SAND2010-7457C

Strategic Planning for Sustainability

Facilities Management & Operations Center
Sandia National Laboratories
Jack Mizner, P.E., LEED AP
Bill Kitsos, P.E., PMP

Sandia National Laboratories is a multi-program laboratory operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin company, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Sandia Overview Statistics

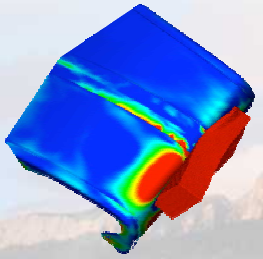
Sandia's facilities and infrastructure systems support a workforce of over 11,415 people, including regular employees, contractors, and resident visitors

Physical area = 188,000 acres
Paved roads = 49 miles
Unpaved roads = 38 miles
Owned buildings = 6.9 million GSF
Leased buildings = 461,000 GSF
Total buildings = 7.40M GSF

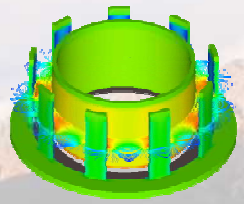
Mission Areas:

Nuclear Weapons
Defense Systems and Assessments
Energy, Resources and Nonproliferation
Homeland Security and Defense

Engineering Sciences

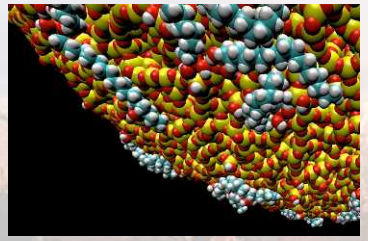


Computer Science

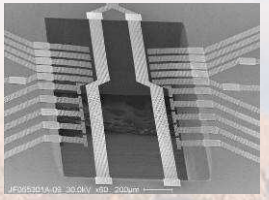


Pulsed Power

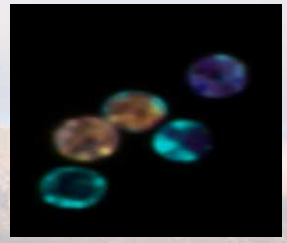
Materials



Micro Electronics



Bioscience



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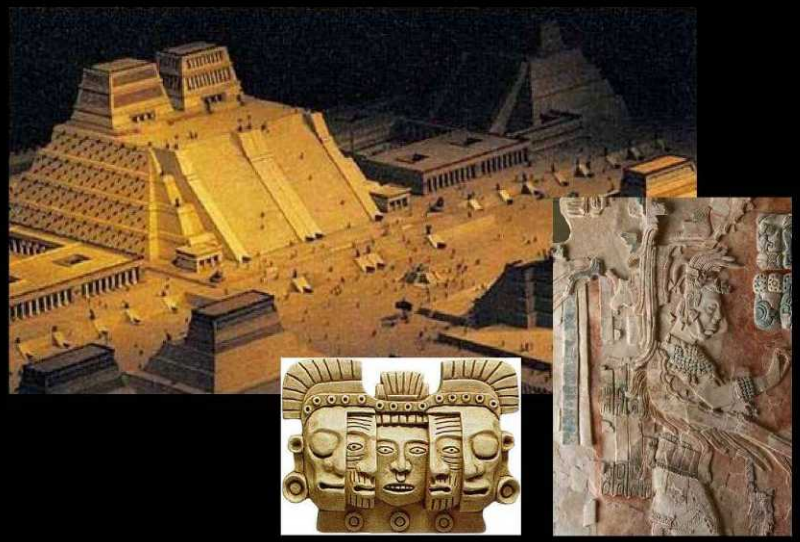
Campus planning to support science & engineering excellence did not begin in Albuquerque



