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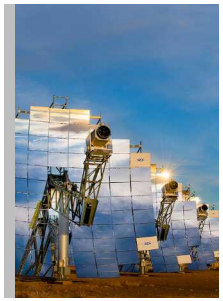

Sandia National Laboratories Energy Management Program Overview

Chris A. Evans

Sandia National Laboratories

Exceptional service in the national interest

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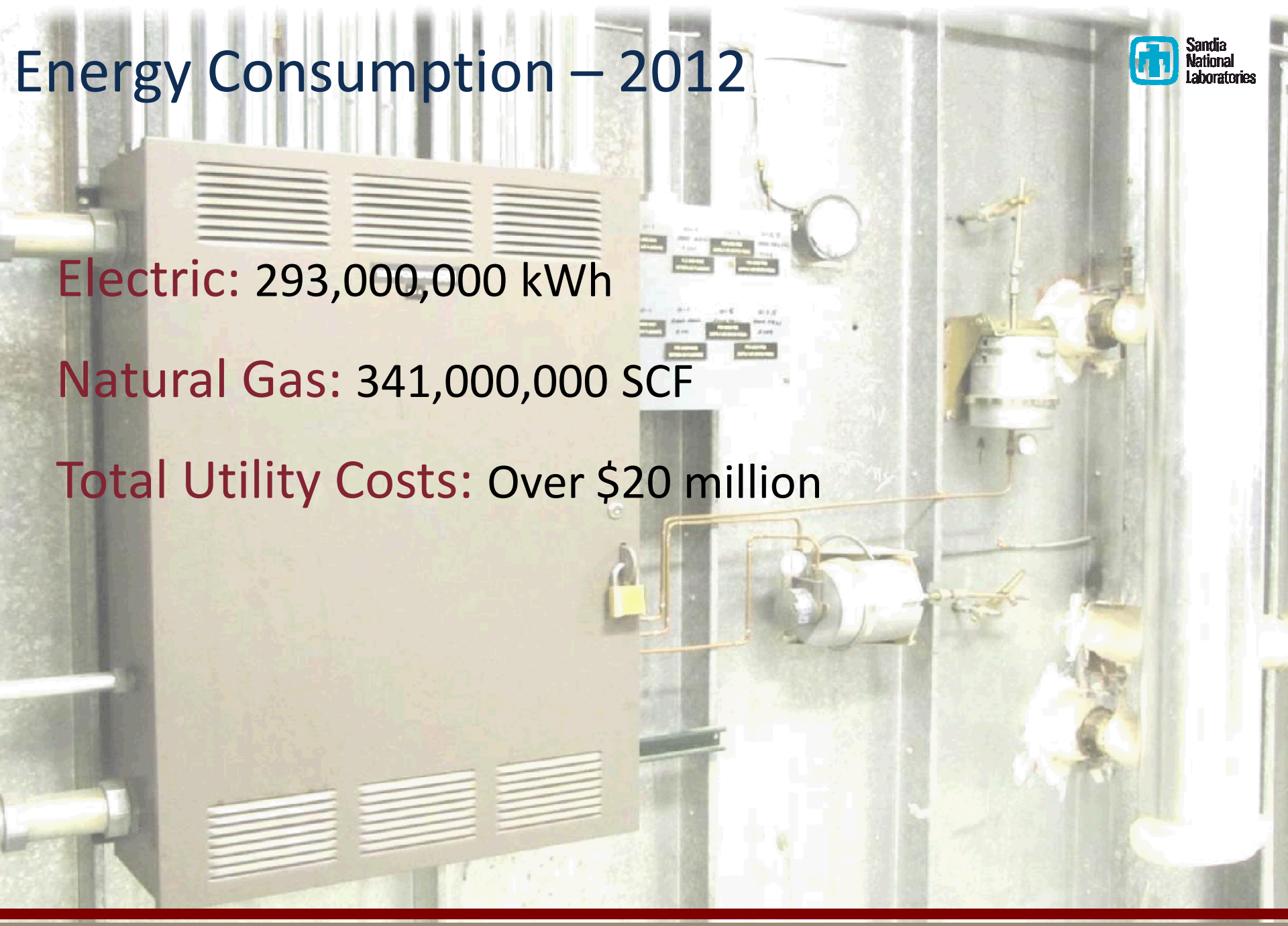
Site Overview

- Locations
  - Kirtland Air Force Base, Albuquerque, NM
  - Livermore, CA
  - Tonopah, NV
  - Kauai, HI
- Workforce: 11,000
- Major buildings: 225
- Space: 7.4 million gross square feet

Energy Consumption – 2012



Electric: 293,000,000 kWh

Natural Gas: 341,000,000 SCF

Total Utility Costs: Over $20 million

Legal and Other Requirements

- **EPAct 2005 – *Energy Policy Act of 2005***
  - Established energy-management goals for federal facilities and fleets
  - Amended portions of the National Energy Conservation Policy Act
- **EISA 2007 – *Energy Independence and Security Act of 2007***
  - Established energy-management goals and requirements
  - Sets federal energy-management requirements in several areas
- **EO 13423 – *Strengthening Federal Environmental, Energy, and Transportation Management***
  - Establishes goals that are more aggressive than EPAct 2005 goals
- **EO 13514 – *Federal Leadership in Environmental, Energy, and Economic Performance***
  - Sets sustainability goals for federal agencies
  - Focuses on improving their environmental, energy, and economic performance

Site Sustainability Plan Goals and Targets

DOE/NNSA Goal SNL Strategic Objective	Targets
Greenhouse Gas Reductions	28% reduction by 2020 (2008 baseline)
Energy Intensity	30% reduction by 2015 (2003 baseline)
Metering	90% of electricity in 2012; 90% natural gas and chilled water by 2015
Renewable Energy	7.5% of site consumption by 2013
Fleet Management	2% annual reduction in petroleum use
High-Performance Sustainable Buildings	15% of buildings (>5,000 SF) by 2015
Water Efficiency	26% reduction by 2020 (2007 baseline)
P2 and Sustainable Acquisition	50% waste diversion by 2015; meet and include green purchasing requirements in contracts
Data Centers Energy Audits New Construction	Meter all data centers and obtain power usage effectiveness of 1.4 by 2015

Energy Strategies

- Reduce current demand; use less.
- Eliminate current demand; turn off or remove.
- Use resources efficiently; use fewer resources for the same task.
- Manage new demand.
- Migrate to noncarbon-emitting energy sources.
- Reduce transportation fossil-fuel use.
- Deliver resources to mission-critical activities reliably and securely.

