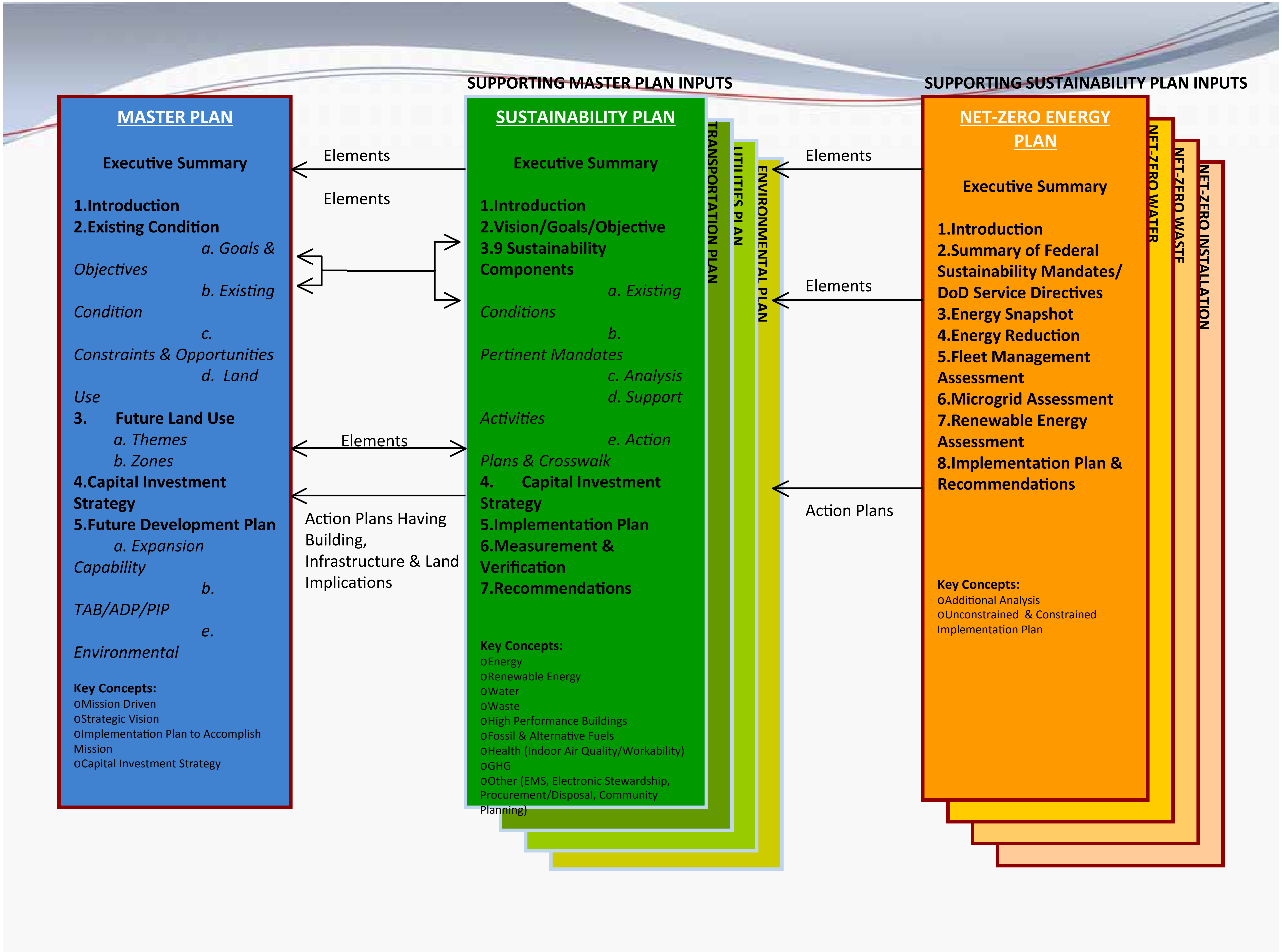
Sustainability Planning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Definition

"Sustainable development is development that meets the needs of the present without compromising the ability of future

generations to meet their

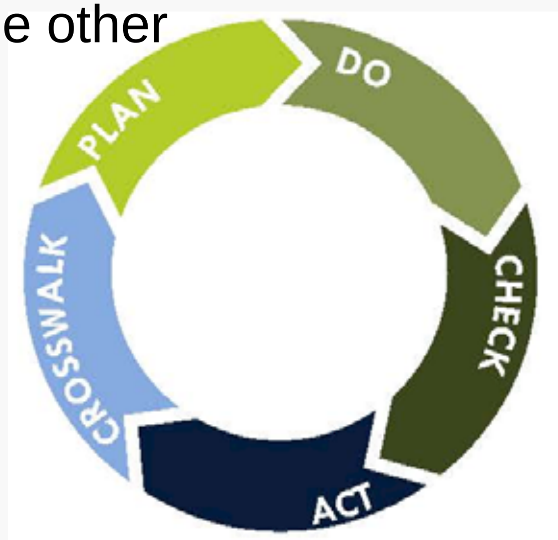
own needs."

– Brundtland Commission Report, 1987

Note: For all the following slides in the presentation, all references and numbers to locations are for demonstration / educational purposes only and represents data from earlier versions of various submittals.

Process: Sustainability Planning

- Plan: Develop Action Plans for each component
- Do: Implement Action Plans
- Check: Measure and verify Action Plans
  - Modify Action Plans as required (iterative process)
- Act: Continue to implement the Action Plan with necessary adjustments. When complete, implement the next phase. Update plan as required
- Crosswalk: Crosswalk Action Plans to each of the other Sustainability Components



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Sustainability Vision

Vision Example

Installation X will continue supporting mission requirements, while maintaining a superior Quality of Life in an accountable, sustainable, efficient, and conservation-minded community

Typical Sustainability Goals

1. Goal 1: Adopt sustainable building standards – flexibility in varying from norm; design for function/use
2. Goal 2: Maximize energy efficiency in existing facilities and new construction
3. Goal 3: Conserve water resources
4. Goal 4: Reduce dependence on fossil fuels
5. Goal 5: Improve mobility to reduce VMT
6. Goal 6: Maximize tree planting and open space in order to reduce heat island effect, buffer against noise pollution , enhance natural habitat
7. Goal 7: Improve community health (Indoors/ Outside)
8. Goal 8: Awareness: Establish requirements and hold people accountable
9. Goal 9: Reduce solid waste
10. Goal 10: Increase use of energy efficient equipment, appliances and green products
11. Goal 11: Reduce greenhouse gas (GHG) emissions
12. Goal 12: Become NZEI by 20xx.
13. Goal 13: Install a smart microgrid (grid-connected/island connected, if feasible)
14. Goal 14: Build in resilience and security measures for utility services and infrastructure (energy, water and information technology)

Sustainability Objectives Example

Goal 1: Adopt sustainable building standards – flexibility in varying from norm; design for function/use

■■ Objective 1.1: Optimize functionality and size of buildings
■■ Objective 1.2: Improve construction standards and Installation Design Guide to include sustainable building practices
■■ Objective 1.3: Provide training in building design or renovations with energy-efficient technologies
■■ Objective 1.4: Develop guidelines and implement comfort control for building interiors
■■ Objective 1.5: Ensure energy performance is included in the evaluation of the design
■■ Objective 1.6: Integrate energy and water efficiency/ conservation review early in process
■■ Objective 1.7: Develop mold reduction plan (while buildings are vacated)
■■ Objective 1.8: Future construction shall consistently meet or exceed United States Green Building Council (USGBC) LEED Silver certifiable

- **Existing conditions overview, answering**: What are the existing conditions?
- **Primary mandates, goals and objectives: answering:** To what end is the installation working?
- **Analysis, answering:** What has to get done to achieve the goals and objectives?
- **Action plans, answering:** How can the analysis in the previous step be organized into manageable, feasible actions or projects that follows the analysis?
- **Crosswalk, answering:** What is the impact of this component to other sustainability components?
- For energy, renewable energy, fossil fuel, utility resilience and security, **cross-walk with Net-Zero Energy Plan**

Energy Example

Energy considered:

- Electricity
- Natural gas
- Steam
- Propane
- Fuel Oil

Both sites have experienced significant reductions

Energy Sources Used at Defense Distribution Center, Susquehanna

Location	Electricity	Natural Gas	Propane	No. 2 Fuel Oil
New Cumberland	X	X	X	X
Mechanicsburg	X	X	X	X

New Cumberland Energy Consumption (MMBtu [000])

	Elec.	Fossil Fuel	Total	Area (kSF)	EUI	% Fossil
FY03	183	310	493	6,334	77.83	63
FY12	222	220	442	7,249	60.97	50
Reduction	(39)	90	51	(915)	16.87	
% Reduct.	-21.4	29.1	10.4	-14.4	21.7	

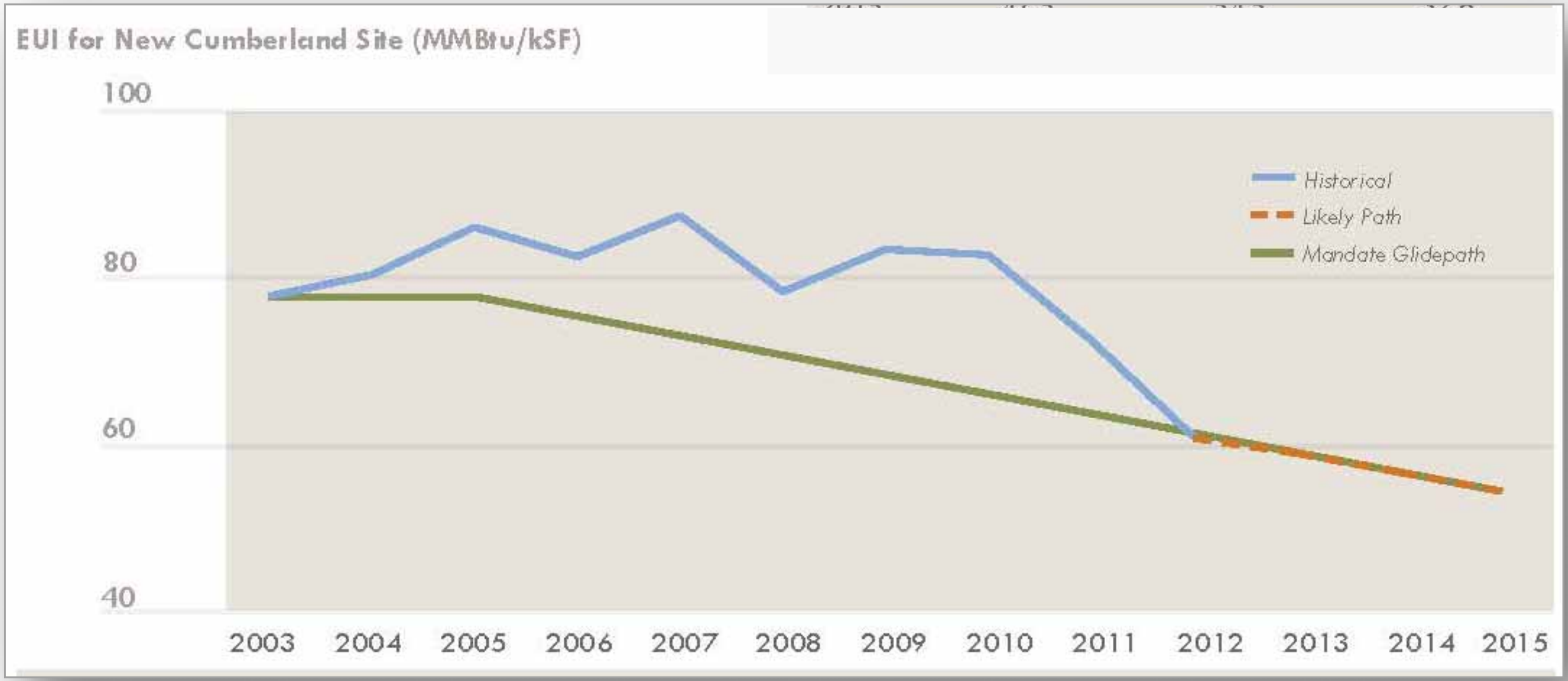
TABLE 3.1

Mechanicsburg Energy Consumption (MMBtu [000])

	Elec.	Fossil Fuel	Total	Area (kSF)	EUI	% Fossil
FY03	47	251	298	4,833	61.65	84
FY12	50	100	151	4,590	32.82	67
Reduction	(3)	151	147	243	28.84	
% Reduct.	-7.3	60.0	49.4	5.0	46.8	

Energy: Analysis Summary Example

- On path to meet 30% reduction by 2015 mandate
- Having electrical and natural gas meter data will facilitate project prioritization



Energy: Analysis Summary Example

- Maximize Enhanced Use Leases (EULs), Energy Savings Performance Contracts (ESPCs), Power Purchase Agreements (PPAs), and Utility Energy Service Contracts (UESCs)
- Linear regression shows strong correlation of fossil fuel consumption to heating degree days.
- Regression model can be used to develop an energy performance indicator (EnPI) of actual to predicted consumption
- Models show new warehouses will likely consume 40 to 50% less heating energy than those from World War I and World War II; enhanced controls in admin facilities should save 10% to 30%

Energy: Action Plans Example

Prioritized Action Plans

Action Plan	Cost
ENG 1: Energy-Efficient Heating, Ventilation, and Air Conditioning (HVAC) Equipment	$2M-$3M (annual)
ENG 2: Energy-Efficient Lighting and Controls	$1M-$2M
ENG 3: Building Level Metering – Benchmarking	$100,000
ENG 4: Energy Awareness – Building Energy Bills	In-house cost
ENG 5: Establish Building Energy Monitor (BEM) Program	In-house cost
ENG 6: Centralized Access and Control of Direct Digital Controls (DDC) Systems	$200,000
ENG 7: Training for Energy Team	In-house cost
ENG 8: Procurement	$40,000-$50,000
ENG 9: Innovative Design for New Buildings	In-house cost
ENG 10: Maximize Available Funding Sources	$1M-$5M
ENG 11: Replace Roofs Using "Cool Roof" Technology, where economically feasible	$200,000 (annual)
ENG 12: Form a Sustainability Council	In-house cost
ENG 13: Continue Regular Contact with Utility Providers	$5,000
Total Cost	$175.355M (major ECM)

Energy: Best Practices Example

- Energy manager staffs program, prepares annual Energy Management Plan, and keeps backlog of projects (funding limits)
- Emphasis on user accountability
- Low-hanging fruit projects, like lighting retrofits, are complete or are planned
- Metering of electric, natural gas, and water is scheduled for completion in FY12