But we're taking campus planning into the 21st century -

2006 LRDP

2006 Long-Range Development Plan - Sandia's development vision supporting lab transformation

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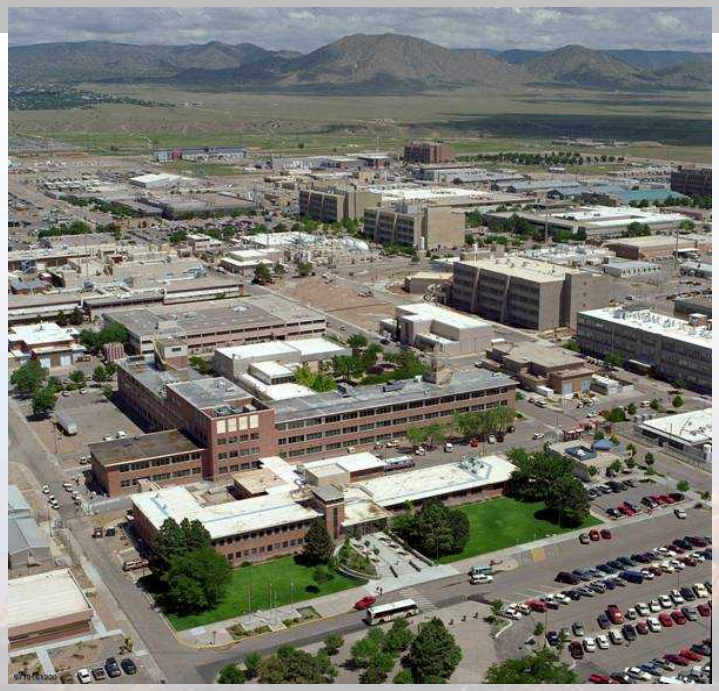
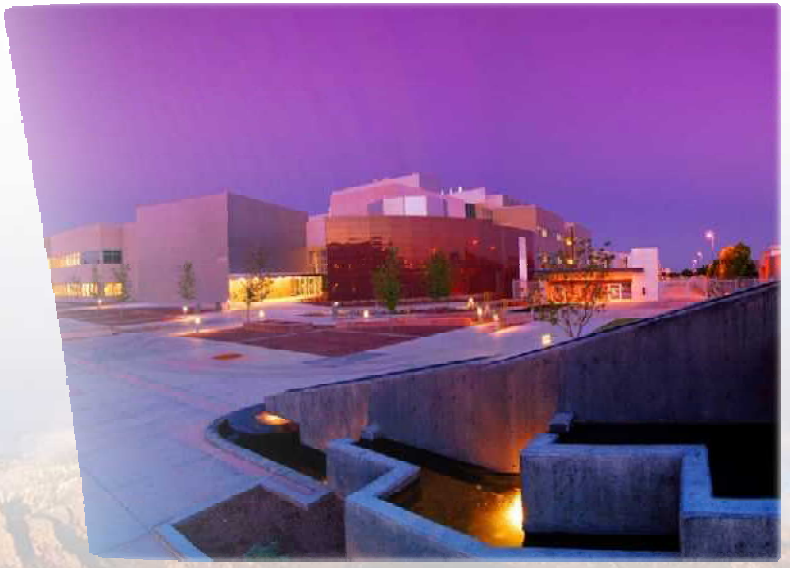
Think Big