Sustainable Design

- Provide metering and control systems to track and trend performance.
- Showcase SNL research and development (R&D) activities.
- Promote a sustainable business model.
- Improve partnerships with external resource providers and collaborators.

How are we accomplishing these tasks?

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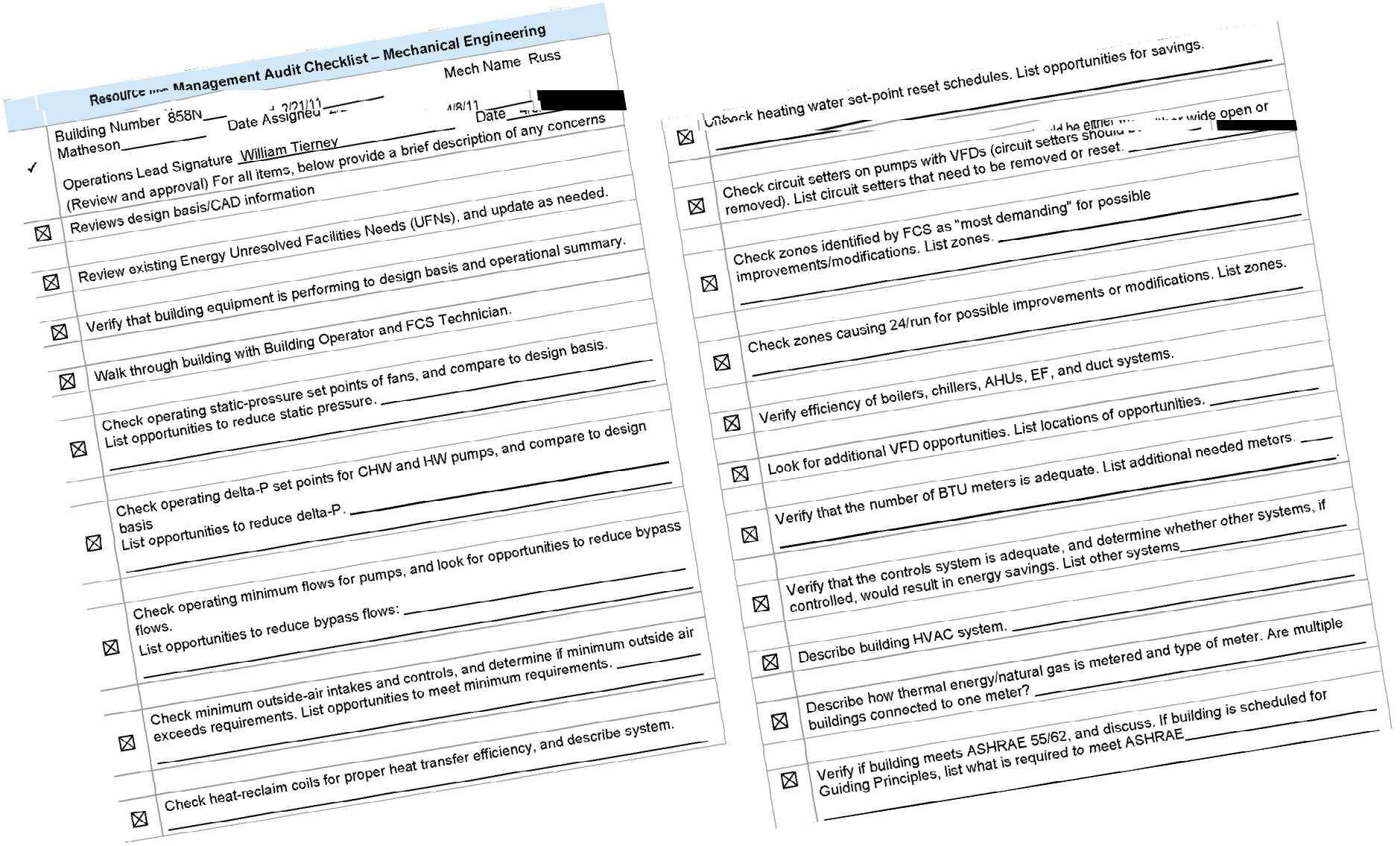
- Auditing and retrocommissioning
- Metering
- Using building automated controls
- Increasing awareness
- Implementing projects

Auditing and Retrocommissioning Strategy

- Perform audits using in-house engineering and maintenance staff.
- Develop in-house checklist.

Auditing is an effective method for identifying energy-conserving measures (ECM), and it also results in reliable facilities.

Energy Audit Checklist



Resource [illegible] Management Audit Checklist – Mechanical Engineering

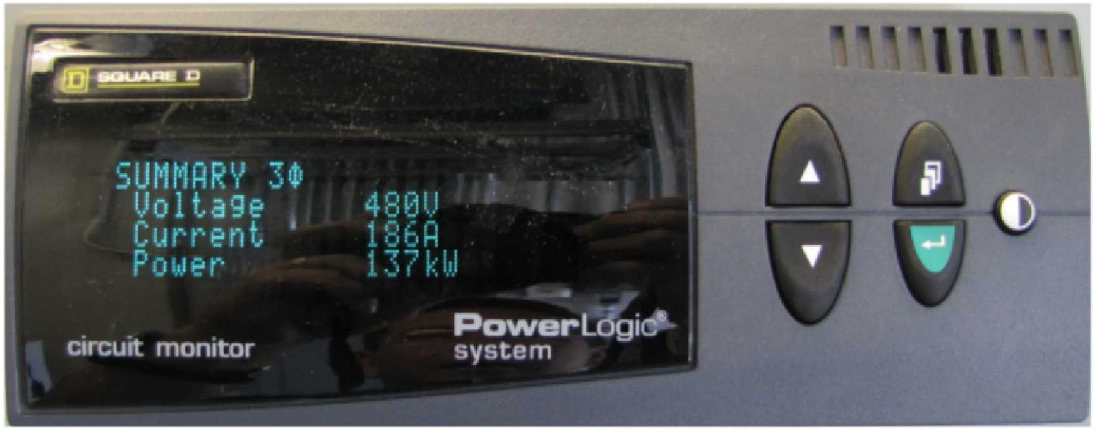
Building Number 858N Date Assigned 3/21/11 Mech Name Russ
Matheson
✓ Operations Lead Signature William Tierney 4/8/11 Date [redacted]
(Review and approval) For all items, below provide a brief description of any concerns