Energy: NZE Integration Example

Net-Zero Energy Plan and Sustainability Plan Action Plan Integration

Sustainability Plan Action Plans	Net-Zero Energy Plan Action Plans that correspond to or support a Sustainability Plan Action Plan
Phase 1 is the same as the Sustainability Plan Phase 1, which targets establishing a framework	Phase 1: Establish program framework (complete before initiating phases 2 and 3)
MAB 1 complements Sustainability Plan ENG 3, Building Level Metering – Benchmarking	MAB 1 Complete baselines
NZE MRV 1 is the same as Sustainability Plan MRV 1, Develop and maintain M&V protocols	MRV 1 Develop and maintain M&V protocols
AWR 1 complements Sustainability Plan ENG 4, Energy Awareness – Building Energy Bills	AWR 1 Promote awareness of energy conservation/efficiency and mission readiness
Phase 2 promotes the purpose of Sustainability Plan Phase 2, begin reductions focusing on energy and fossil fuels	Phase 2: Begin demand reductions (Complete before initiating phase 3)
FEDS 1 will help refine Sustainability Plan ENG 1, Energy efficient HVAC equipment, and ENG 2, Energy efficient lighting and controls	FEDS 1 Complete level 2 assessment and complete FEDS lighting/building envelop recommendations
EQST 1 will help refine Sustainability Plan ENG 6, Centralized access and control DDC systems	EQST 1 Complete enhanced controls
AEMR1 supports building energy reduction overall goal	AEMR 1 Complete Energy Management Program Projects
AWR 1 complements Sustainability Plan ENG 4, Energy Awareness – Building Energy Bills	AWR1 Promote awareness of energy conservation/efficiency and mission readiness
Phase 3 actions are integrated into each Sustainability Plan Phase 3	Phase 3: Perform operation and maintenance (on-going)
MRV 2 complements Sustainability Plan MRV 5, measure and verify building performance	MRV 2 Execute steady state measurement and verification protocol
MRV 3 is the same as Sustainability Plan MRV 3	MRV 3 Execute commissioning and re-commissioning program
MRV 4 is the same as Sustainability Plan MRV 4	MRV 4 Execute auditing/MOU high performance buildings
EC 1 is the same as Sustainability Plan ENG 13	EC 1 Maintain good relations with utility provider
AWR1 complements Sustainability Plan ENG 4, Energy Awareness – Building Energy Bills	AWR 1 Promote awareness of energy conservation/efficiency and mission readiness

AEMR: Annual Energy Management Report
AWR: Awareness
EC: Energy Conservation
ENG: Energy
EQST: eQuest Model
FEDS: Facility Energy Decision System Model
MAB: Measurement and Baseline
MRV: Measurement and Verification

Water Example

Water Systems considered:

- Potable water
- Wastewater
- Stormwater (separate from wastewater)
- Water reuse systems (currently none; golf course irrigation potential)
- Industrial Processes
  - Some process water used at wastewater treatment plant for chemical mixing and other in-plant uses
  - Non-potable system used for golf course irrigation (potable used if non-potable is not available)
- Landscaping
  - Limited areas irrigated with potable water
  - Xeriscape used with new development

The golf course is currently irrigated with potable and nonpotable water

Xeriscaping outside Building 750

Stormwater conduit

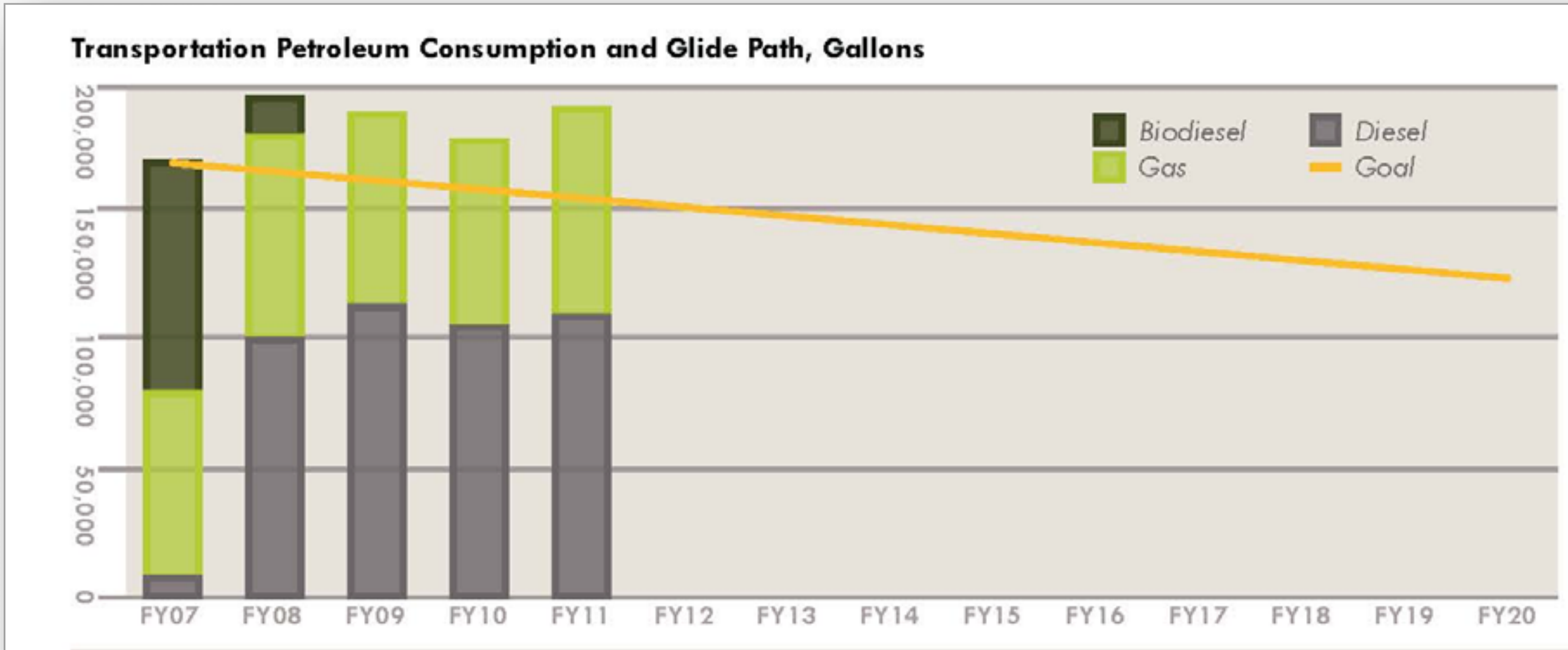
Waste Example

Waste Systems considered:

Wooden pallet waste

- Pallets: Current not able to reuse; sold or stockpiled and shredded for mulch
- Core: Source-separated paper
- Sales: Unwanted furniture taken to Recycling Center and reused or sold
- Yard trimmings: Composted on-site
- Scrap metal and batteries: Collected and sold
- Trash: Taken to Harrisburg incinerator (Household trash is taken by York Waste)
- Hazardous waste: Managed separately
- Electronic waste: Managed separately
- Construction and demolition debris: Handled by building contractors and diverted from disposal
- Reusable materials: Diverted from disposal through DLA Disposition

Fleet Glidepath Example



- A 35% reduction is needed over the next several years to meet reduction goal of 2% annually from 2005 to 2020.

Fossil Fuel/Alternative Fuel: NZE Integration Example

Net-Zero Energy Plan and Sustainability Plan Action Plan Integration

Sustainability Plan Action Plans	Net-Zero Energy Plan Action Plans that correspond to or support a Sustainability Plan Action Plan
NZE Phase 1 action plans form the basis for Sustainability Plan action plans FLS 1 and FLS 9.	Phase 1: Establish program framework (Complete before initiating phases 2 and 3)
	MAB 1 Complete baselines
	MRV 1 Develop and maintain M&V protocols
	AWR 1 Promote awareness of fuel conservation/efficiency and mission readiness
	ORG 1 Form a VAM and develop policies
	PLN 1 Update and maintain the fleet management plan
	PLN 2 Develop and approve the Table of Distribution and Allowances (TDA)
	TRN 1 Develop training and education program for mechanics, first-line supervisors and managers
	FLC 1 Turn-in excess vehicles (at 10 per year)
FSL 1: Increase alternative-fuel vehicles and electric cars for GOVs.	FLA 1 Replace remaining fleet vehicles (5T GVW and under) with alternative fuel models (at 10 per year)
FSL 2: Increase electric charging stations/ plug-in stations for GOVs	
FSL 9: Develop a plan to ensure all light-duty trucks will be fueled by alternative fuels by December 2015 (ongoing).	
NZE Phase 2 action plans support the fuel reduction from fleet reduction; the Sustainability Plan action plans include fleet but also target biking, walking, transit, and ride share/van pools .	Phase 2: Begin reductions in fossil fuel, improvements in fuel efficiencies and increase number of AFVs (5T and under GVW)
	MRV 2 Determine effectiveness of scheduled services
	AWR2 Promote awareness of AFVs
	FLC 1 Turn-in excess vehicles (at 10 per year)
	FLC 2 Maintain good relations with GSA
	FLE 1 Replace poor performance (low cost-benefit <.7) fleet vehicles with newer fuel-efficient models (at 10 per year)
Phase 3 NZE Plan actions are consistent with the Sustainability Plan action plans that support fleet vehicle reductions.	Phase 3: Continue reductions in fossil fuel, improvements in fuel efficiencies and replace vehicles that are not the "right size."
	MRV2 Determine effectiveness of scheduled services
	AWR1 Promote awareness of fuel conservation/efficiency and mission readiness
	FLC1 Turn-in excess vehicles (at 10 per year)
	FLC2 Maintain good relations with GSA
FSL 1: Increase alternative-fuel vehicles and electric cars for GOVs.	FLE2 Replace vehicles that are not the "right size" (i.e., ½-ton light truck is filling in for a 1 ton truck position)
FSL 2: Increase electric charging stations/ plug-in stations for GOV	
FSL 9: Develop a plan to ensure all light-duty trucks will be fueled by alternative fuels by December 2015 (ongoing).	

Sustainability Plan Action Plans	Net-Zero Energy Plan Action Plans that correspond to or support a Sustainability Plan Action Plan
NZE Phase 4 action plans continue the program built in Phases 1 through 3: awareness, measurement and verification, and continued vehicle replacements. This program is driving by the NZE Plan, and the results integrated into the energy reduction glide path of the Sustainability Plan.	Phase 4: Continue reductions in fossil fuel, improvements in fuel efficiencies and increase number of AFVs (passenger vehicles and trucks above 5T GVW)
	MRV 2 Determine effectiveness of scheduled services
	AWR 2 Promote awareness of AFVs
	FLC 1 Turn-in excess vehicles (at 10 per year)
	FLC 2 Maintain good relations with GSA
	FLA 2 Replace remaining fleet vehicles (Over 5T GVW) with alternative fuel models (at 10 per year)

AWR: Awareness FLC: Fleet Conservation FLA: Fleet Alternative FLE: Fleet Efficiency
MAB: Measurement and Baseline MRV: Measurement and Verification PRC: Process ORG: Organization
TRN: Training

High Performance Buildings Example

- Defined in the "Federal Leadership in High Performance and Sustainability Buildings" Memorandum of Understanding
  - Employ integrated design principles
    - Use integrated planning and design process
    - Employ total building commissioning practices
  - Optimize energy performance
    - Establish whole building performance target
    - Perform measurement and verification
  - Protect and conserve water
    - Use 20% less potable water indoors
    - Use 50% less potable water outdoors
  - Enhance indoor environmental quality
    - Meet ASHRAE for ventilation and thermal comfort
    - Establish strategy for moisture control
    - Achieve daylighting factor of 2% in 75% of space for critical tasks
    - Use low-emitting materials (paints, sealants, etc.)
    - Project indoor air during construction
  - Reduce environmental impact of materials
    - Use products meeting USDA's biobased content recommendations
    - Salvage at least 50% construction, demolition and land clearing waste
    - Eliminate use of ozone-depleting compounds

Indoor Air Quality (IAQ) Example

- 80% of people's lives is spent indoors, therefore ensuring that the air quality of indoor environments supports good health is important
- Examples of impacting factors in work environment:
  - Ventilation systems drawing outside air in office environments
  - Trucks idling near warehouses with open bays
  - Residences with humid basements
  - Coworkers bringing cleaners, varnishes, or other products

IAQ: Analysis Summary Example

- Indoor air quality can be compromised in multiple ways. Most indoor air quality issues are from Administrative areas, although warehouses are not exempt from complaints
- A Certified Industrial Hygienist (CIH) is on the Installation to respond to air quality issues and proactively establish baseline exposures.
- The Installation is working toward being a Voluntary Protection Program (VPP) Installation under the Occupational Safety and Health Administration (OSHA)
- Training is provided weekly, keeping employees up-to-date on health and safety practices in the workplace.

Greenhouse Gas (GHG) Example

- Three scopes of GHG emissions:
  - Scope 1, direct GHG emissions from sources that are owned or controlled by the Installation (addressed by the Energy and Renewable Energy sections)
  - Scope 2, direct GHG emissions generated from electricity, heat, or steam purchased (addressed by the Energy and Renewable Energy sections)
  - Scope 3 emissions are from sources not owned or controlled by the Installation that are related to agency activities such as vendor supply chains, delivery services, and employee travel and commuting
- Installation is in xxx County portion of the state Intrastate Air Quality Control Region
  - Area is classified as maintenance for ozone, nonattainment for particulate matter 2.5 (PM2.5), and attainment or unclassified for the other National Ambient Air Quality Standards (NAAQS). The Installation operates under Air Quality-Title V operating permit (Permit No. 67- 05041)
- Emission sources
  - Central Heat Plant (#2 fuel oil),
  - #2 oil-fired emergency generators
  - Other combustion sources, degreasing station, and woodworking operations.

GHG: Analysis Summary Example

- The DoD SSPP establishes thresholds for scope 1, 2, and 3 GHG emissions. Installation x calculates its emissions using the Federal Energy Management Program (FEMP) Regional Electrical Reporting Tool
- Data centers continue to be scrutinized for consolidation. DLA should be prepared to report GHG emissions from data centers regardless of whether the facilities are located onsite or contracted offsite
- Out of 3,068 people working at installation x:
  - 5%participate in alternative transportation of some type
    - Carpool participants: 126 employees
    - Vanpool participants: 30 employees
    - Cyclists: 2 employees
    - Transit riders: 3 employees
    - Walkers: 2 employees

Utility Resilience and Security (URS)

- Refers to the Installation's ability to continue to meet critical mission objectives given a threat, be it man-made or natural.