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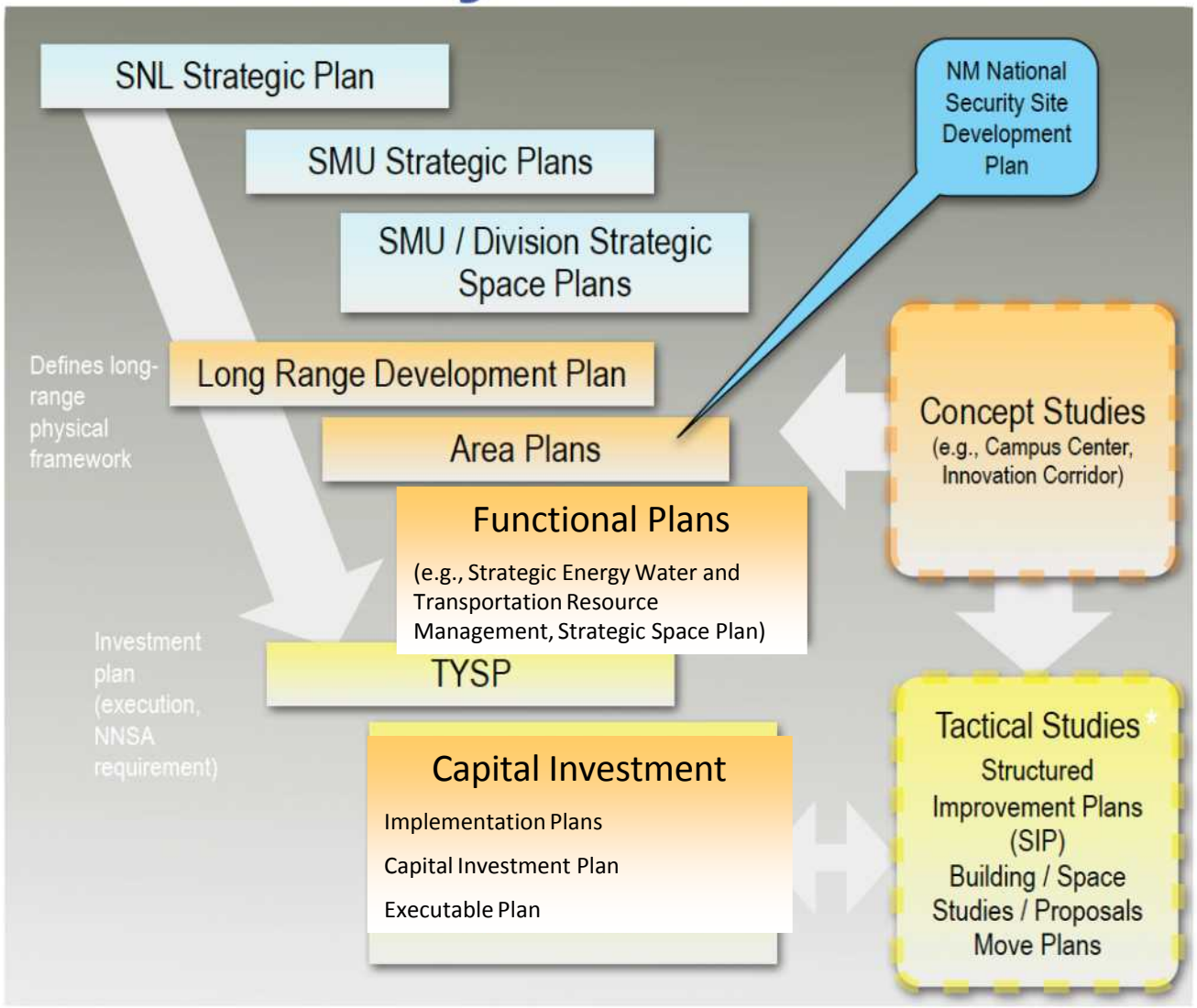
Hierarchy of Plans



Corporate Strategic Energy, Water and Fleet Resource Management Plan

- This Plan provides a clear link between carbon footprint and water-management objectives, R&D initiatives, site planning, project planning, project selection, and project execution.
- This Plan addresses E.O. 13514 goals and develops long-term strategies to meet them, contingent on resources provided.
- The Strategic Plan directs the Site Sustainability Plan.

Strategic Vision

SNL leads the DOE complex, the nation, and the world in innovative, large-scale institutional transformation to a sustainable, carbon-neutral environment while increasing mission effectiveness, resource reliability, and resource security. Each person at SNL understands and accepts his or her vital role in achieving this vision.