- ☒ Reviews design basis/CAD information
- ☒ Review existing Energy Unresolved Facilities Needs (UFNs), and update as needed.
- ☒ Verify that building equipment is performing to design basis and operational summary.
- ☒ Walk through building with Building Operator and FCS Technician.
- ☒ Check operating static-pressure set points of fans, and compare to design basis. List opportunities to reduce static pressure. _____
- ☒ Check operating delta-P set points for CHW and HW pumps, and compare to design basis. List opportunities to reduce delta-P. _____
- ☒ Check operating minimum flows for pumps, and look for opportunities to reduce bypass flows. List opportunities to reduce bypass flows: _____
- ☒ Check minimum outside-air intakes and controls, and determine if minimum outside air exceeds requirements. List opportunities to meet minimum requirements. _____
- ☒ Check heat-reclaim coils for proper heat transfer efficiency, and describe system. _____
- ☒ Unback heating water set-point reset schedules. List opportunities for savings. _____
- ☒ Check circuit setters on pumps with VFDs (circuit setters should be either wide open or removed). List circuit setters that need to be removed or reset. _____
- ☒ Check zones identified by FCS as "most demanding" for possible improvements/modifications. List zones. _____
- ☒ Check zones causing 24/run for possible improvements or modifications. List zones. _____
- ☒ Verify efficiency of boilers, chillers, AHUs, EF, and duct systems.
- ☒ Look for additional VFD opportunities. List locations of opportunities. _____
- ☒ Verify that the number of BTU meters is adequate. List additional needed meters. _____
- ☒ Verify that the controls system is adequate, and determine whether other systems, if controlled, would result in energy savings. List other systems _____
- ☒ Describe building HVAC system. _____
- ☒ Describe how thermal energy/natural gas is metered and type of meter. Are multiple buildings connected to one meter? _____
- ☒ Verify if building meets ASHRAE 55/62, and discuss. If building is scheduled for Guiding Principles, list what is required to meet ASHRAE _____

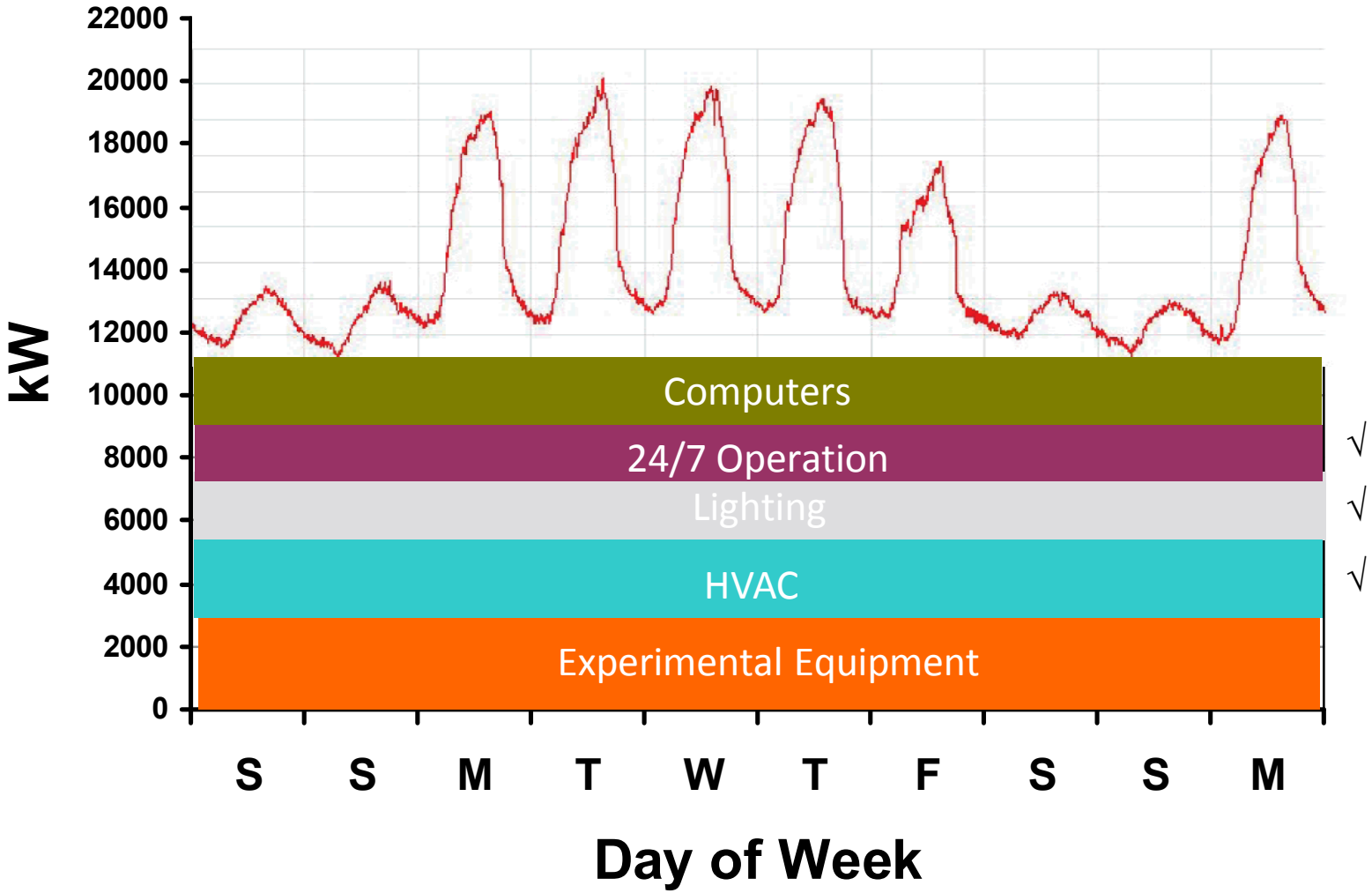
Metering

Meter electricity on 90% of individual facilities

- One manufacturer
- Advanced metering
- Continuous data monitoring
- Required on new construction

