



Washington Headquarters Services
Defense Facilities Directorate

Federal Facilities Council

Energy Forum

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Overview

§ Pentagon Basics

- Renovation

§ Pentagon Energy Management

- Where We Have Been
- What We are Doing
- Program Goals

§ Commissioning

§ Summary

Pentagon at a Glance

- § Currently classified as the largest low-rise office building in the world
- § National Historic Landmark
- § 6.5 million Sq. Ft
 - 34 acre footprint
- § Annual electric bill of \$6.5 million
- § 150 miles of ductwork
- § 280,000 HVAC control points – over 500,000 by end of Renovation

The Pentagon - A Small City



The Pentagon was completed in 1943 and the first major renovation did not start until 1991.

- 3 Empire State Bldgs.
- 7,748 windows
- 17.5 miles of corridors
- 25,000 personnel
- 1,000,000 calls each day
- Police force
- Metro Train/Bus Hub
- Health Facilities
- Post Office
- Mini-mall
- Heliport

The Need for Renovation



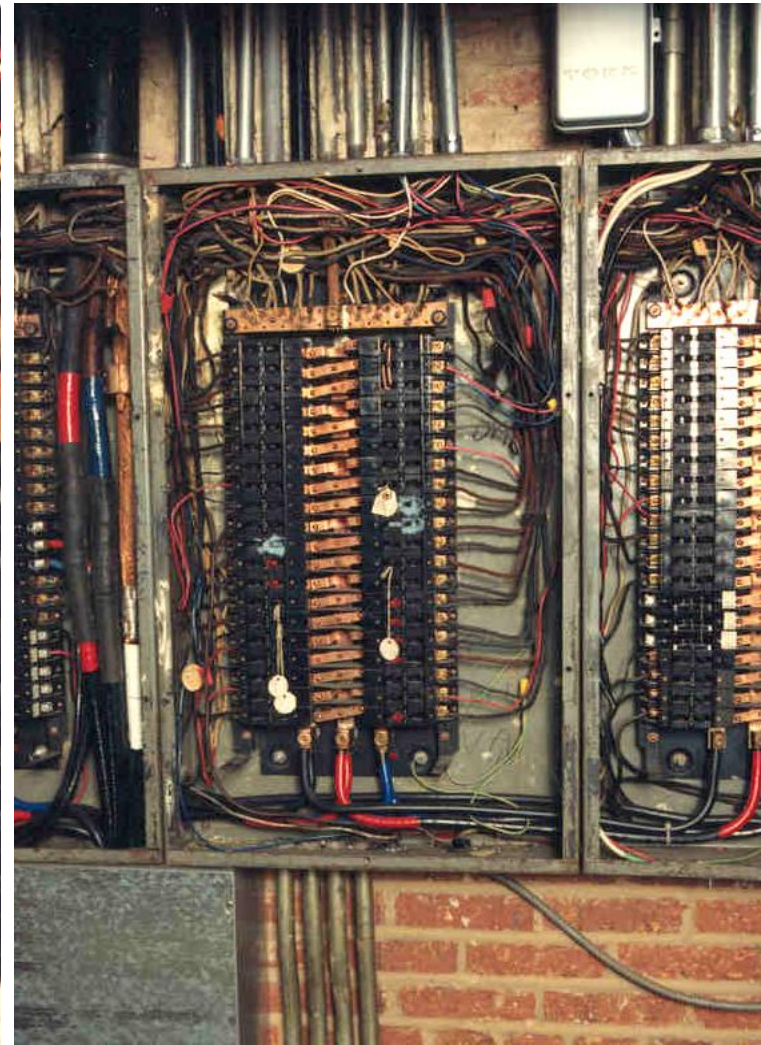
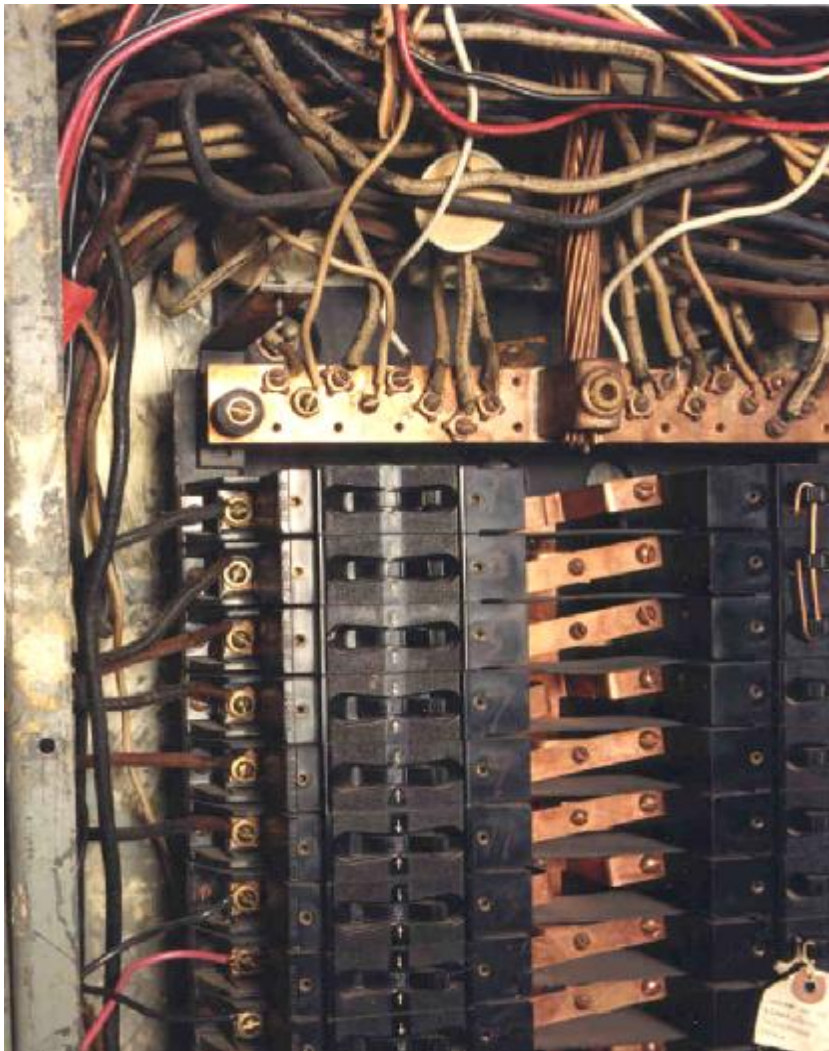
Major building systems beyond repair, non-compliant with modern building codes and ADA, hazardous materials present throughout, poor energy efficiency

