Mission Assurance, Renewables and the Smart Grid

Mark Wagner
Vice President Government Relations
Johnson Controls, Inc.

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Agenda

1. The Art of the Possible: 29 Palms ESPC Project

2. A Day in the Life of a Smart Building


- **Renewable Energy:** 8 acre photovoltaic farm – Over 1 MW of power
- **Energy Savings:** Building Management System & lighting upgrades
- **Improved Quality of Life & future MilCon Savings:** New central chillers
- **Energy Security:** Cogeneration plant – 7 megawatt / dual fuel
- **$65M Investment** – No upfront cost to Navy

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Energy Savings Performance Contracts (ESPC)

- A powerful tool for financing energy efficiency projects
- Many energy service companies (ESCOs) available
- Working with you, the selected ESCO designs, constructs, finances and services the project
- Examples of the many technologies available:
  - Lighting improvements
  - Building Automation Systems
  - HVAC Upgrades & Controls
  - Water Efficiency
  - Boilers & Chillers
  - Electric Motors and Drives
  - Cogeneration systems
  - Renewable energy
- Department of Energy & Army Corps of Engineers have IDIQ contracts
Benefits of ESPCs

- No upfront investment by facility owner
- Investment is paid back over time with energy savings
- Energy savings are guaranteed
- Performance of new equipment is guaranteed
- Rigorous Measurement & Verification of savings
- Reduced energy consumption & smaller carbon footprint
- Enhanced indoor environment
- DOE & Army ESPC IDIQ’s to streamline process
- Stimulates local economy and jobs
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ESPC Model: How it Works

Baseline energy costs

Cost for upgrade covered by guaranteed savings

Saved energy costs

Increased energy costs thanks to performance based solutions

Detailed Analysis

Cost

Contract begins

Investment

Timeline

Contract duration

Reduced energy costs

Contract ends

Guaranteed Benefit

Cost

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A Day in the Life of a Smart Building

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8:00 pm
Smart planning for tomorrow

• System accesses tomorrow’s weather forecast

• Real time price forecasts are received from the electric utility

• System schedules night time ice storage generation

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4:00 am
Chiller fault detected

• On-board diagnostics determines a chiller valve has failed

• System calculates costs associated with this fault based on real time price forecasts

• System auto-generates a work order and notifies facility manager by smart phone

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7:00 am
Chiller repaired

• Service technician arrives after being dispatched automatically

• Technician quickly fixes problem knowing the source and the new parts required

• Repair allows system to generate enough ice prior to spike in prices anticipated later in the afternoon
8:00 am
Employees plug in vehicles at work

- Electric or plug-in hybrid vehicles recharge when real time price of electricity is low
- Smart charging supports voltage regulation for the local utility
- Purchase or sale of power to building is automatically factored into payroll system

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9:00 am
Meeting space is ready to go

• The building management system prepares the conference room for a meeting with 15 people

• Occupancy and CO₂ sensors provide an override in the case less or more people attend the meeting
10:00 am
Call for carbon reporting data

- OFEE calls and asks the Sustainability Manager about the base’s carbon management strategies

- Enterprise dashboard provides access to carbon emissions data for the most recent quarter and annual carbon reductions

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11:00 am
Utility power price triggers automatic demand reduction

• The price for electricity from 12pm-2pm exceeds the threshold pre-defined by the base
• The following actions to reduce power demand are taken:
  ▪ reset space temps by 2°F
  ▪ slowly dim lighting 20% in occupant spaces
• Actions and impact reported back to utility
12:00 pm
Power price triggers automated demand reduction for the building

• The building management system also takes action in common areas:
  - dispatch ice storage cooling
  - increase chilled water set point
  - dim lighting in common areas by 20%

• Actions and impact are reported back to utility

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1:00 pm
Higher price triggers more aggressive automated reductions

- Dim lighting by 40%
- Reset space temps by 4°F
- Throttle non-production servers

- Actions and impact are reported back to the utility

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Automated demand reductions leverage IT system integration

- System alerts employees via email or text message to unplug their laptops and run on battery power from 2-4pm

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3:00 pm
Cloud cover causes solar photovoltaic generation to drop

• Building receives a demand limiting signal from utility during the 2pm - 5pm period

• When cloud cover causes solar production to drop, system uses on-site electric storage to meet demand reduction goal

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5:30 pm
Leaving the office

• As employee badges out, the system automatically turns off the lights and puts the computer into stand-by.

• When he arrives to parking deck, his plug-in electric vehicle has been charged just enough for him to get home.

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6:30 pm
End of the workday

• System controls lighting and HVAC to follow the janitorial staff throughout the building

• Video surveillance system counts occupants remaining after hours and adjusts temperature points and lighting

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Section 2841
Unified Energy Monitoring and Utility Control System Specification

Adopt an energy and utility monitoring control system specification for use throughout DOD for the purpose of monitoring and controlling:

A) Utilities and energy use
B) Indoor environments
C) HVAC components
D) Central plant equipment
E) Renewable energy generation systems
F) Lighting
G) Power distribution networks

With the goal of establishing installation-wide energy monitoring and utility control systems.

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Today’s Installations
Lack Installation-wide Energy Monitoring and Utility Control Systems

- Building #1
- Building #2
- Building #3
- Building #4
- Building #5

Building #1
- Many incompatible monitoring and control systems - different models, features, manufacturers, and communication protocols.

Building #2
- Lacks energy efficient control
- Old direct digital controls (DDC) or pneumatic controls (analog)
- Unable to integrate to installation-wide system

Building #3
- Under construction
- Does not comply with upcoming specifications.
- Will become just like buildings #1 and #2.

Building #4
- Newly metered building may lack automated data collection
- Unable to take required control action to reduce energy consumption
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Vision for Tomorrow
Installation-wide Energy Monitoring and Utility Control System

- Remote building connected by wireless transmission
- Provides the ability to monitor and control all energy and utility systems installation-wide from a single location
- Energy Monitoring and Utility Control System
  - Built on a building automation system technology platform
  - Similar system in all metered buildings
  - Direct interface with Smart Grid

Base Operations Control Center
- Logical and physical distribution system
- Network Backbone
- Power Distribution Networks
- Solar PV
- Indoor Environments
- Lighting Systems
- HVAC Components
- Sub-station Transformer
- Meters
- Water
- Gas
- Wind Power
- Smart Grid
- Fence line
- Steam Plant