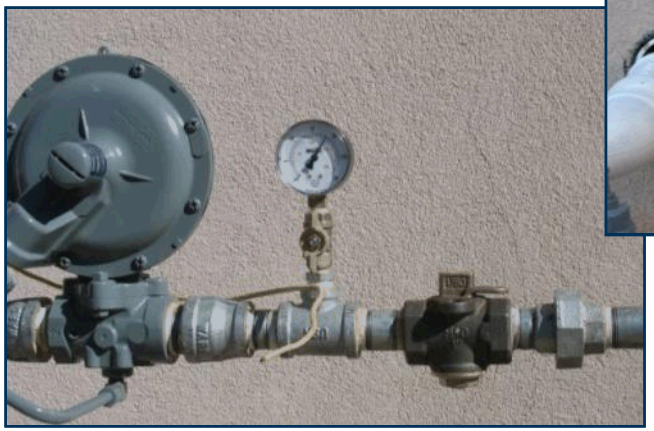


Continually Analyze Data



Energy Metering at SNL/NM

- Natural Gas
  - 97 individually metered buildings
  - 100% of site metered
- Chilled Water
  - 36 individually metered buildings
  - Energy use captured as part of electric use
- Hot Water
  - 45 individually metered buildings
  - Energy use captured as part of natural gas use



Building Automated Control System

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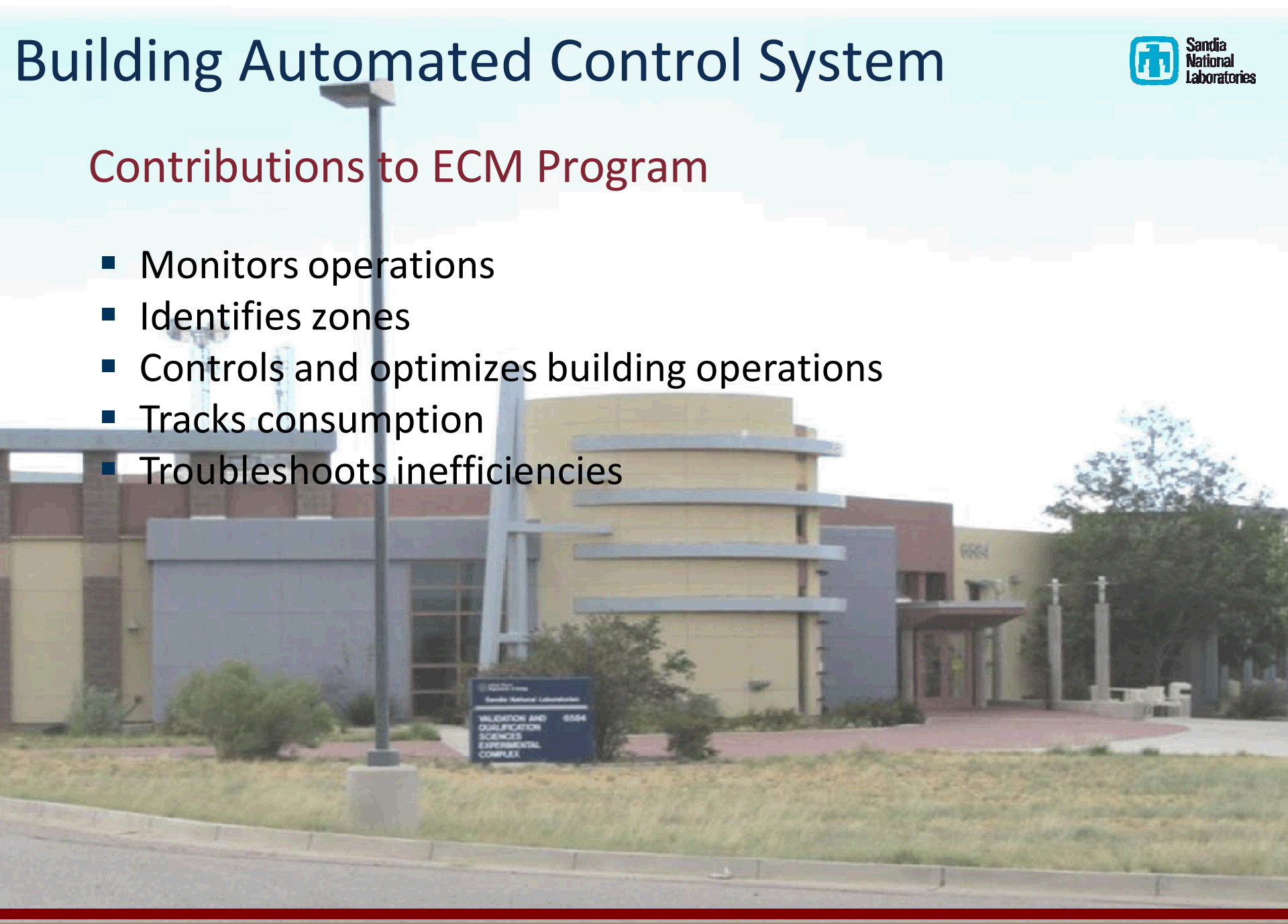
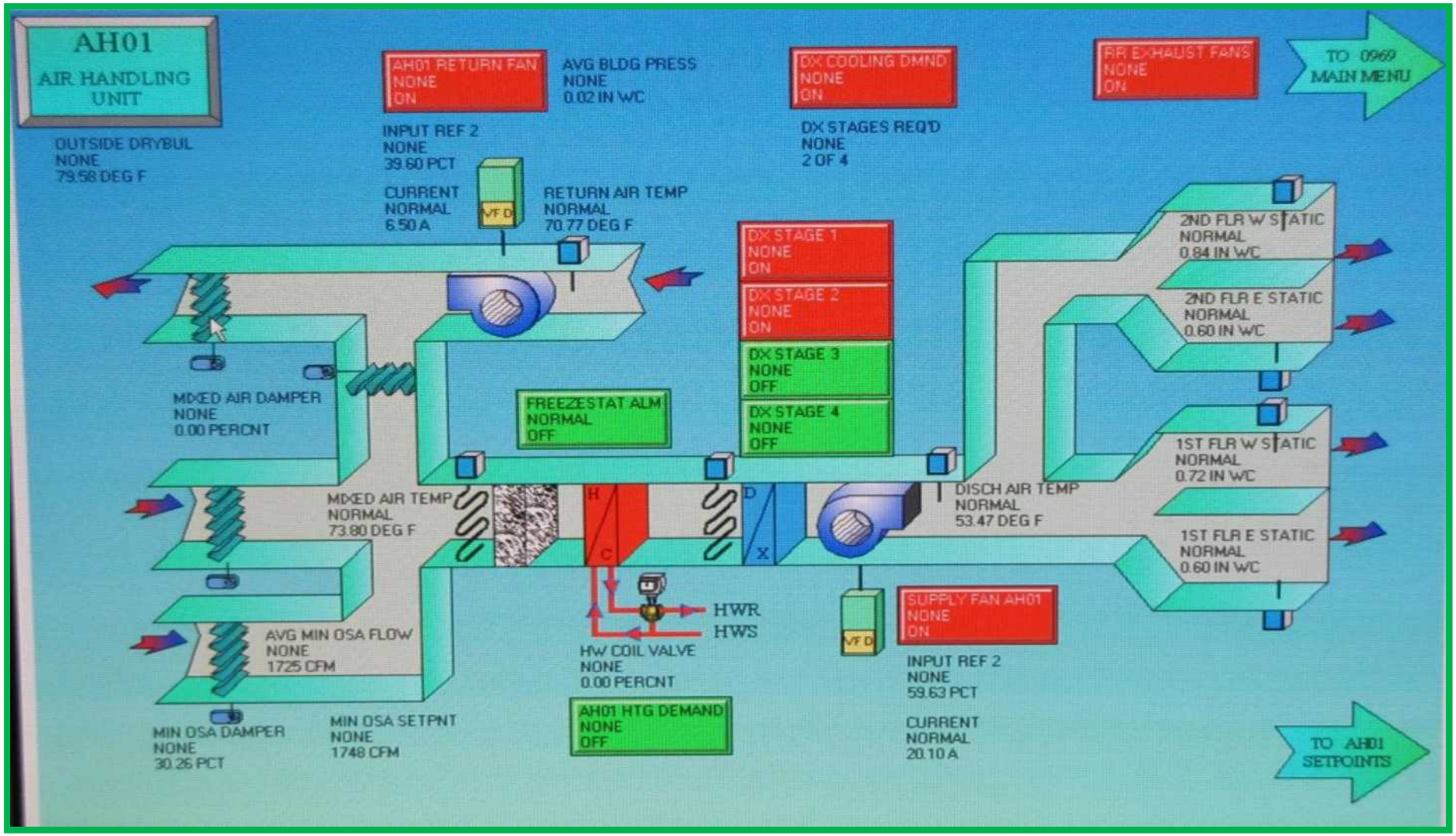
Contributions to ECM Program