- There are five dimensions of utility resilience and security that must be addressed for a complete analysis

■■ Surety: Prevent loss of access to required utility sources
■■ Supply: Access alternative and renewable utility sources
■■ Survivability: Ensure resilience in systems to overcome loss of access
■■ Sufficiency: Provide adequate utility support for critical missions when, where, and in the quantities needed
■■ Sustainability: Promote support for installation's mission, its community, and the environment

URS: Action Plans Example

Action Plan	Cost ($000)
URS 1: Conduct formal study of Installation-wide systems	$100 (annual)
URS 2: Monitor ingress/egress with cameras and motion detectors	$60
URS 3: Place critical systems underground	$10,000
URS 4: Use electrical and renewable energy	$400
URS 5: Ensure utility adequacy	$20 (3 years)
URS 6: Develop and install a secure microgrid	$10,000
Total Cost	$20,620

Score Card Example

Installation Sustainability Scorecard

Component	Description	Status	Rating
1. Energy	Improve energy management and reduce use through conservation, energy efficiency, building retrofits, and enhanced facility design	Ongoing improvements	G
2. Renewable Energy	Increase provisions for renewable power generation	Limited by geographic location; working with other entities, such as Defense Distribution Depot San Joaquin, to meet NZE by 2040 goal	G
3. Water	Reduce water consumption intensity through conservation and new technologies	Water is prevalent and inexpensive; retrofits always considered	G
4. Waste	Diversion and reduction programs: use of reusable and recyclable consumer products consumed in office, food service, fleet, recreation, child development center, grounds, maintenance operations, and construction and demolition-related practices; and, purchase products that accommodate waste diversion, reuse, and recycling.	Advanced program, continually improving diversion rates and expanding recycling and composting programs	G
5. Fossil/ Alternative Fuel and Transportation	Use site planning, mass transit, and alternative vehicle technologies to reduce total vehicle fuel consumption and GHG emissions	Program taps into rideshare and van pools; have alternative fuel on Installation	G
6. High Performance Building	Increase number of buildings that comply with LEED and Guiding Principles for Federal Leadership in High-Performance Buildings	A high priority for the Installation, but struggling to achieve due to finite resources (funding, staff, time)	A
7. Health/Indoor Air Quality	Ensure indoor air quality promotes health; increase awareness of the effects of using specific chemical products and the merits and suitability of alternative products and processes; identify and work to remove procurement barriers	A high priority for the Installation, but awareness program is needed	A
8. Greenhouse Gases	Reduce Scope 1, 2, and 3 GHG emission generation	A priority for the Installation, Energy and Fossil/Alternative Fuel and Transportation	A
9. Utility Resilience and Security	Ensure that the Installation is self-sufficient and can function as an island for an extended period of time in the event of an emergency	A high priority for the Installation, but several projects are needed to achieve the level at which the Installation desires to be	A
10. Others: Environmental Management System (EMS)	Follow protocol established to monitor and reduce operational impacts on the environment	Installation applies its EMS	G
10. Others: Electronics Stewardship	Ensure purchases are Energy Star (or equivalent), and equipment is disposed of in accordance with DLA policy.	Installation is adhering to requirements for electronics	G
10. Others: Procurement	Conduct sustainable procurement practices, including following DoD's Green Procurement Program, and purchasing Energy Start and Electronic Product Environmental Assessment Tool (EPEAT)-registered electronics	Installation is adhering to requirements for procurement	G
10. Others: Community Planning	Meeting with regional agencies on transportation, renewable energy, and environmental issues. Review real property for consolidations and reductions.	Overall, Community Planning is a strong program, and is continually being improved upon.	G

Notes: Ratings are subjective and based on observations of projects, programs, and policies as well as indicators of data collected during the development of this plan. The scorecard should be viewed as a self-evaluation; the Installation is able to review and modify the ratings as appropriate.

G Green signifies that meeting the mandate and action plans are under way, the attainment of the goal appears to be on track, and there are no significant current action plans required.

A Amber signifies that effort is needed to meet the mandate, the attainment of the goal may not be on track, or some additional effort is likely required.

R Red signifies that little to no progress has been made toward meeting that mandate for the component and that additional resources and actions must be prioritized to get the plan back on track.

Measurement & Verification Program

- Review goals
- Analyze implementation plan to assess progress toward goals
- Amend scorecard as required

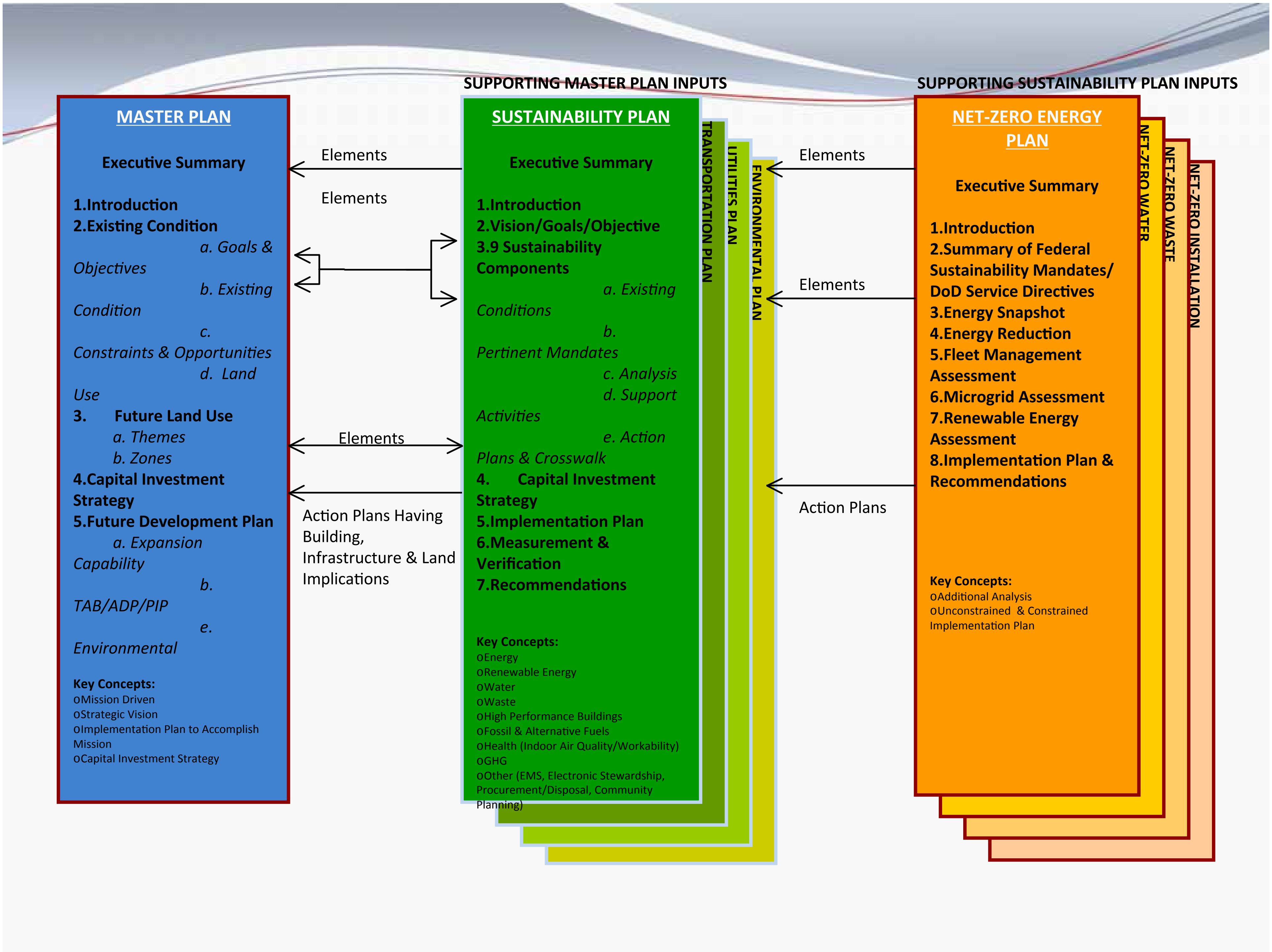
Defense Distribution Center, Susquehanna Goals

Sustainability Component	EO 13423	EO 13514	DoD SSPP for FY11	DLA Goal	Installation Goal	NDAA 2007
Energy Reduction	Reduce energy consumption 30 percent by FY15		Reduce energy intensity 30 percent by FY15; 37 percent by FY20			
Renewable Energy	Ensure half of renewable energy is from new sources and on agency property, if possible	Design FY20 buildings to be NZE by FY30		Net Zero by FY40		25 percent renewable by FY25
Water Reduction	Reduce water use 16 percent by FY15	Reduce water use 26 percent by FY20	Reduce water intensity 26 percent by FY20			
Waste Reduction		50 percent solid waste diversion by FY15	50 percent solid waste diversion by FY15			
Fossil fuels	Reduce petroleum by fleet use 20 percent by FY15	Reduce petroleum by fleet use 30 percent by FY20	Reduce petroleum by fleet use 30 percent by FY20			
GHG Reduction		Reduce Scope 3 GHGs 13.5 percent by FY20	Reduce Scope 3 GHGs 13.5 percent by FY20			
Utility Resilience and Security					Smart Microgrid	

Plan Recommendations

- **Funding Sources: Investigate and maximize the** use of ESPCs, PPAs, EULs, and UESCs. In the future, appropriated "energy/energy-focused" monies will probably be more centrally managed, be managed at a higher level, and be extremely competitive among the agencies/services within DoD
- **Smart Microgrid: Pursue the development of** a smart microgrid for the Installation that could connect critical assets. Initial feedback is that the Installation favors an "islanded" system
- **Net-Zero Water Status: Though it is not required** at this time, develop the necessary prerequisite action plans for achieving net-zero water
- **Net-Zero Waste Status: Though it is not required** at this time, develop the necessary prerequisite action plans for achieving net-zero waste **Sustainable Return on Investment Tool:** Consider using an SROI tool for performing lifecycle analysis within the context of these action plans to satisfy Section 8.F of EO 13514

Net-Zero Energy Planning

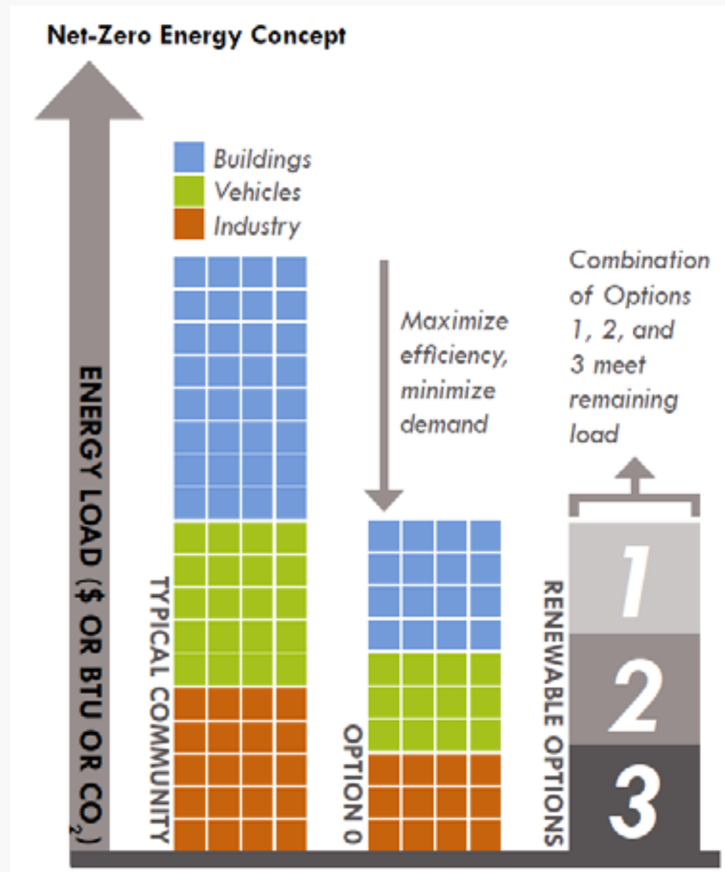

SUPPORTING MASTER PLAN INPUTS
SUPPORTING SUSTAINABILITY PLAN INPUTS
MASTER PLAN
Executive Summary
1.Introduction
2.Existing Condition
a. Goals & Objectives
b. Existing Condition
c. Constraints & Opportunities
d. Land Use
3. Future Land Use
a. Themes
b. Zones
4.Capital Investment Strategy
5.Future Development Plan
a. Expansion Capability
b. TAB/ADP/PIP
e. Environmental
Key Concepts:
oMission Driven
oStrategic Vision
oImplementation Plan to Accomplish Mission
oCapital Investment Strategy
Elements
Elements
Elements
Action Plans Having Building, Infrastructure & Land Implications
SUSTAINABILITY PLAN
Executive Summary
1.Introduction
2.Vision/Goals/Objective
3.9 Sustainability Components
a. Existing Conditions
b. Pertinent Mandates
c. Analysis
d. Support Activities
e. Action Plans & Crosswalk
4. Capital Investment Strategy
5.Implementation Plan
6.Measurement & Verification
7.Recommendations
Key Concepts:
oEnergy
oRenewable Energy
oWater
oWaste
oHigh Performance Buildings
oFossil & Alternative Fuels
oHealth (Indoor Air Quality/Workability)
oGHG
oOther (EMS, Electronic Stewardship, Procurement/Disposal, Community Planning)
TRANSPORTATION PLAN
UTILITIES PLAN
ENVIRONMENTAL PLAN
Elements
Elements
Action Plans
NET-ZERO ENERGY PLAN
Executive Summary
1.Introduction
2.Summary of Federal Sustainability Mandates/ DoD Service Directives
3.Energy Snapshot
4.Energy Reduction
5.Fleet Management Assessment
6.Microgrid Assessment
7.Renewable Energy Assessment
8.Implementation Plan & Recommendations
Key Concepts:
oAdditional Analysis
oUnconstrained & Constrained Implementation Plan
NET-ZERO WATER
NET-ZERO WASTE
NET-ZERO INSTALLATION

Definition

“A net-zero energy military installation produces as much energy on-site from renewable energy generation or through the on-site use of renewable fuels, as it consumes in its buildings, facilities, and fleet vehicles”

In principle, an NZEI should reduce its load through conservation (of what is supplied, use only what is needed) and energy efficiency (typically the most cost-effective measure that will allow the highest returns per dollar spent), then meet the remaining load through renewable energy. Having the renewable energy on site is preferred over the energy being off site. Defining an NZEI is complicated by the need to consider, in addition to individual buildings, public facilities, and infrastructure, and the question of how to integrate systems (grid, distributed energy interconnections, alternative energies, batteries, thermal storage, and even electrical transportation vehicles).