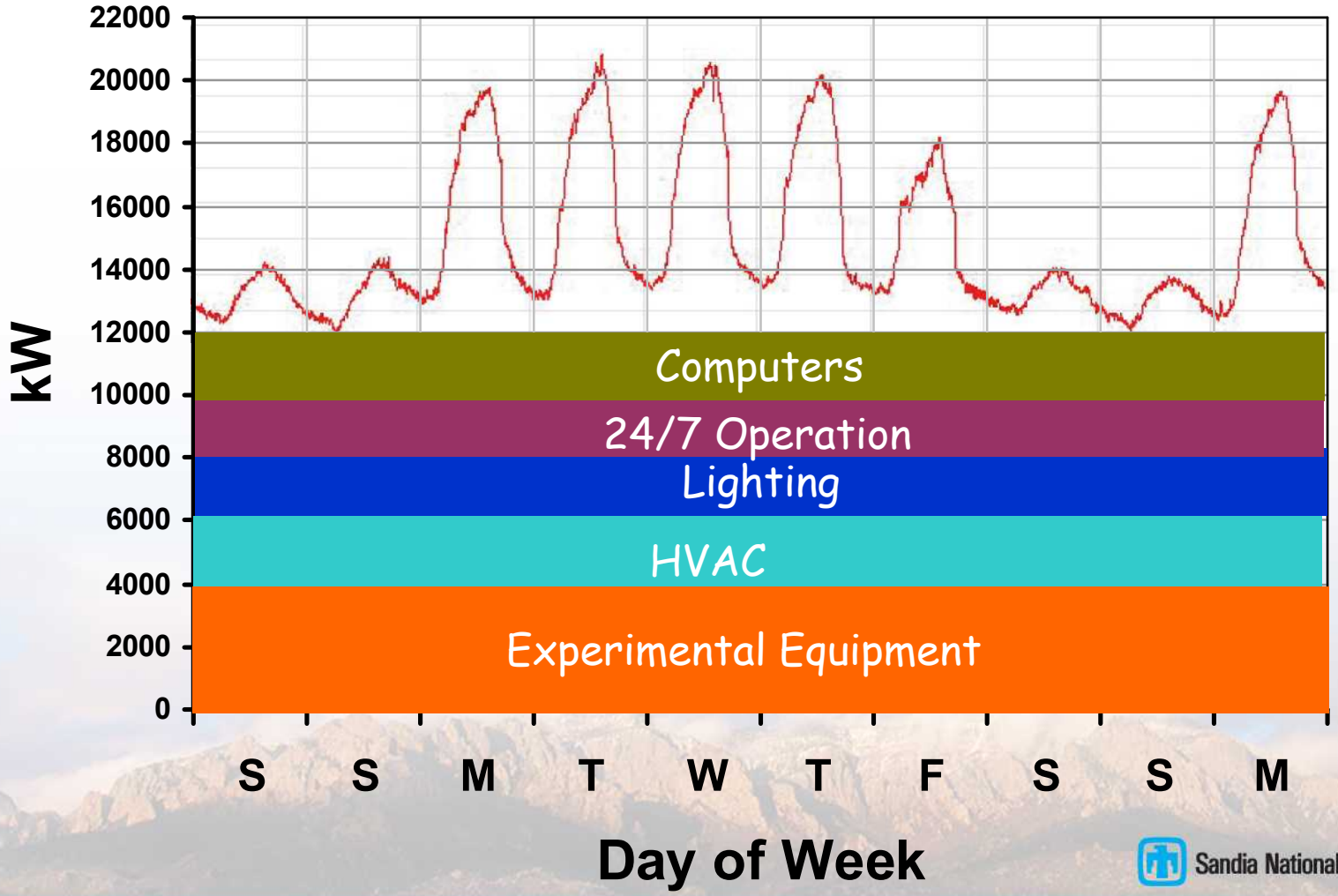
Strategies

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

Corporate Strategies

#	Objective	Corporate Strategy										
		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	Provide metering and control systems to track and trend performance	Showcase SNL R&D	Promote a sustainable business model	Improve partnerships with external resource providers and collaborators
2.1.1.1	Ensure that at least 15% of existing buildings of greater than 5,000 gross square feet (GSF) and building leases of greater than 5,000 GSF meet the High Performance and Sustainable Buildings (HPSB) Guiding Principles for Existing Buildings.	X	X	X		X			X		X	X
2.1.2.1	Reduce Scope 1 and 2 GHG footprints by a minimum of 2.3% annually or by 28%.	X	X	X	X	X	X		X	X	X	X
2.1.2.2	Reduce Scope 3 GHG footprint by a minimum of .8% annually or by 10%.					X	X		X		X	X
2.1.3.1	Reduce energy consumption by a minimum of 2% annually or 24%.	X	X	X	X	X			X		X	X
2.1.3.2	Reduce energy intensity by a minimum of 2% annually or 24%.	X	X	X	X	X			X		X	X
2.1.4.1	Reduce water consumption by a minimum of 2% annually or 26%.	X	X	X	X				X		X	X
2.1.4.2	Reduce water intensity by a minimum of 2% annually or 26%.	X	X	X	X				X		X	X
2.1.5.1	Reduce the consumption of petroleum products by SNL Fleet Transportation by a minimum of 2% annually or 30%.						X			X		
2.1.6.1	Become a net-zero energy institution.	X	X	X	X	X	X	X	X	X	X	X
2.1.6.2	Reduce energy intensity by a minimum of 2% annually or 44%.	X	X	X	X	X			X			X
2.1.6.3	Use no petroleum products for fleet transportation.					X	X					