- Monitors operations
- Identifies zones
- Controls and optimizes building operations
- Tracks consumption
- Troubleshoots inefficiencies



Operational Control



Building Automated Control System

Communication

Create Change Your Life, Your Nation, Your Planet

Safe Secure Sustainable

Earth Day 2012

New!
Presentations on Request

Building 800

Thunderbird Cafeteria

TA-IV Cafeteria

SNL Energy and Sustainability Website

October 2012
Energy Awareness Month
exhibits held on campus

Heating System Modernization

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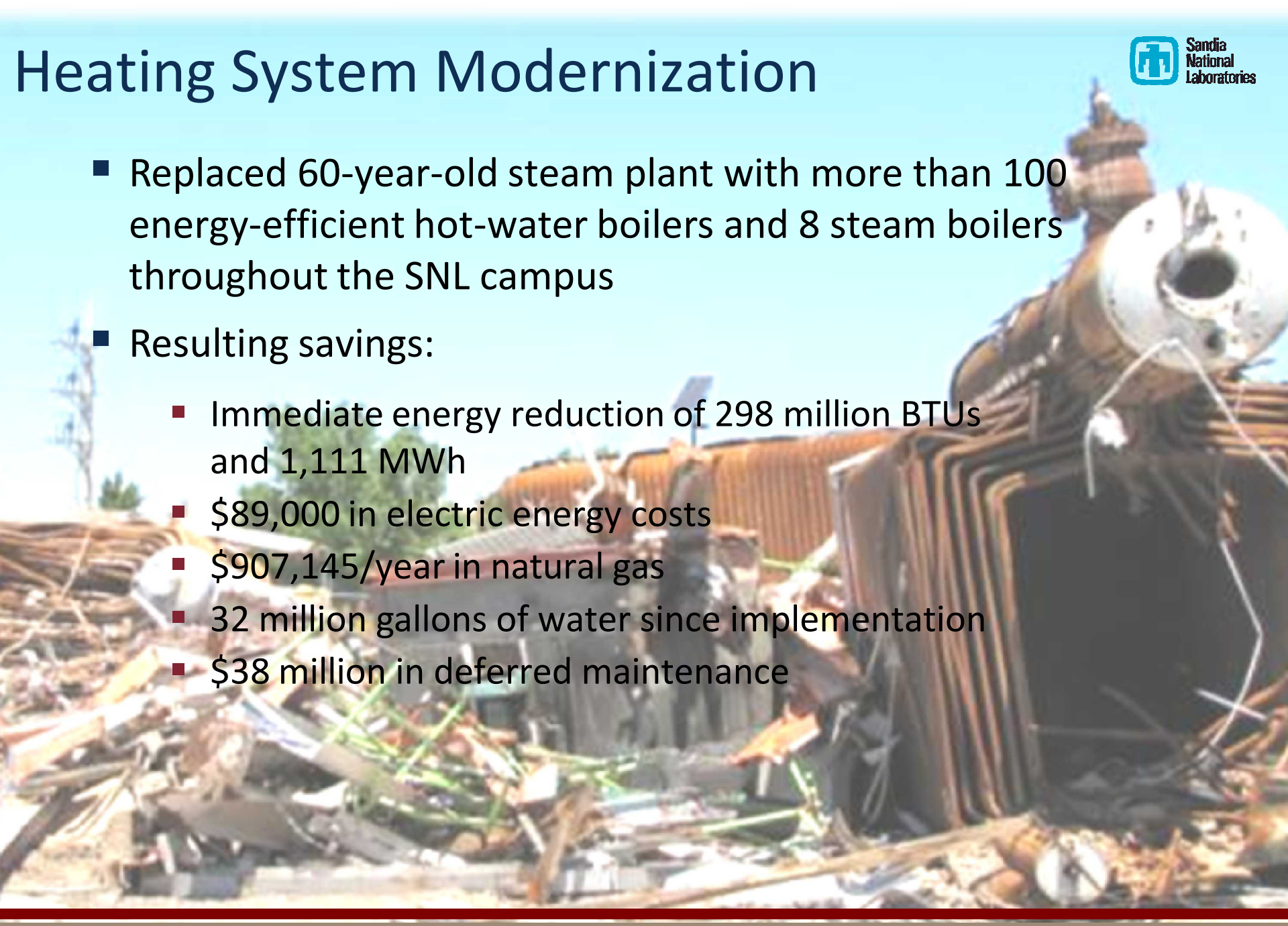
- Replaced 60-year-old steam plant with more than 100 energy-efficient hot-water boilers and 8 steam boilers throughout the SNL campus
- Resulting savings:
  - Immediate energy reduction of 298 million BTUs and 1,111 MWh
  - $89,000 in electric energy costs
  - $907,145/year in natural gas
  - 32 million gallons of water since implementation
  - $38 million in deferred maintenance



Projects: Large-Scale “Free Cooling”

Cooling Tower: The Core of the System

Large-scale free cooling using direct/indirect evaporative cooling techniques.

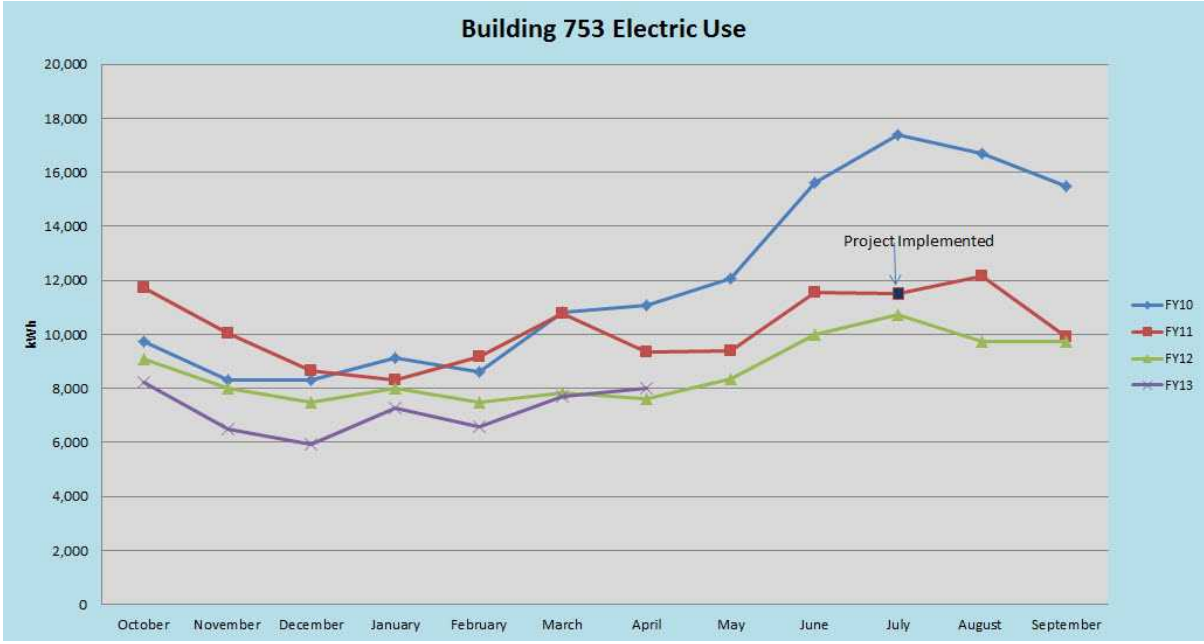
- Offsets a 100 kilowatt (kW) electrical load
- Reduces energy use by 2,280 kWh/day
- Saves roughly $35,000/year in energy costs

The cold-plate heat exchanger uses the cold tower water produced in the winter to cool the chilled water in the building.

Energy data gathered from October 2010 to March 2011 show the energy demand from refrigerant compressors at installed building was *zero*.