The original definition of an NZEI adopted by the DoD-

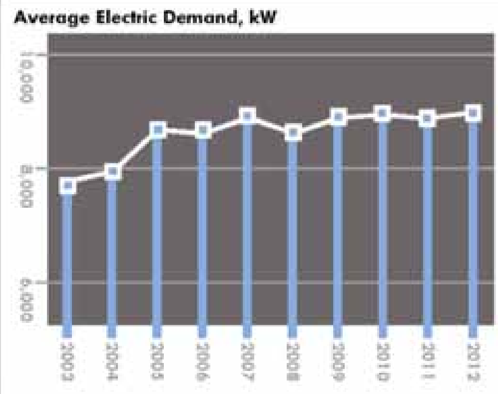


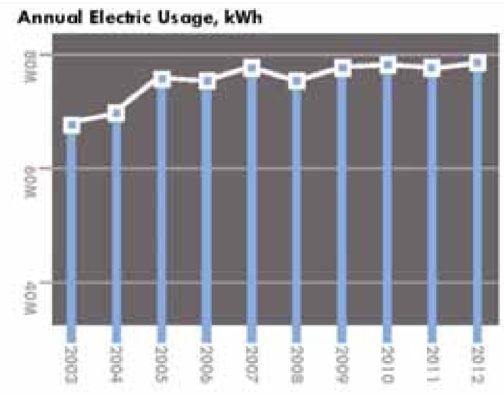
Net Zero Energy Plan TOC

- Introduction
- Mandate Summary
- Energy Snapshot (Baseline)
- Energy Reduction Assessment
- Fleet Management Reduction Assessment
- Micro-grid Assessment
- Renewable Energy Assessment
- Implementation Plan
- Recommendations

Energy Snapshot: Electric

- Total FY12 consumption for installation x and sub-installation y: **272,637 MMBtu** (Installation x: 85%)
- *FY11 data somewhat skewed due to both old and new central heat plants (CHPs) in operation*





Annual Electrical Usage

FY	New Cumberland				Mechanicsburg				Totals			Area (kSF)
	Average kW	kWh	MMBtu	Area (kSF)	Average kW	kWh	MMBtu	Area (kSF)	Average kW	kWh	MMBtu	
03	6,126	53,667,715	183,168	6,334	1,570	13,749,237	46,926	4,833	**7,696**	**67,416,952**	**230,094**	**11,167**
04	6,265	54,878,881	187,302	6,369	1,628	14,264,873	48,686	4,833	**7,893**	**69,143,754**	**235,988**	**11,202**
05	6,945	60,833,830	207,626	5,824	1,777	15,564,930	53,123	4,833	**8,721**	**76,398,760**	**260,749**	**10,657**
06	7,001	61,330,349	209,320	5,799	1,647	14,428,025	49,243	4,833	**8,648**	**75,758,374**	**258,563**	**10,632**
07	7,103	62,223,024	212,367	5,775	1,858	16,279,675	55,563	4,833	**8,961**	**78,502,699**	**267,930**	**10,608**
08	6,938	60,781,153	207,446	6,200	1,712	14,993,563	51,173	4,833	**8,650**	**75,774,716**	**258,619**	**11,033**
09	7,255	63,554,912	216,913	6,193	1,706	14,940,320	50,991	4,833	**8,961**	**78,495,232**	**267,904**	**11,026**
10	7,249	63,501,138	216,729	6,138	1,769	15,495,400	52,886	4,833	**9,018**	**78,996,538**	**269,615**	**10,971**
11	7,207	63,135,502	215,481	7,050	1,732	15,171,300	51,780	4,833	**8,939**	**78,306,802**	**267,261**	**11,884**
12	7,250	65,158,203	227,320	7,249	1,740	14,747,000	50,317	4,590	**8,990**	**79,905,203**	**272,637**	**11,839**

Energy Reduction Projects

- Right: FY11 DoD Annual Energy Management Report (AEMR)
- Below: Summary of projects in AEMR and those proposed from modeling
- Industrial processes (emergency generators) considered, load very small (95 MMBtu/yr)

Project Savings and Costs

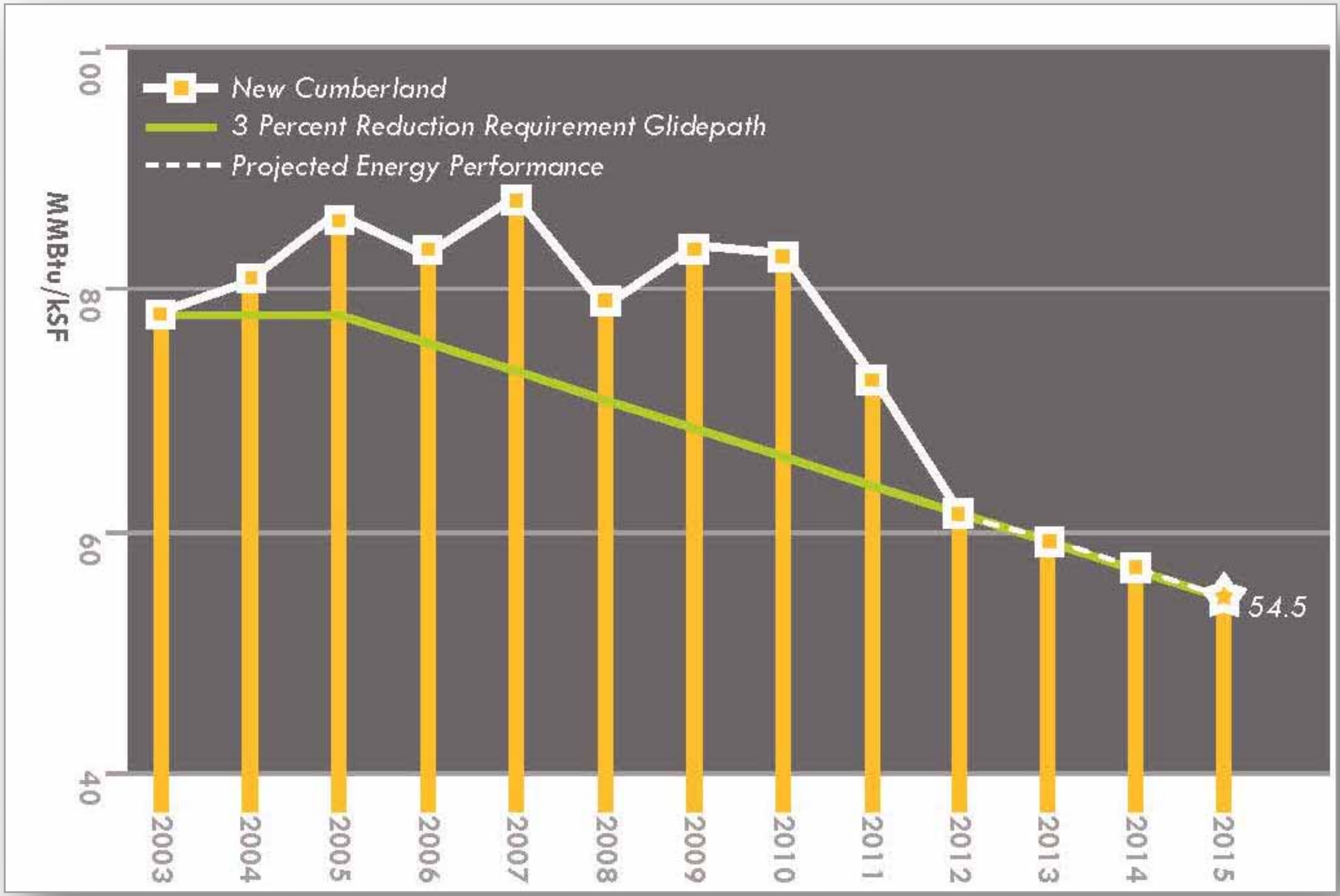
Project	Annual Savings (MMBtu)	Project Cost ($)
Transpired Solar Collectors (2001, 82, 732, 765, 760)	49,784	$6,154,632
AEMR List Minus EDC Solar Collector	21,174	$6,274,000
FEDS Lighting/Envelope	7,150	$837,687
Enhanced Controls in Admin	16,720	$2,000,000
Awareness Program (after 4 yrs)	3,833	$100,000
New Warehouses (MILCON)	27,900	$413,840,000
Total	126,560	$429,206,319

DoD Annual Energy Management Program Projects

Description	Energy Benefit (Production or Savings) MMBtu	Funding Type/ Mechanism	Appropriation	Estimate of Financial Obligation ($000)	Estimated Payback Period (Years)
Convert Building 87 from steam to hot water and replace HVAC, control systems, and transpired solar collectors (ER 40% efficient)	1,750	Appropriated	Working Capital Fund	2,125	9.0
Building 400 boiler replacement and natural gas conversion	3,056	Appropriated	Working Capital Fund	485	9.7
Building 315 HVAC unit replacement and conversion to natural gas (94 percent efficient condensing boiler)	1,583	Appropriated	Working Capital Fund	105	4.2
Building 316 HVAC unit replacement and conversion to natural gas (94 percent efficient condensing boiler)	727	Appropriated	Working Capital Fund	75	6.4
Lighting Building 80 with sensors (ECIP) (T5 HO with motion sensor)	2,249	Appropriated	ECIP MILCON	458	6.0
Lighting Building 89 with sensors (ECIP) (T5 HO with motion sensor)	3,031	Appropriated	ECIP MILCON	585	6.0
Lighting Building 53 with sensors (ECIP) (T5 HO with motion sensor)	1,735	Appropriated	ECIP MILCON	550	10.0
Conversion of Building 300 to natural gas and replacing HVAC equipment	378	Appropriated	Working Capital Fund	158	9.5
Lighting Building 51 (T5 HO with motion sensors)	1,085	Appropriated	Working Capital Fund	243	6.7
Lighting Building 56 (T5 HO with motion sensors)	1,627	Appropriated	Working Capital Fund	322	6.2
Lighting Building 55 (T5 HO with motion sensors)	1,705	Appropriated	Working Capital Fund	525	9.5
EDC admin cafeteria refrigeration system replacement	35	Appropriated	Working Capital Fund	85	4.0
Lighting Building 50 (T5 HO with motion sensors)	813	Appropriated	Working Capital Fund	243	9.0
Lighting Building 52, Bays 4 and 5 (T5 HO with motion sensors)	220	Appropriated	Working Capital Fund	25	3.0
Add motion sensors to last 30 percent of T5 HO lights in Building 84	590	Appropriated	Working Capital Fund	58	3.0
Add motion sensors to last 30 percent of T5 HO lights in Building 83	590	Appropriated	Working Capital Fund	58	3.0
Add motion sensors to last 30 percent of T5 HO lights in Building 82	590	Appropriated	Working Capital Fund	58	3.0
Add motion sensors to last 30 percent of T5 HO lights in Building 85	590	Appropriated	Working Capital Fund	58	3.0
Add motion sensors to last 30 percent of T5 HO lights in Building 87	590	Appropriated	Working Capital Fund	58	3.0
EDC transpired solar collector	26,730	Appropriated	ECIP MILCON	3,800	6.0

ER = Energy Rating *HO = high output*

Energy Reduction
Installation x EUI Glidepath



Demo/Construction Accounting

Fiscal Year (FY)	Previous Year kSF	Previous MMBTU	Previous MMBTU/kSF	Demolitions		Construction		End Year kSF	End Year MMBTU
				Total Demolition kSF	Total MMBTUs	Total New Construction kSF	Total MMBTUs		
FY12	7,466	459,767	61.58	(410)	(14,707)	300	5,400	7,356	450,460
FY13	7,356	450,460	61.23	(99)	(2,548)	265	4,452	7,523	457,460
FY14	7,523	457,460	60.81	(0)	(0)	28	478	7,551	457,938
FY15	7,551	457,938	60.65	(0)	(0)	0	0	7,551	457,938
FY16	7,551	457,938	60.65	(0)	(0)	0	0	7,551	457,938
FY17	7,551	457,938	60.65	(899)	(30,047)	866	15,588	7,518	503,573
FY18	7,518	503,573	66.98	(5)	(120)	13	245	7,526	503,938
FY19	7,526	503,938	66.96	(416)	(14,944)	978	17,562	8,088	536,444
FY20	8,088	536,444	66.33	(0)	(0)	0	0	8,088	536,444
FY21	8,088	536,444	66.33	(0)	(0)	0	0	8,088	536,444
FY22	8,088	536,444	66.33	(471)	(16,970)	360	6,480	7,976	559,894
FY23	7,976	559,894	70.19	(0)	(0)	0	0	7,976	559,894
FY24	7,976	559,894	70.19	(0)	(0)	0	0	7,976	559,894
FY25	7,976	559,894	70.19	(0)	(0)	773	13,905	8,749	573,799
FY26	8,749	573,799	65.59	(0)	(0)	0	0	8,749	573,799
FY27	8,749	573,799	65.59	(0)	(0)	0	0	8,749	573,799
FY28	8,749	573,799	65.59	(205)	(5,289)	620	10,980	9,164	590,068
FY29	9,164	590,068	64.39	(0)	(0)	0	0	9,164	590,068

Vehicle Allocation Methodology

- Using combinatorial optimization an “fuzzy” logic, an optimal set within a finite set of vehicles is found using neural networks and logic scoring of preference (LSP) application.
- The bandwidth of logic functions are expanded from “yes/no” to a percentage of preferences 0-100% and these preferences are directly linked to a quantitative measure of “cost/benefit” ratio.

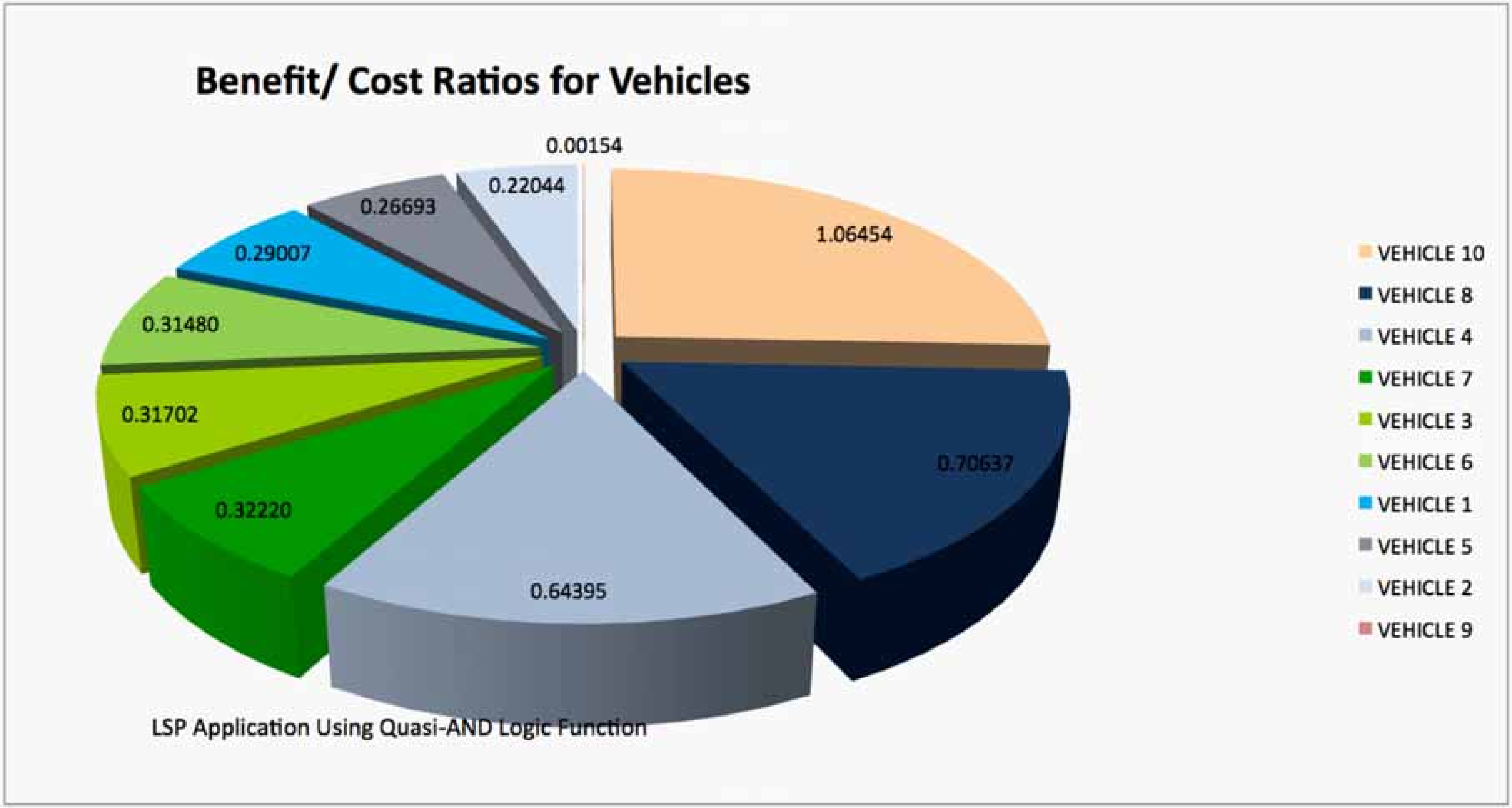
Vehicle Allocation Methodology

- For the purposes of the study, there were five criteria: mission, fuel type, miles per gallon cumulative mileage and age.
- Each criterion were weighted of 40%, 30%, 15% 10% and 5% (subjective)
- Life cycle costs of the vehicle were cost of the lease, maintenance cost and energy costs.