Daily Load Profile



Cost of Conservation vs. Renewables

- Nightwatchman
- Automatically puts computers during non-working hours into standby or hibernate mode.
- Reduces annual electrical use by nearly % = 6088 MWh/yr
- Initial Cost = $410,000
- Maintenance Cost = $55,000
- Annual Savings
- Simple P/B <1 year

- Photo voltaics
- To produce 6088 MWh of electricity per year, requires 2.5 MW of installed PV
- Cost of installed PV is coming down, but
- At $8/W, $20M, P/B = 44 yrs.
- At $6/W, $15M, P/B = 33 yrs
- At $4/W, $10M, P/B = 22 yrs

Every watt saved is a watt that doesn't need to be generated

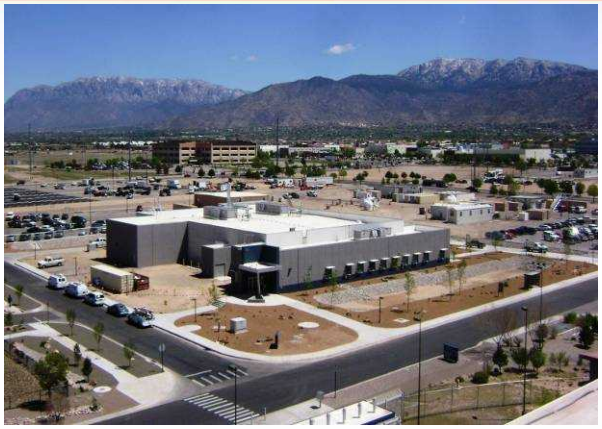
Green Buildings

GOAL	STATUS
All new construction and major renovations greater than $5 million to be LEED® Gold certified	9% of total GSF is LEED certified.
15% of existing buildings to be compliant with the five High Performance Sustainable Building of (HPSB) Guiding Principles.	8.8% of buildings are compliant with the five guiding principles.

Projects and Planned Activities

- Building 750 achieved LEED-EBOM Silver, but did not meet the Guiding Principles.
- Identify and assess buildings to meet HPSB goals.
- Schedule certification of existing buildings, based on assessments

Major Sustainable Design Accomplishments



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First Leap Into Sustainability

Process and Environmental Technology (PETL)

- 1996 Design (completed in 2000)
- 151,000 gsf - office/chemistry lab facility
- Heat pipe recovery system with evaporative cooling, 1M gallon water thermal energy storage system,
- 21rst Century (Labs21) High-Performance Building

Conference Room Renovation

- 1999 - First project to use green materials
- Natural, sissal wall covering
- Recycled materials (ceiling tiles, carpet)
- Low VOC carpet
- Did not increase costs

LEED – New Construction (NC)

Model Validation & System Certification Test Center (MVSCTC)

- Design/build - 18,600 gsf facility (2002)
- Employed U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED, V1.0) process
- LEED Certification not submitted
- Received "2003 White House Closing the Circle Award" in the category of Sustainable Design/Green Buildings

Joint Computational Engineering Laboratory (JCEL)

- Design/bid/build – 66,143 gsf facility (2004)
- First LEED certified project at Sandia
- First LEED Silver building in the NNSA

LEED-NC (cont.)

Weapons Engineering Technology Laboratory (WETL)