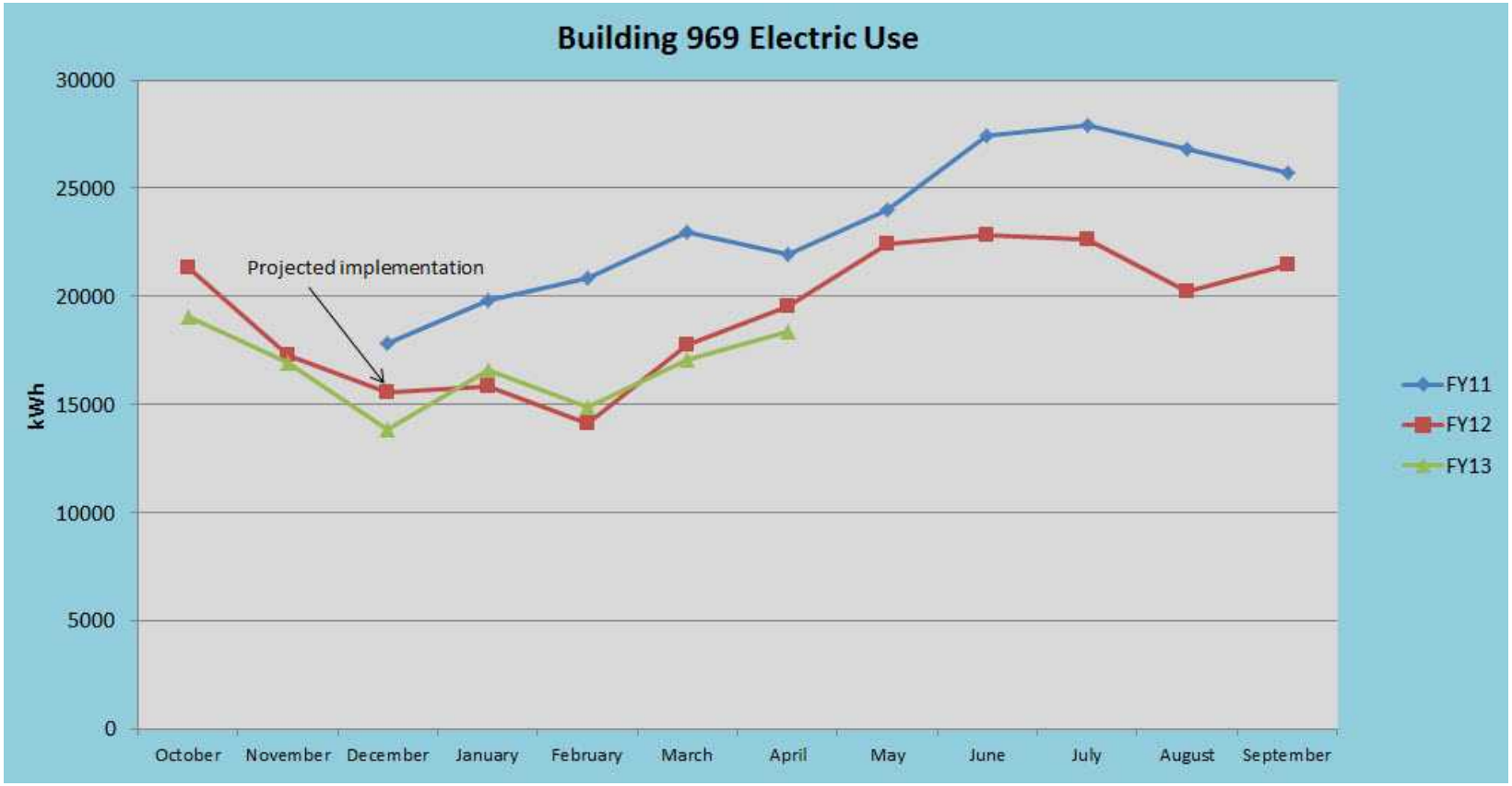
Projects: Occupancy Sensors

Building 753 Project Costs and Payback	
Project Cost	$15,800
Annual Savings	$3,620
Simple Payback	4.36 years

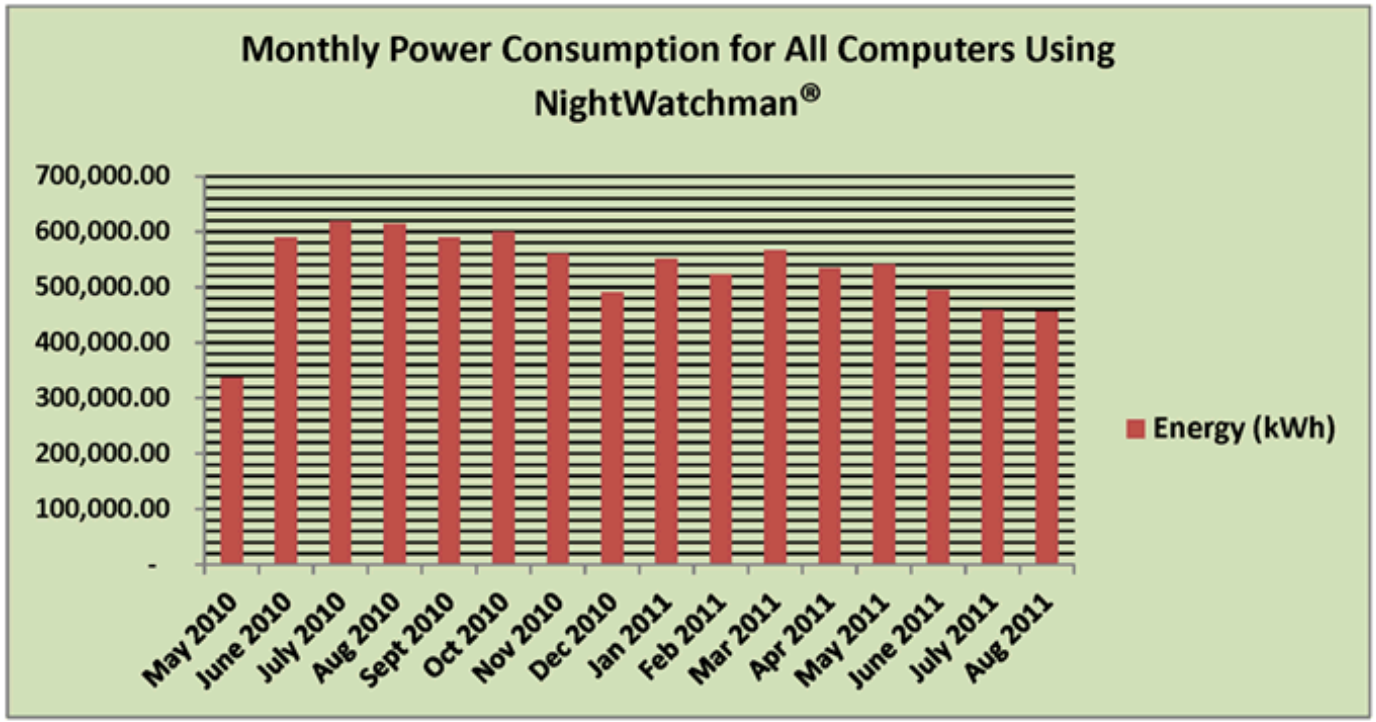


Projects: Building 969 Digital Controls

- Building converted to full digital control



Projects: NightWatchman® Software



	2010	2011	Savings
June	589,233	494,342	94,891
July	618,864	458,577	160,287
August	614,390	456,939	157,451