Vehicle Allocation Methodology

Veh# w LCC	Mission @.4	Type Fuel@.3	MPG@.15	Mileage (mi) @ .1	Age (yrs) @.05
1 w $100k	Expt w exch	diesel	<= 70	80k	>3
2 w $90k	<Quasi	NG	<= 30	10k	>9
3 w $80k	>Quasi	electric	<= 10	70k	>4
4 w $70k	Quasi	hybird	<= 30	20k	>2
5 w $60k	Expt w exch	gas	>= 80	30k	>8
6 w $50k	>Quasi	electric	<= 10	90k	>5
7 w $40k	<Quasi	diesel	<= 50	40k	>6
8 w $30k	Quasi	E85	<= 70	80k	>7
9 w $20k	Low	gas	<= 50	50k	>1
10 w $10k	Expt w exch	E85	<= 50	60k	>6

Vehicle Allocation Methodology



Summary: Fleet
Impacts of Future Transportation Changes

Impacts of Future Transportation Changes

FY	Transportation Energy		Totals		
	Reductions (MMBtu)	Increases (MMBtu)	Facility Energy (MMBtu)	Transportation Energy (MMBtu)	Total Remaining Load (MMBtu)
11			501,098	34,043	535,141
12	(317)	0	446,951	31,211	478,162
13	0	0	407,524	31,211	438,735
14	(455)	41	366,672	30,797	397,468
15	(466)	39	325,341	30,370	355,711
16	(491)	318	325,341	30,197	355,538
17	(516)	287	310,882	29,968	340,850
18	(558)	45	311,007	29,455	340,462
19	(554)	0	313,625	28,901	342,526
20	(610)	0	313,625	28,291	341,916
21	(561)	0	313,625	27,730	341,355
22	(517)	0	303,135	27,213	330,348
23	(153)	0	303,135	27,060	330,195
24			303,135	27,060	330,195
25			317,040	27,060	344,100
26			317,040	27,060	344,100
27			317,040	27,060	344,100
28			322,731	27,060	349,791

Accounts for construction and demolition associated with MILCON projects

Renewable Energy: Analysis Example

Priority Assessment Tool Evaluation – New Cumberland

Technology	Cost of Electricity	Resource Availability/ Potential	Emissions	Land/Space Available	Mission Impact Risk	Support for RE Projects at Installation	Support for RE Projects in Surrounding Community	Current Installation Efforts/Projects	State Regulatory Status	State Renewable Portfolio Standard	Availability of Technology Incentives	Technology Cost	Total Score
Thermal Energy – Transpired Solar Collectors	3	2	5	5	5	5	3	4	5	3	4	3	47
Solar – Photovoltaic, Building Scale	3	2	5	4	5	5	3	2	5	3	5	3	45
Thermal Energy – Passive Solar Water Heating	3	2	5	5	5	5	3	2	5	3	4	3	45
Thermal Energy – Ground Source Heat Pumps	3	2	5	2	5	5	3	4	5	3	3	4	44
Solar – Photovoltaic, Utility Scale	3	2	5	2	3	5	3	2	5	3	5	4	42
Wind – Building Scale, Vertical Axis	3	2	5	3	5	5	3	1	5	3	3	3	41
Wind – Utility Scale, Horizontal Axis	3	2	5	1	5	5	3	1	5	3	3	5	41
Biomass – Landfill Gas	3	2	2	3	5	5	3	1	5	3	3	4	39
Biomass – Waste to Energy	3	3	2	3	4	5	3	1	5	3	3	3	38
Biomass – Wood	3	3	2	3	4	5	3	1	5	3	3	3	38
Thermal Energy – Geothermal Power	3	1	5	2	5	5	3	1	5	3	3	1	37
Thermal Energy – Concentrated Solar Thermal	3	2	5	1	2	5	3	1	5	3	3	1	34
Biomass – Biofuels	3	1	2	3	4	5	3	1	5	3	1	2	33
Biomass – Grass	3	1	2	3	4	5	3	1	5	3	1	2	33
Biomass – Mineral Oils	3	1	2	3	4	5	3	1	5	3	1	2	33
Biomass – Algae	3	1	2	3	4	5	3	1	5	3	1	1	32

Key: Potential Limited Improbable

Renewable Energy: Recommendation

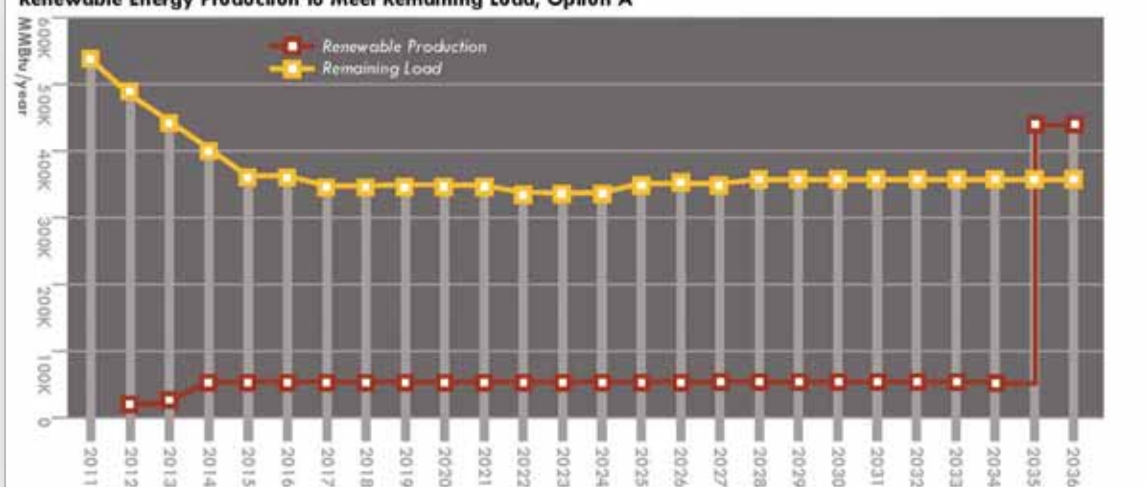
- **Option A:** Renewable energy at Installation x to meet remaining load

Renewable Production to Meet Remaining Load, Option A

Technology	FY Completed/Planned	Annual Production Capacity MWh/Year	Annual Production Capacity MMBtu/Year	Offset in Energy, Equivalent MMBtu/Year	Capital Cost, $	LCOE without Incentives, $/kWh	Annual Energy Produced, $ per MMBtu/Year	% of NZEI Goal (New Cumberland)	Payback Years
Proposed Project[1]									
Biomass (Wood) Power Plant (15 MW)	TBD (2035)	114,018		389,143	93,632,000	0.114	$241	111.3	31.6
Subtotals		**114,018**		**389,143**	**93,632,000**		**$241**	**111.3**	
Planned Projects Totals			**49,784**	**49,784**	**6,154,361**		**$124**	**14.1**	
Grand Total		**114,018**	**49,784**	**438,927**	**99,786,361**		**$227**	**125.4**	

[1]Proposed project timeline is TBD. To depict it in the implementation plan, the project was added in 2035.

Renewable Energy Production to Meet Remaining Load, Option A



Renewable Energy: Recommendation

- **Option B:** Renewable energy at installation

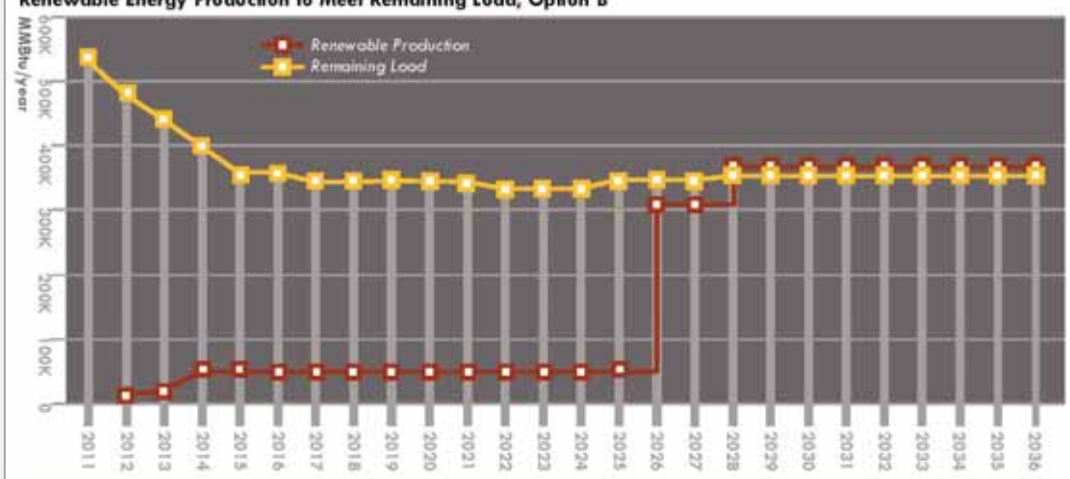
z

Renewable Production to Meet Remaining Load, Option B

Technology	FY	Annual Production Capacity		Offset in Energy, Equivalent MMBtu/Year	Capital Cost, $	LCOE without Incentives, $/kWh	Annual Energy Produced, $ per MMBtu/Year	% of NZEI Goal (New Cumberland)	Payback Years
		MWh/ Year	MMBtu/ Year						
Proposed Projects – Tracy Site, Defense Distribution Depot San Joaquin									
Biomass (Wood) Power Plant (10 MW)	TBD (2026)	74,913	N/A	255,678	77,241,000	$0.13-$0.15	302	73.1	75.0
Solar Photovoltaic – Utility Scale (26 MW)	TBD (2028)	47,830	N/A	163,242	135,200,000	$0.16-$0.25	828		56.0
New Cumberland Portion				61,750				17.8	
Total		**124,943**			**220,595,361**			**90.9**	

Notes: 1. Proposed projects timeline is TBD. To depict them in the implementation plan, these projects were added in 2026 and 2028. 2. The biomass plant and solar PV project shown at Tracy would accommodate required renewable energy production at both San Joaquin and New Cumberland. A portion of the solar PV project production (61,750 MMBtu) is needed for the requirement at New Cumberland. 3. The total offset in energy for New Cumberland is 317,428 MMBtu/year.

Renewable Energy Production to Meet Remaining Load, Option B



Renewable Energy: Recommendation Example

- **Option A, more favorable and is recommended**
- Recognize that the implementation date is several years into the future and verification of remaining load and feasible technologies will continue

Decision Matrix, Options A and B

Criteria	Option A Values/ Remarks	Option B Values/ Remarks	Option A Rating	Option B Rating
Architecture/ Technology			+	+
Technical Requirements			+	+
Operational Requirements			-	0
Site Location	Fuel from off-site		-	+
Permitting			-	-
Capital	$100M	$220M	+	-
Life-Cycle Cost/ Levelized Cost of Energy (without incentives)	0.114	0.16-0.25 0.13-0.15	+	-

Net-Zero Energy Plan
Implementation Plan Example

Consolidated Implementation Plan

FY	Energy Control Measures																								
	Energy Reduction					Fleet Management							Microgrid							Renewable Energy					
13	MAB1	MRV1	AW1			MAB1	MRV1	ORG1	PLN2	TRN1	PLN1	AWR1	PRC5	PRC6	PRC7	PRC8	PRC9	PRC10	GRID	MAB1	MRV1				
14	FEDS1	EC1	MRV2	MRV3	MRV4	FLC1	FLA1	PLN1	MRV2	AWR2	FLC2		MRV3	GRID											
15	FEDS1	AWR1	MRV2	MRV3	MRV4	FLC1	FLA1	TRN1	PLN1	AWR1	MRV2		MRV4	TRN2	TRN3	PRC10	GRID								
16	FEDS1	EC1	MRV2	MRV3	MRV4	FLC1	FLE1	PLN1	MRV2	AWR2	FLC2		PRV12	GRID											
17	FEDS1	AWR1	MRV2	MRV3	MRV4	FLC1	FLE1	TRN1	PLN1	AWR1	MRV2														
18	EQST1	EC1	MRV2	MRV3	MRV4	FLC1	FLE2	PLN1	MRV2	AWR2	FLC2														
19	EQST1	AWR1	MRV2	MRV3	MRV4	FLC1	FLE2	TRN1	PLN1	AWR1	MRV2														
20	AEMP1	EC1	MRV2	MRV3	MRV4	FLC1	FLA2	PLN1	MRV2	AWR2	FLC2														
21	AEMP1	AWR1	MRV2	MRV3	MRV4	FLC1	TRN1	PLN1	AWR1	MRV2															
22	AEMP1	EC1	MRV2	MRV3	MRV4	FLC1	PLN1	MRV2	AWR2	FLC2															
23	AEMP1	AWR1	MRV2	MRV3	MRV4	FLC1	TRN1	PLN1	AWR1	MRV2															
24	AEMP1	EC1	MRV2	MRV3	MRV4	PLN1	MRV2	AWR2	FLC2																
25	AEMP1	AWR1	MRV2	MRV3	MRV4	TRN1	PLN1	AWR1	MRV2																
26	EC1	MRV2	MRV3	MRV4		PLN1	MRV2	AWR2	FLC2																
27	AWR1	MRV2	MRV3	MRV4		TRN1	PLN1	AWR1	MRV2																
28	EC1	MRV2	MRV3	MRV4		PLN1	MRV2	AWR2	FLC2																
29	AWR1	MRV2	MRV3	MRV4		TRN1	PLN1	AWR1	MRV2																
30	EC1	MRV2	MRV3	MRV4		PLN1	MRV2	AWR2	FLC2																
31	AWR1	MRV2	MRV3	MRV4		TRN1	PLN1	AWR1	MRV2																
32	EC1	MRV2	MRV3	MRV4		PLN1	MRV2	AWR2	FLC2												MRV5					
33	AWR1	MRV2	MRV3	MRV4		TRN1	PLN1	AWR1	MRV2												PRC1	PRC2	PRC3	PRC4	PRC5	
34	EC1	MRV2	MRV3	MRV4		PLN1	MRV2	AWR2	FLC2												MRV2					
35	AWR1	MRV2	MRV3	MRV4		TRN1	PLN1	AWR1	MRV2												PRC9	MRV2	MRV3	TRN2	TRN3	PRC8
36	EC1	MRV2	MRV3	MRV4		PLN1	MRV2	AWR2	FLC2				MRV2	TRN1	MRV1	ISLAND				MRV4	PRC7	PRC8			
37	AWR1	MRV2	MRV3	MRV4		TRN1	PLN1	AWR1	MRV2				MRV3	ISLAND						PRC7	PRC8				
38	EC1	MRV2	MRV3	MRV4		PLN1	MRV2	AWR2	FLC2				MRV4	TRN2	TRN3	PRC10	ISLAND			PRC7	PRC8				
39	AWR1	MRV2	MRV3	MRV4		TRN1	PLN1	AWR1	MRV2				PRV12	ISLAND						PRC7	PRC8				
40	EC1	MRV2	MRV3	MRV4		PLN1	MRV2	AWR2	FLC2				MRV4	PRC9	PRC10					PRC7	PRC8				

1. Action plan numbers are specific to the particular actions from which they are derived. The same action plan number can appear more than once.