All Building Systems Need Replacement: *Plumbing*



Building Code Violations:

Electrical, Fire, Life Safety, ADA and Others



Presence of Hazardous Materials

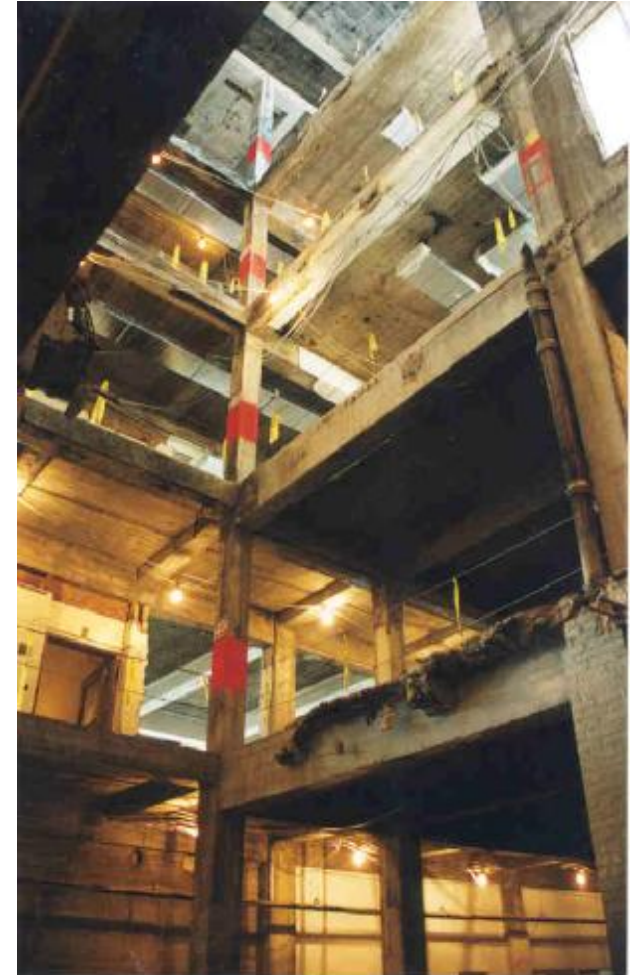
Asbestos, Lead Paint, Mercury, PCBs



THE SOLUTION: *A COMPLETE RENOVATION*

“Ceiling to Slab”