Projects: Fume Exhaust/Bypass Drives

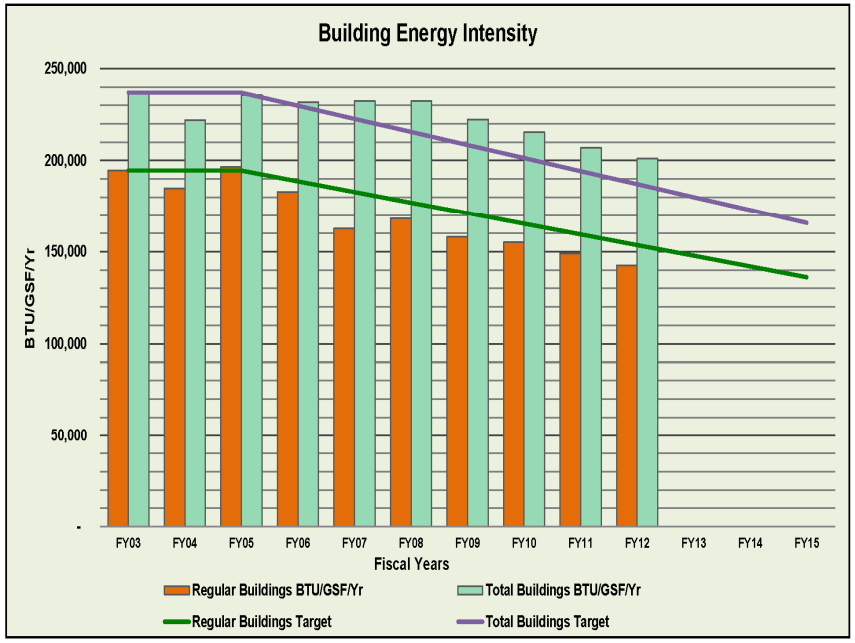
Building 1090 Fume Exhaust System Modification

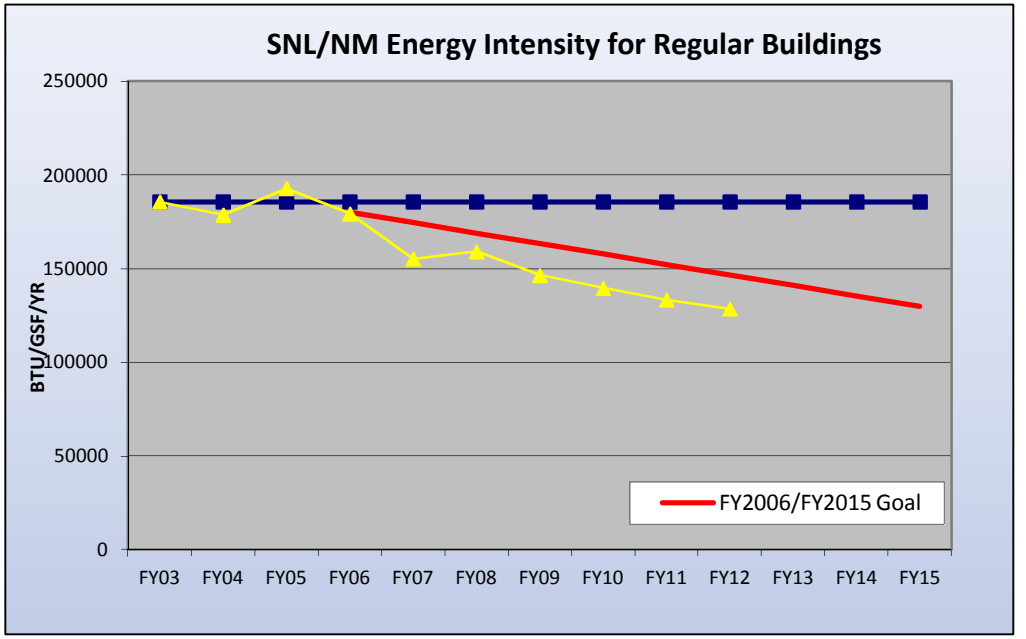
- Originally connected to a constant-volume exhaust system
- Redesigned to use a variable-volume system with optimized ducting

Energy Savings

- Combined energy savings from exhaust fans: $4,000/yr
- Lab exhaust fan EF-1: Approximately 38,544 kWh/yr
- Lab exhaust fan EF-2:
  - 15 HP motor: Energy reduced from 1.76 kW to 0.57 kW/yr (a 61% reduction)
  - Total kWh energy savings: Approximately 10,424 kWh/yr

Energy Performance





SNL/NM Energy Intensity (Thousand BTU/GSF/YR)										
	FY03	**FY04**	**FY05**	**FY06**	**FY07**	**FY08**	**FY09**	**FY10**	**FY11**	**FY12**
Energy Intensity (all bldgs.)	236	222	235	231	232	232	222	215	206.9	201
Energy Intensity (reg. bldgs.)	195	185	195	183	154	168	158	155	149	142

12.5% reduction in energy intensity for all SNL/NM buildings from a FY03 baseline

Classic ECM Problems

- Outside air dampers – open
- VAV linkages – broken or not aligned
- Simultaneous heating/cooling
- Excessive reheat
- Differing operational requirements
- Demand-based – not implemented
- Insufficient lighting controls
- Insufficient direct digital controls

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Thank you for your time!

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