2. Action plan descriptions can be found within each action designated by the table headings.

Managing Client Expectations

- Client involvement early and often in the process
- Planned more frequent IPRs (In Progress Reviews)
- SHAREPOINT site invaluable in disseminating information quickly among the internal team and external client
- Single point of contact on the team and client
- Consulting in a pre-scoping manner with the client reduced potential areas of confusion
- Listening intently and responding to client inquiries quickly created a collaborative atmosphere

Sustainable Energy Management

Case Study: Monroe County, FL Energy Retrofit Project

New Partners for Smart Growth
February 7, 2013

HDR

Agenda

- Sustainable energy management
- Management systems
- Overview of ISO 50001 *Energy Management Systems*
- Case study: Monroe County, FL energy retrofit project
  - Examples of data analysis and monitoring using ISO 50001 methodology

Energy Management Issues

Fixed & uncontrollable overhead

Price Volatility

Not core business/mission

Crisis management

Technology is silver bullet

Short term perspective

Management systems are tools used to address these, and other issues

Sustainable Energy Management – Management System Perspective

Sustainable energy management
is ***<u>not</u>*** a destination…..

it is a ***<u>process</u>***!

Management Systems

Quality – QMS

ISO 9001:2008 ***Quality Management Systems – Requirements***

Environmental – EMS

ISO 14001:2004 ***Environmental Management Systems – Requirements with guidance for use***

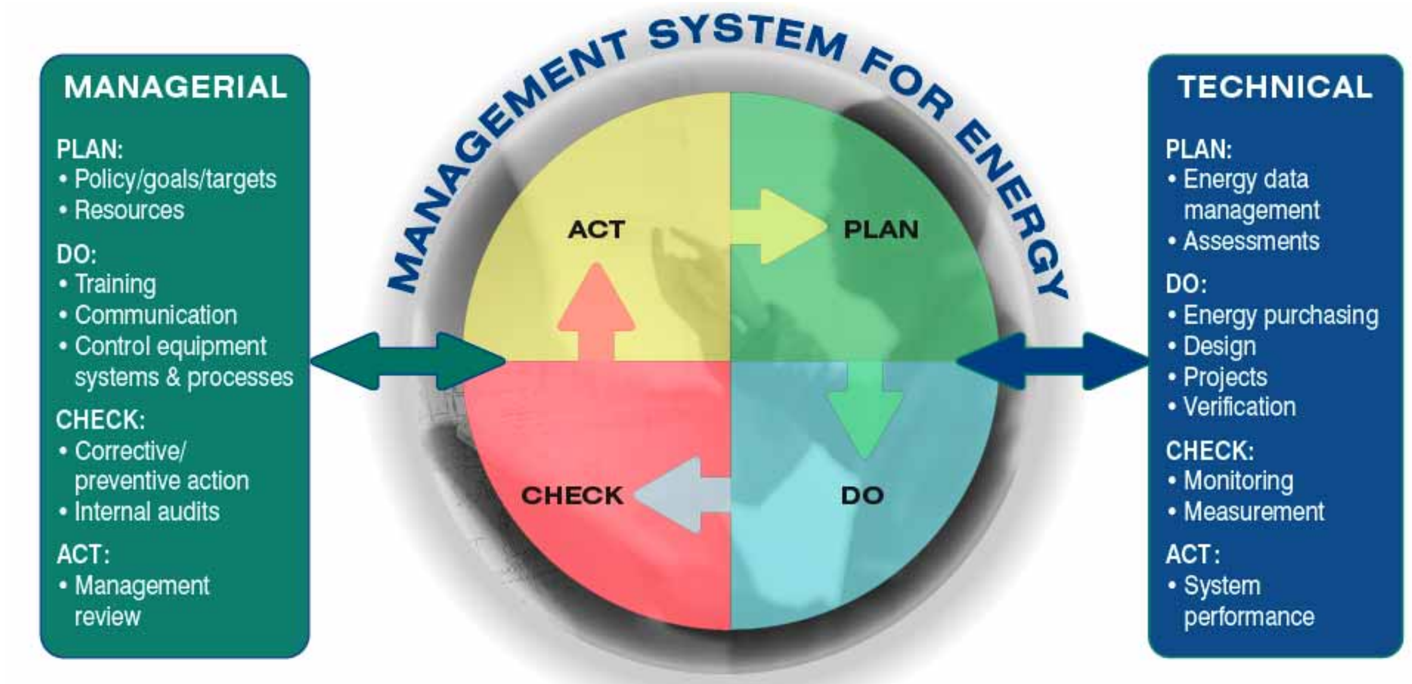
Energy – EnMS

ANSI/MSE 2000:2008 ***Management System for Energy***

ISO 50001:2011 ***Energy Management Systems – Requirements with guidance for use***

Energy Management Systems – ANSI/MSE 2000, ISO 50001, others

A Management System for Energy provides an organized structure to incorporate Managerial and Technical elements to maximize benefits using the PLAN-DO-CHECK-ACT continuous improvement model.



Development of ISO 50001

- ISO appoints project committee PC 242 to develop standard
- The United States and Brazil are the Secretariat of PC 242
- There are 48 participating nations and 17 observing nations
- ISO 50001 published in June 2011
- PC 242 transitioned to a technical committee – TC 242

ANSI
American National Standards Institute

BSI

First international meeting
September 2008 in Washington, DC

ISO 50001 - Definitions

Boundaries **–** physical or site limits and/or organizational limits as defined by the organization

Energy Baseline – quantitative reference providing a basis for comparison of energy performance

Energy Use – manner or kind of application of energy

Energy Consumption – quantity of energy applied

Energy Efficiency – ratio or other quantitative relationship between an output of performance, service, goods or energy, and an input of energy

Energy Performance – measurable results related to energy efficiency, energy use and energy consumption

Energy Performance Indicator (EnPI) – quantitative value or measure of energy performance, as defined by the organization

Key Elements of an Energy Management System (EnMS)

•***Energy policy*** top management's official statement of the organization's commitment to managing energy

•***Cross-divisional management team*** led by a representative who reports directly to management and is responsible for overseeing the implementation of the energy management system

•***Energy review*** to assess current and planned energy use, energy sources and consumption and identify *significant energy uses* and opportunities for improvement

•***Baseline(s)*** of the organization's energy use

•***Energy performance indicators* (EnPIs)** that are unique to the company and are tracked against the baseline to measure progress

Key Elements of an Energy Management System

- ***Energy objectives and targets*** for energy performance improvement at relevant functions, levels, processes or facilities within an organization

- ***Action plans*** to meet those targets and objectives

- ***Operating controls and procedures*** for *significant energy uses*

- ***Measurement, management, and documentation*** for continuous improvement for energy performance

- ***Internal audit of progress*** reported to management based on these measurements.

- ***Management review*** to determine the effectiveness of the EnMS and resulting energy performance improvements

Monroe County, FL - Energy Retrofit Project

- **Jackson Square, Key West**
- **4 buildings with an area of approximately 200,000 sq ft**
- **3 of the buildings are served by a central chilled water plant**
- **5 electric meters**
- **all systems operate 24/7**

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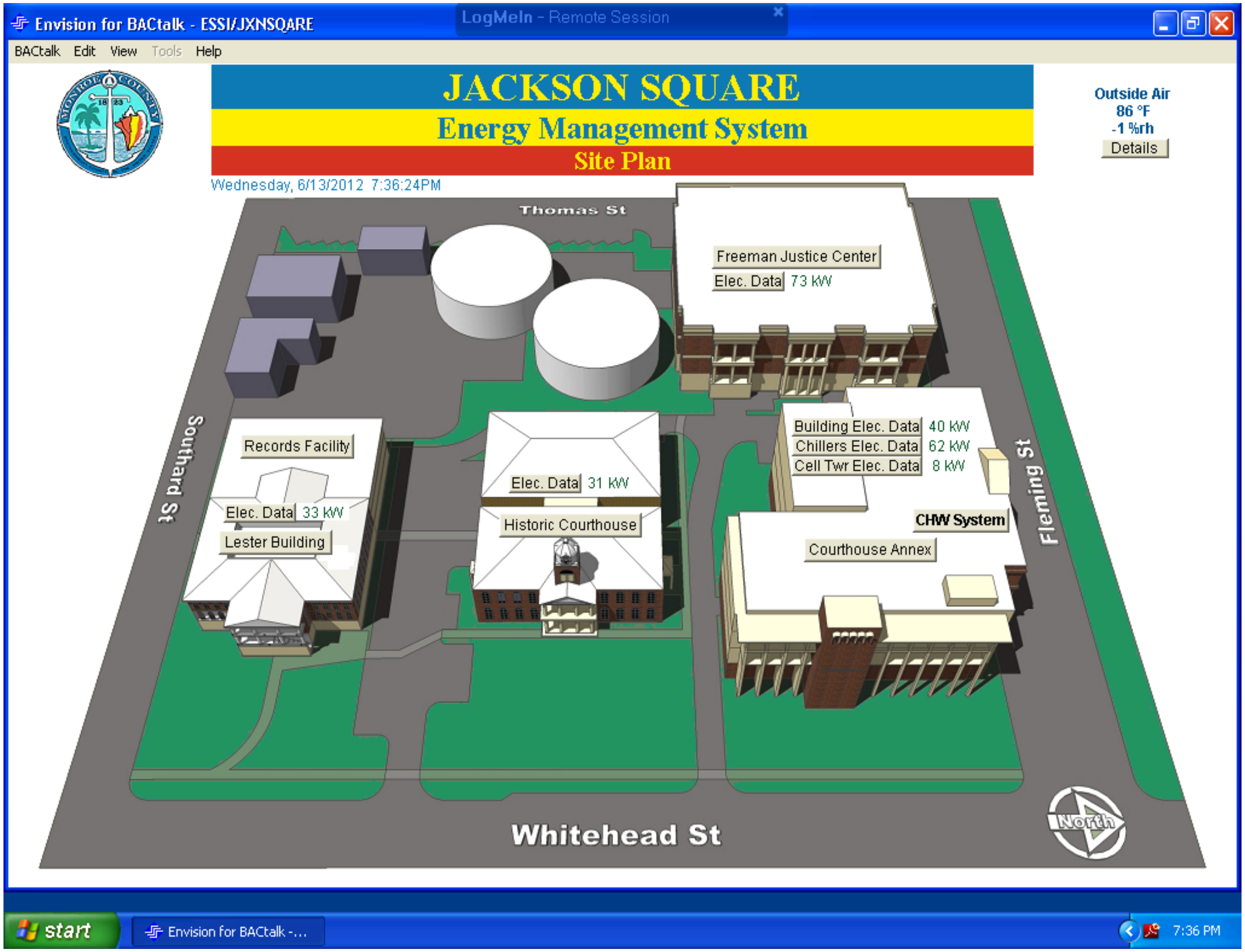
Envision for BACtalk - ESSI/JXNSQARE
LogMeIn - Remote Session
BACtalk Edit View Tools Help
JACKSON SQUARE
Energy Management System
Site Plan
Wednesday, 6/13/2012 7:36:24PM
Outside Air
86 °F
-1 %rh
Details
Thomas St
Freeman Justice Center
Elec. Data 73 kW
Building Elec. Data 40 kW
Chillers Elec. Data 62 kW
Cell Twr Elec. Data 8 kW
CHW System
Courthouse Annex
Records Facility
Elec. Data 33 kW
Lester Building
Elec. Data 31 kW
Historic Courthouse
Southard St
Fleming St
Whitehead St
North
start
Envision for BACtalk -...
7:36 PM

HDR

Energy Sources - electricity

The chilled water plant accounts for 30% of the total consumption

Cooling (the chilled water plant) identified as a *significant energy use*

Building	Average Demand (kW)	Peak Demand (kW)	Energy (kWh)	Cost	Account Number	Meter Number
Chiller Plant	228	328	981,960	$ 131,826	1065003-00	E000069849
Jefferson Annex	78	90	467,680	$ 60,170	1065802-13	E000061561
Freeman Justice Center	145	150	752,760	$ 97,650	1065002-00	E000061558
Lester Building	143	160	653,520	$ 87,015	1065793-02	E000061504
Old Courthouse - Addition	95	108	468,840	$ 61,814	1065797-10	E000061559
Totals for Jackson Square			3,324,760	$ 438,474		

Project Selection Tool – (ECMs identified during audit - bundle ECMs to reach *target*)

Shaded cells are user input

Energy Conservation Measure	Demand Savings (kW)	Energy Savings (kWh)	Electric Cost Savings	CHW Savings (ton-hours)	CHW Cost Savings	Total Cost Savings	ECM Cost	Simple Payback (yr)
Lighting	17.9	140,228	$ 17,473	-	$ -	$ 17,473	$ 66,999	3.8
Chilled water plant	24.0	263,996	$ 32,668	-	$ -	$ 32,668	$ 285,000	8.7
Retro-commissioning-Controls	10.0	211,930	$ 24,885	231,832	$ 10,471	$ 35,356	$ 170,500	4.8
Motors - VFDs	13.0	34,598	$ 4,498	10,958	$ 495	$ 4,992	$ 28,338	5.7
Envelope	-	1,940	$ 220	8,650	$ 391	$ 610	$ 4,600	7.5
TOTALS	***64.9***	***652,692***	***$ 79,743***	***251,440***	***$ 11,357***	***$ 91,100***	***$ 555,437***	6.1