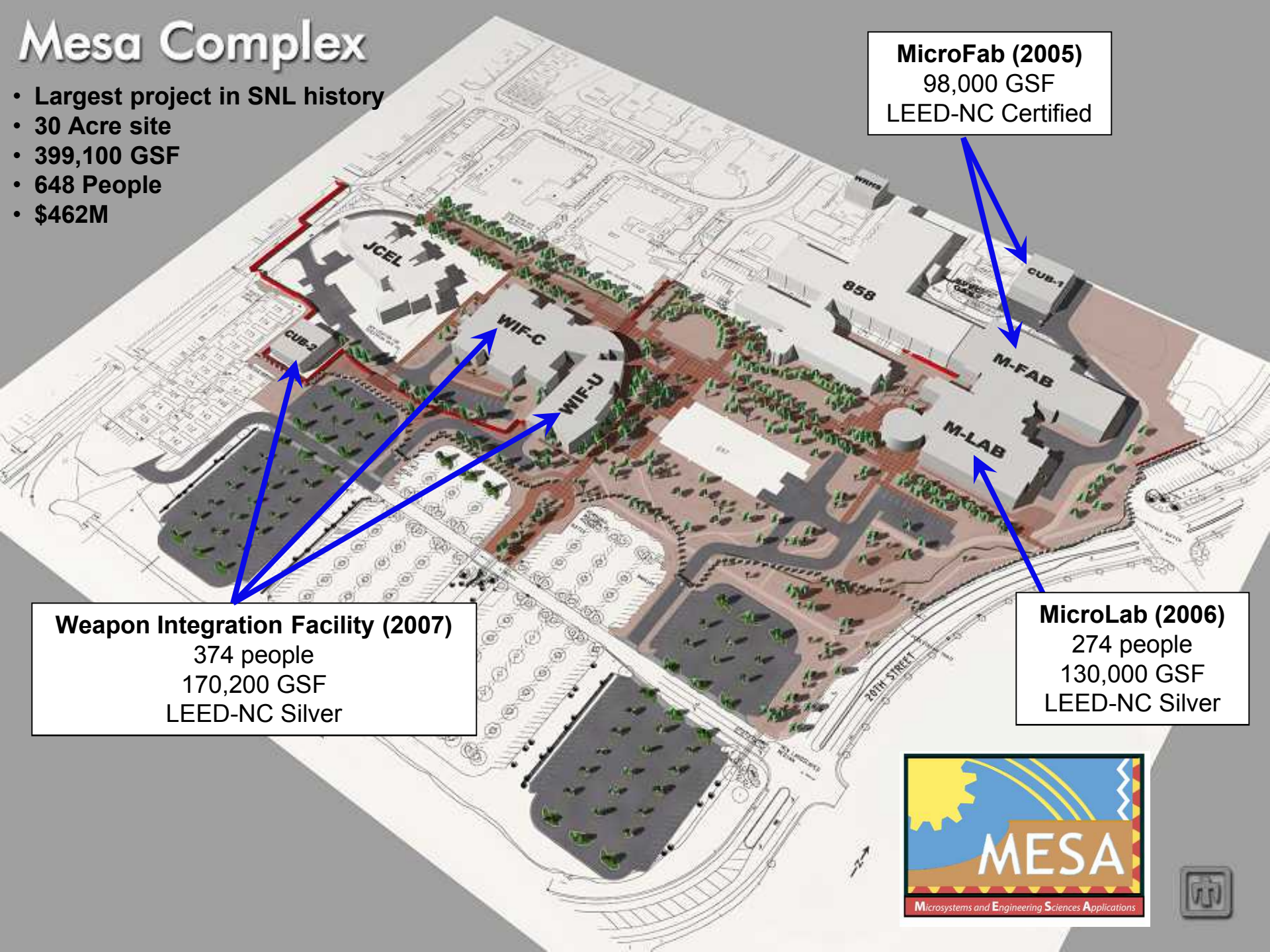
- 31,500 gsf (2005)
- Laboratory facility
- LEED Certified project at Pantex

Center for Integrated Nanotechnologies (CINT)

- 97,000 gsf (2007)
- Advanced research laboratories, office space, and cleanroom
- LEED-NC Certified

Mesa Complex

- **Largest project in SNL history**
- **30 Acre site**
- **399,100 GSF**
- **648 People**
- **$462M**