- § Replace all building systems
- § Remove or encapsulate all hazardous materials
- § Improve energy efficiency
- § Bring building up to code compliance
- § Improve vertical mobility, comply w/ ADA
- § Enhance security
- § Improve pedestrian & vehicular traffic flow
- § Preserve/Restore Historical Features





- Replacement of Exterior High Pressure Water Lines

- Monitoring & Control Systems
- Building Operations Command Center

- Fire Sprinklers
- Automatic Fire Doors
- Fire/Life Safety Codes
- ADA Compliance

- Security Improvement

Pentagon Energy Management

Where We Have Been

- **Assessing Performance**
 - **Per EPLRA 2005, Baseline Year Changed From 1985 to 2003**
 - **Allows Greater Accuracy in Baseline Determination**
 - **New Baseline Determined in October 2006**
 - **FY2003 Baseline – 163kBtu/SF per Year**
- **Energy Accounting**
 - **Developed Utility Forecasting Tool**
 - **Accounting Process to Track Costs**
 - **Forecasts Future Costs**
- **Wedge Level Sub-metering in Wedge 2 – 212 Meters**
 - **Detailed Sub-metering**
 - **Chilled Water, Steam, Natural Gas, Electric Energy**

Pentagon Energy Management

What we are doing

- EPA “Energy Star” Products
 - Computers – 70% Less Electricity
 - Monitors – Shut Off After 20 Minutes of no Activity
- Alternative Fuels at Pentagon Fueling Station (1st in US!)
 - Bio Diesel
 - Ethanol – 85 (E-85)
 - Natural Gas
- Mass Transit Subsidies
 - 34,000 Total Participants and \$35.9 Million per Year in Disbursements
 - Includes Approximately 11,000 Pentagon Participants and \$13.3 Million per Year in Disbursements

Pentagon Energy Management

What we are doing (cont.)

- Incorporated Energy Conservation Measures into all contracts
 - § Initiate recycling program that diverts 50% of waste stream from landfills.
 - § Integration of EPP products into all contracts (custodial, O&M, construction)
 - § Integrated Sustainable Design
 - § Energy Budgets
 - § Life cycle cost analysis
 - § Construction Energy Plan
 - § Building Commissioning
- ESPC with Honeywell and Currently Looking at:
 - Install Boilers at FOB2
 - Chiller Improvement – Water Side Economizer



Pentagon Energy Management Program Goals

OBJECTIVE	ACTIONS	TARGET DATE
Data Collection	Develop Energy End-Use Profile for Pentagon Guides Energy Management Team to Identify Best Energy Efficient Opportunities Accountability for Energy Reduction Goals. Verify Savings from Energy Conservation Measures (ECM's)	Aug-07
Cost Allocation for Tenants	Identify High Energy Users Monthly Reports (Creates Awareness)	Oct-07
Operational Analysis	Identify Inefficient Operations Internal Review Control Systems to Optimize Energy Conservation	Mar-08
Building Tune-ups	Implementation of Continuous Commissioning Principles	Mar-08 and Beyond
Data Mining	Detect and Diagnose Energy Degradation Prior to Failure	Mar-08 and Beyond

Continuous Commissioning

- **Develop Performance Monitoring**
- **Indoor environmental parameters, building and systems performance**
- **Establish Operating Procedures - Include Corrective Actions for Troubleshooting**
- **Control Strategies - to Improve Indoor Environmental Quality and Efficiencies**
- **Comprehensive Measurement and Verification Plan**
- **Comprehensive Best Practices and Reliability Centered Maintenance**
- **Cross-Functional Training Program**