Ref No.	x	Building	Energy Conservation Measure	Description	Demand Savings (kW)	Energy Savings (kWh)	Electric Cost Savings	CHW Savings (ton-hours)	CHW Cost Savings	Total Cost Savings	ECM Cost	Simple Payback (yr)
1	x	Lester Building	Lighting	Lighting Retrofits	3.4	13,908	$ 1,882	-	$ -	$ 1,882	$ 7,873	4.18
2	x	Jefferson Annex	Lighting	Lighting Retrofits	13.0	120,578	$ 14,816	-	$ -	$ 14,816	$ 58,085	3.92
3	x	Freeman Justice Center	Lighting	Lighting Retrofits	1.4	5,741	$ 775	-	$ -	$ 775	$ 1,042	1.34
4		Old Courthouse	Lighting	Lighting Retrofits	-	-	$ -	-	$ -	$ -	$ -	-
5	x	Freeman Justice Center	Motors - VFDs	Prem motors & VFD	10.0	16,538	$ 2,319	10,958	$ 495	$ 2,814	$ 11,500	4.09
6	x	Freeman Justice Center	Retro-commissioning-Controls	Minimum OA schedule	-	1,420	$ 161	86,450	$ 3,905	$ 4,065	$ 7,500	1.84
7	x	Lester Building	Motors - VFDs	Prem motors & VFDs	3.0	18,060	$ 2,178	-	$ -	$ 2,178	$ 16,838	7.73
8	x	Chiller Plant	Chilled water plant	VFD on cooling tower fan	1.0	29,166	$ 3,599	-	$ -	$ 3,599	$ 8,950	2.49
9	x	Chiller Plant	Chilled water plant	VFDs on CHW pumps	2.9	58,332	$ 7,199	-	$ -	$ 7,199	$ 8,950	1.24
10		Chiller Plant	Retro-commissioning-Controls	Other ECM savings	-	-	$ -	-	$ -	$ -	$ -	-
11		Chiller Plant	Chilled water plant	Replace both chillers	-	-	$ -	-	$ -	$ -	$ -	-
12	x	Courthouse Annex	Retro-commissioning-Controls	Schedule AHU-1	-	13,286	$ 1,504	57,312	$ 2,589	$ 4,093	$ 1,000	0.24
13	x	Lester Building	Retro-commissioning-Controls	Demand controlled vent	-	36,450	$ 4,126	-	$ -	$ 4,126	$ 8,000	1.94
14	x	Lester Building	Retro-commissioning-Controls	Setback (6 hours)	-	63,370	$ 7,173	-	$ -	$ 7,173	$ 7,000	0.98
15	x	Jefferson Annex	Retro-commissioning-Controls	Setback (6 hours)	-	17,530	$ 1,984	26,220	$ 1,184	$ 3,169	$ 10,000	3.16
16	x	Old Courthouse	Retro-commissioning-Controls	Setback (6 hours)	-	17,530	$ 1,984	21,850	$ 987	$ 2,971	$ 10,000	3.37
17	x	Old Courthouse	Retro-commissioning-Controls	Recommission water pumps	-	8,333	$ 943	-	$ -	$ 943	$ 2,000	2.12
18	x	Freeman Justice Center	Retro-commissioning-Controls	Setback (6 hours)	-	19,011	$ 2,152	-	$ -	$ 2,152	$ 10,000	4.65
19	x	Freeman Justice Center	Envelope	Window film on west side	-	1,940	$ 220	8,650	$ 391	$ 610	$ 4,600	7.54
20		Jackson Square	Retro-commissioning-Controls	Additional controls-dashboard	-	-	$ -	-	$ -	$ -	$ -	-
21	x	Chiller Plant	Chilled water plant	Replace one chiller	20.2	176,497	$ 21,871	-	$ -	$ 21,871	$ 267,100	12.21
22	x	Lester Building	Retro-commissioning-Controls	Additional controls-dashboard	4.5	14,000	$ 1,987	-	$ -	$ 1,987	$ 46,000	23.15
23	x	Freeman Justice Center	Retro-commissioning-Controls	Additional controls-dashboard	4.5	8,750	$ 1,393	16,000	$ 723	$ 2,115	$ 23,000	10.87
24	x	Old Courthouse	Retro-commissioning-Controls	Additional controls-dashboard	-	3,500	$ 396	8,000	$ 361	$ 758	$ 17,250	22.77
25	x	Jefferson Annex	Retro-commissioning-Controls	Additional controls	1.0	8,750	$ 1,080	16,000	$ 723	$ 1,803	$ 28,750	15.95

Life Cycle Cost Analysis – NIST Handbook 135

Also calculates the greenhouse gas emissions reduction resulting from energy savings

Location: Jackson Square - Key West, FL

ECMs: Lighting retrofits - chilled water plant retrofits - retro-commissioning motors and VFDs - envelope modifications

Bldgs: Lester Building - Jefferson Annex - Freeman Justice Center - Old Courthouse - Chiller Plant

INVESTMENT COSTS

Construction:	$ 555,437	
Supervision:	$ -	0.0%
Design - Contingency:	$ -	
Salvage		
Total Investment:	**$ 555,437**	

Economic Parameters

Base Year:	2,011
Discount Rate:	3.0%
Region:	3
Project Life:	15

ENERGY SAVINGS (COSTS)

	Units	Average Cost per Unit	Annual Reduction	Annual Energy Savings (MMBtu)	Annual Cost Savings	Discount Factor	Life-Cycle Discounted Savings
Electricity	kWh	$ 0.1210	753,016	2,570	$ 91,100	11.610	$ 1,057,668
Gas	ccf	$ -	-	-	$ -	-	$ -
Fuel Oil	gallon	$ -	-	-	$ -	-	$ -
				2,570	$ 91,100		$ 1,057,668

ECONOMIC METRICS

Total Investment:	$ 555,437	*Total Investment:*	$ 555,437
Annual Energy Savings:	$ 91,100	Discounted Energy Savings:	$ 1,057,668
Annual Non-Energy Savings:		Discounted Non-Energy Savings:	$ -
Total Annual Savings:	$ 91,100	*Total Discounted Savings:*	$ 1,057,668
Simple Payback (years):	***6.10***	***Savings To Investment Ratio:***	***1.90***
Total Site Annual Energy Savings (MMBtu):	2570	*Adjusted Internal Rate of Return*	
Energy Savings to Investment:	***4.63*** ***MMBtu/($1,000)***	**AIRR:**	**7.5%**

Baseline Greenhouse Gas Emissions

Energy Type	Unit	Quantity	Energy (MMbtu)	MT CO2	kg CH4	kg N2O	MT CO2e
Electricity	kWh	753,016	2,570	450	16	6	453
Natural Gas	ccf	-	-	-	-	-	-
Fuel Oil #2	US gall.	-	-	-	-	-	-
Propane	US gall.	-	-	-	-	-	-
	Totals		2,570	450	16	6	453

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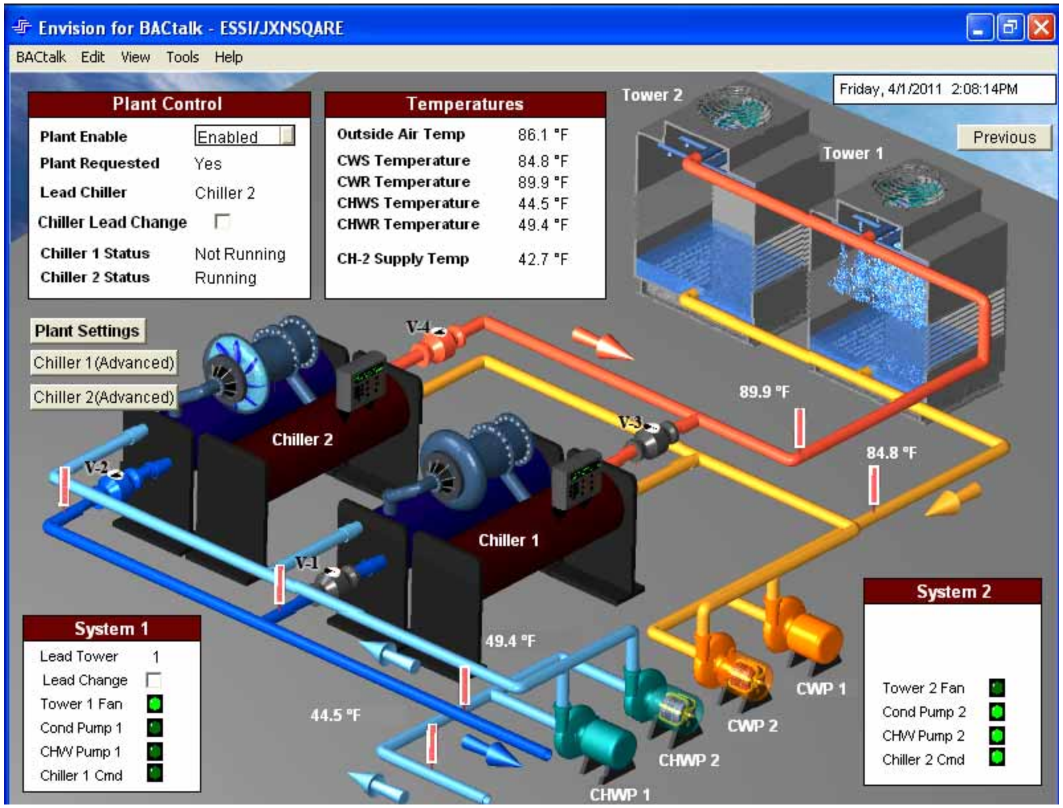
Example ECM – Central Chiller Plant

During an interview with the Director of Public Works, he expressed his primary concern was the sustainability of the chilled water system during a power outage.



Existing Situation

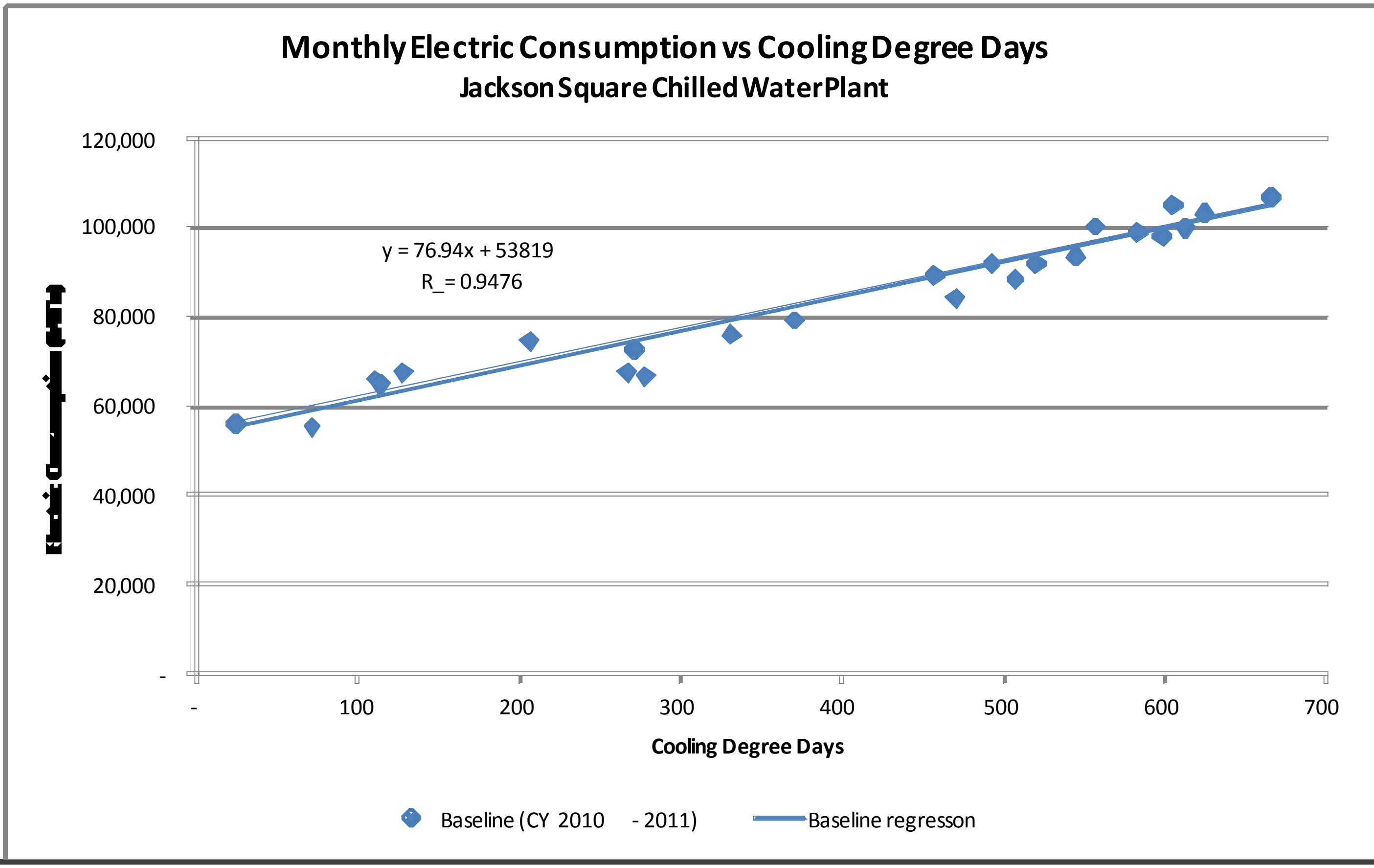
- 24/7 operation
- Serves key buildings
- Reliability critical
- Constant speed chillers, pumps, tower fans
- *Emergency generator not able to start system*

Measurement & Verification – Monitoring Performance

Energy Baseline is a linear regression model with independent variables:

CDD – Cooling Degree Days

NOD – Number of Days in billing cycle



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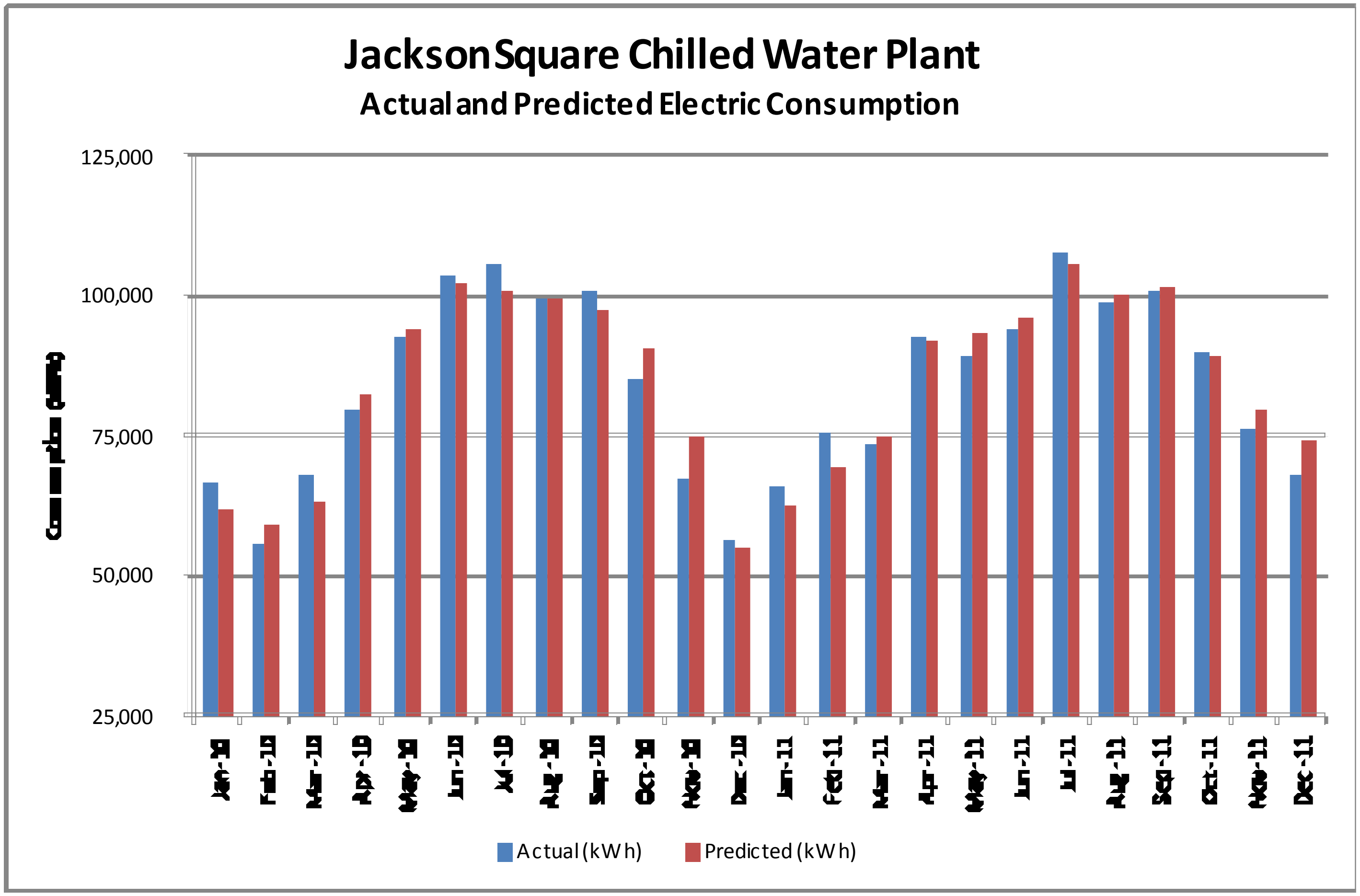
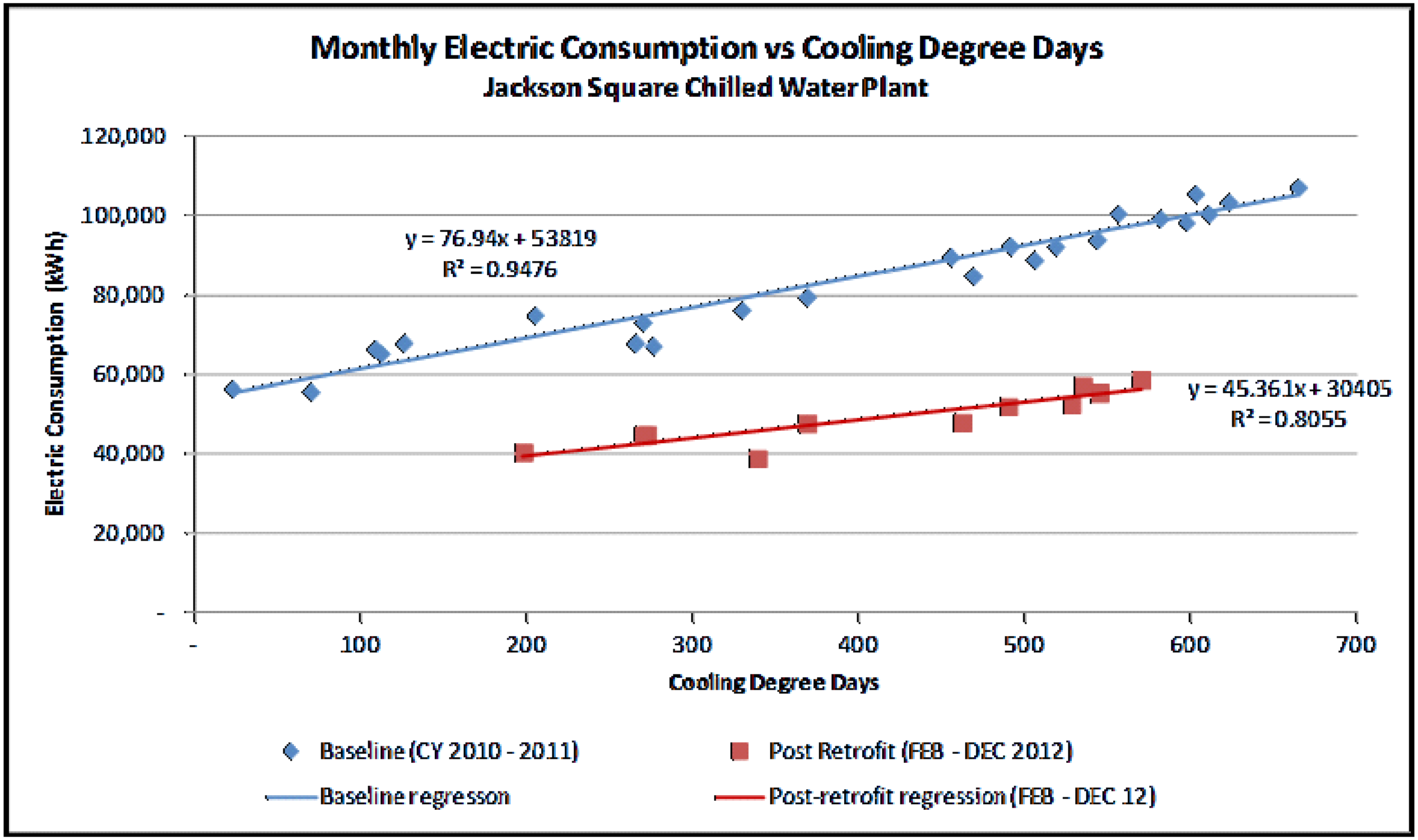
Measurement & Verification – Baseline Period

Trend plot of Actual and Predicted energy consumption



Measurement & Verification – Option C, Whole Building

Post retrofit performance



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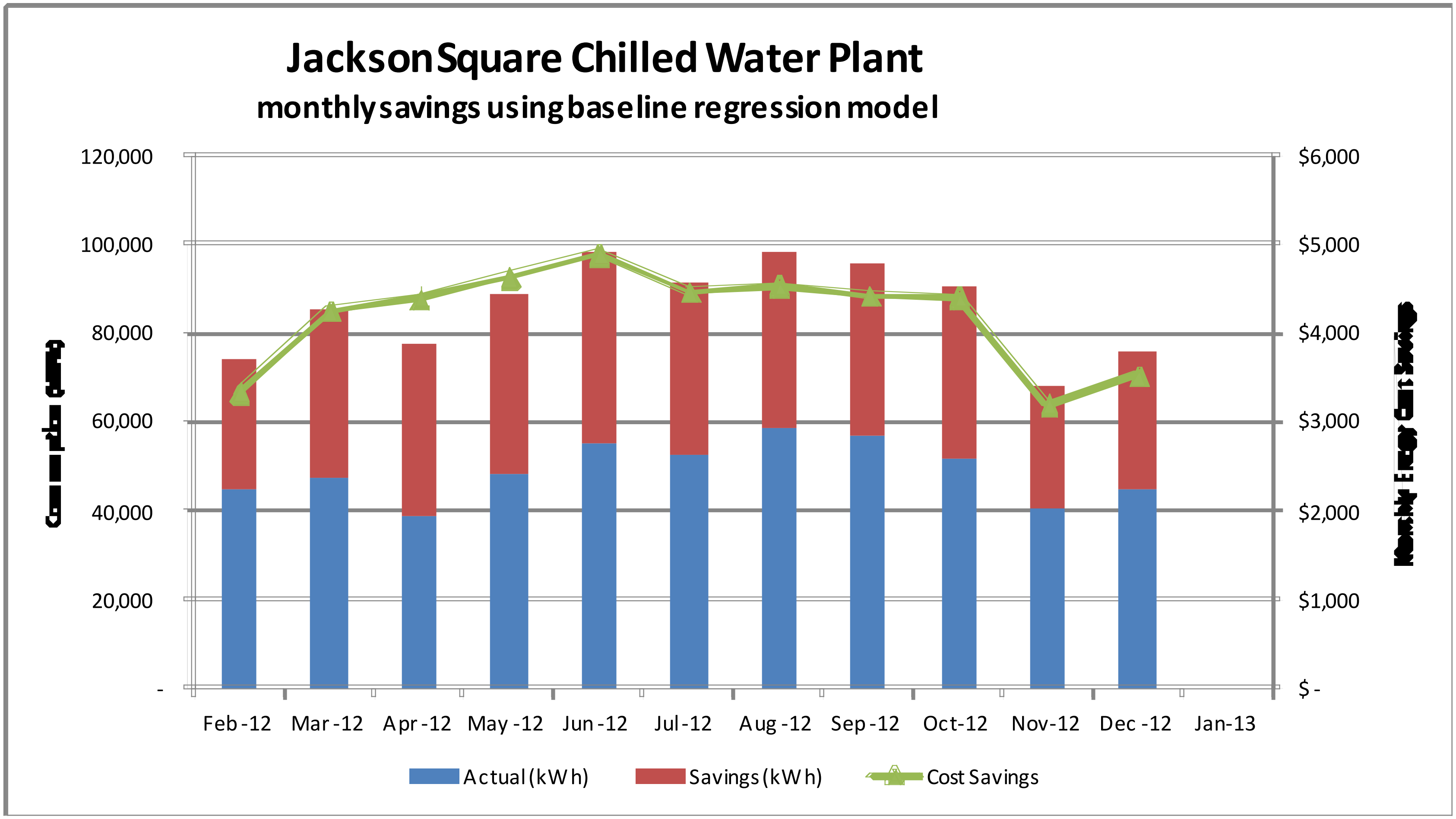
Baseline Model Used to Calculate Savings from Project

Jackson Square Energy Project Savings at CHW Plant

Month	NOD	CDD	Predicted *Baseline* (kWh)	Actual (kWh)	Savings (kWh)	Cost Savings	Percent Savings
Feb-12	30	272	74,197	45,000	29,210	$ 3,337	39%
Mar-12	32	369	85,110	47,880	37,244	$ 4,255	44%
Apr-12	29	339	77,488	39,000	38,501	$ 4,399	50%
May-12	30	462	88,620	48,120	40,512	$ 4,629	46%
Jun-12	32	545	98,465	55,680	42,798	$ 4,890	43%
Jul-12	29	528	91,822	52,680	39,142	$ 4,472	43%
Aug-12	31	570	98,578	58,920	39,658	$ 4,531	40%
Sep-12	31	535	95,921	57,240	38,681	$ 4,419	40%
Oct-12	30	490	90,721	52,200	38,521	$ 4,401	42%
Nov-12	30	198	68,552	40,560	27,992	$ 3,198	41%
Dec-12	31	270	75,802	44,880	30,922	$ 3,533	41%
Jan-13							
To Date	***335***	***4,579***	***945,277***	***542,160***	***403,181***	***$ 46,064***	***43%***

Baseline Regression Mode – Determining Energy Savings



Post-Retrofit Regression to Monitor System Performance –

Introduce Energy Performance Indicator (EnPI)

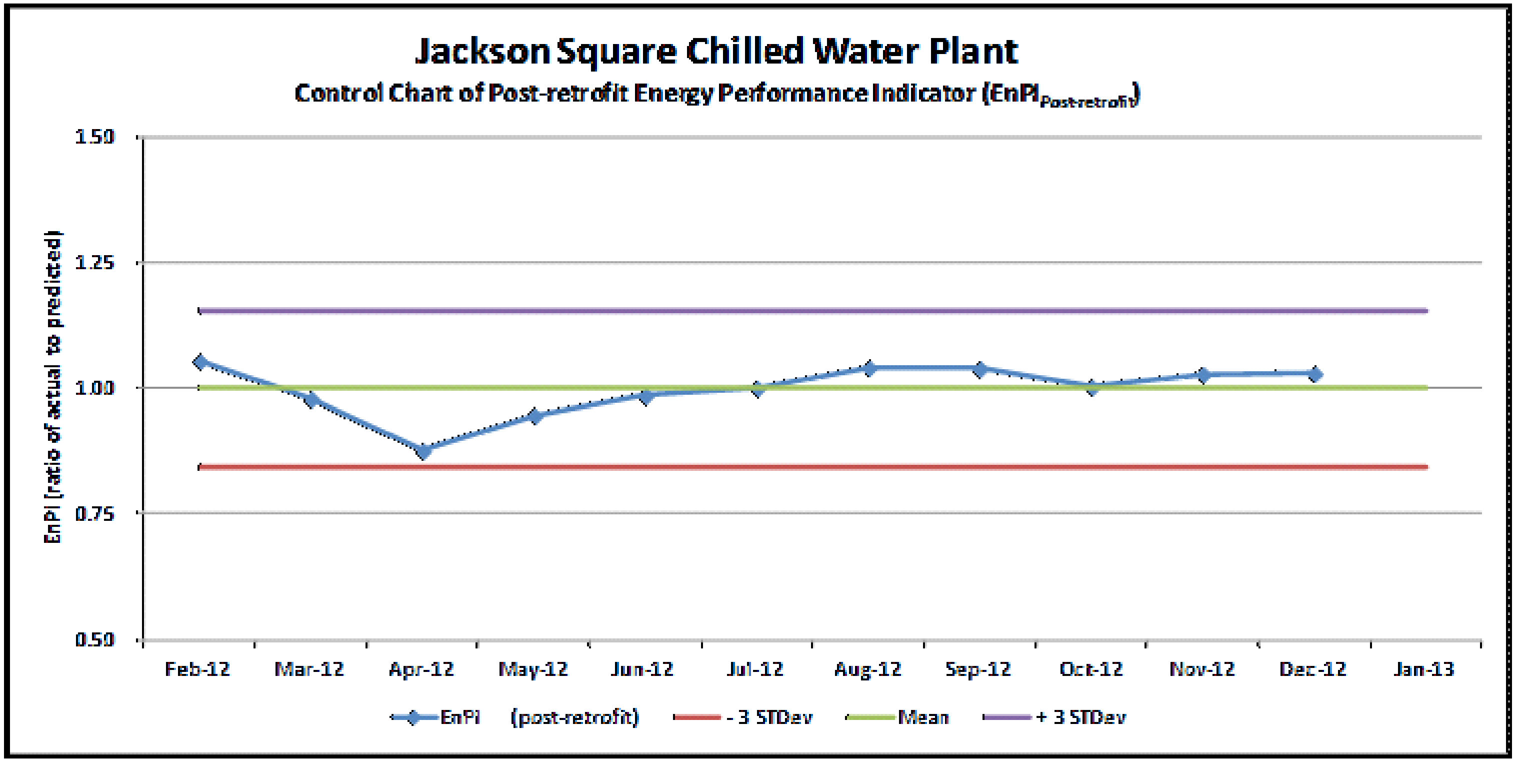
EnPI = (Actual/Predicted) consumption

Jackson Square CHW Plant Post-Retrofit EnPI

Month	NOD	CDD	Predicted *Post-retofit* (kWh)	Actual (kWh)	EnPI *(post-retrofit)*
Feb-12	30	272	42,625	45,000	1.06
Mar-12	32	369	48,863	47,880	0.98
Apr-12	29	339	44,485	39,000	0.88
May-12	30	462	50,834	48,120	0.95
Jun-12	32	545	56,463	55,680	0.99
Jul-12	29	528	52,642	52,680	1.00
Aug-12	31	570	56,514	58,920	1.04
Sep-12	31	535	55,002	57,240	1.04
Oct-12	30	490	52,029	52,200	1.00
Nov-12	30	198	39,413	40,560	1.03
Dec-12	31	270	43,552	44,880	1.03
Jan-13					
To Date	***335***	***4,579***	***542,423***	***542,160***	***1.00***

HDR

Monitor Performance with EnPI Control Chart



HDR

Summary

- **Sustainable Energy Management is a continual process**

- **Management Systems provide a framework using the Plan-Do-Check-Act process**

- **Quantitative tools provide a means to ensure continued *energy performance***

New Partners for Smart Growth

- VAM technique mentioned here has a tremendous application in the planning world.
- DoD has a growing, holistic and responsive program to make installations more sustainable in response to federal mandates.
- Each of the services have specific targets/percentages for the desired number of net-zero energy installations.

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- As sustainability and energy planning is installation- and location- specific, neighboring communities can reap a tremendous benefit from obtaining information on those developing technologies used on the installation, without having to go through necessarily all the levels of analysis.
- As the budgets of DoD installations will be shrinking in the immediate future, the installations will be looking for private-public partnerships and ESPCs to defray some of the costs of attaining directives.

New Partners for Smart Growth

- Sustainable energy management is a process applicable to any organization.

Summary

- DoD is relatively ahead of the power curve to sustainability planning and net-zero energy planning
- The techniques and tools used in this presentation are just one company's answer to address sustainability and net-zero energy planning on the installation/building level
- There is a lot of useful sustainability and energy information from the Guard, Reserve and Active force that is already available.

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