MicroFab (2005)
98,000 GSF
LEED-NC Certified

Weapon Integration Facility (2007)
374 people
170,200 GSF
LEED-NC Silver

MicroLab (2006)
274 people
130,000 GSF
LEED-NC Silver

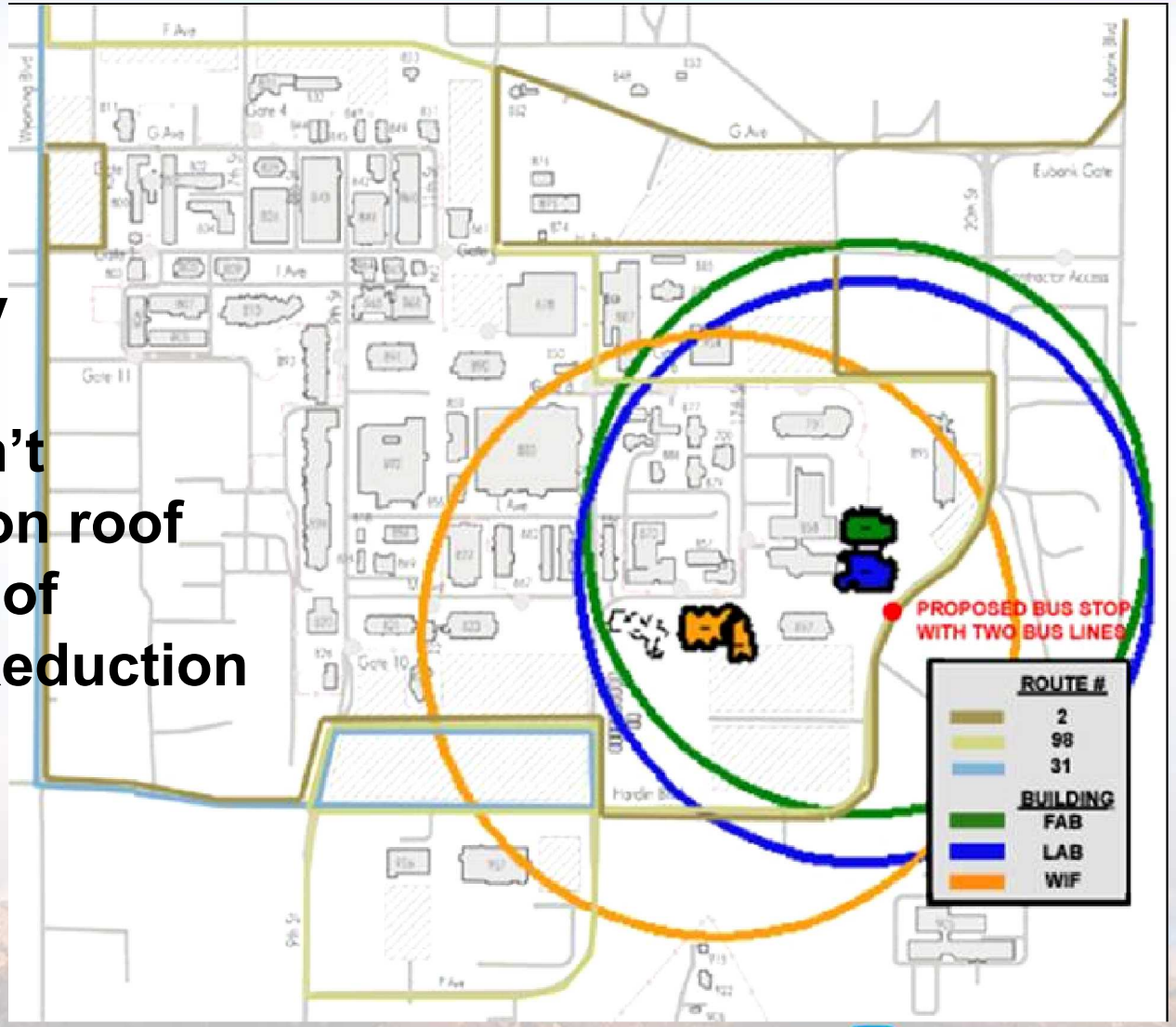
MESA
Microsystems and Engineering Sciences Applications

MESA - APPROACH

- **Three Buildings were designed together (2002), but constructed as separate packages.**
- **Sustainable Design (SD) included in the Conceptual Design Report and the Design Criteria**
- **Participation from Labs 21 team – Pilot partner since 2000.**
- **Energy Programming Workshop – developed goals and performance metrics/targets.**
- **Sustainable Design Charrettes**
  - One day events at programming and schematic design
  - Developed SD goals and metrics
- **SD SMEs reviewed submittals**
- **Three separate LEED applications**

Sustainable Site

- Site Selection
- Bus routes
- Bicycle Racks
- Parking Capacity
- Restore Site
- Stormwater Mgm't
- Heat Islands – non roof
- Heat Islands – roof
- Light Pollution Reduction

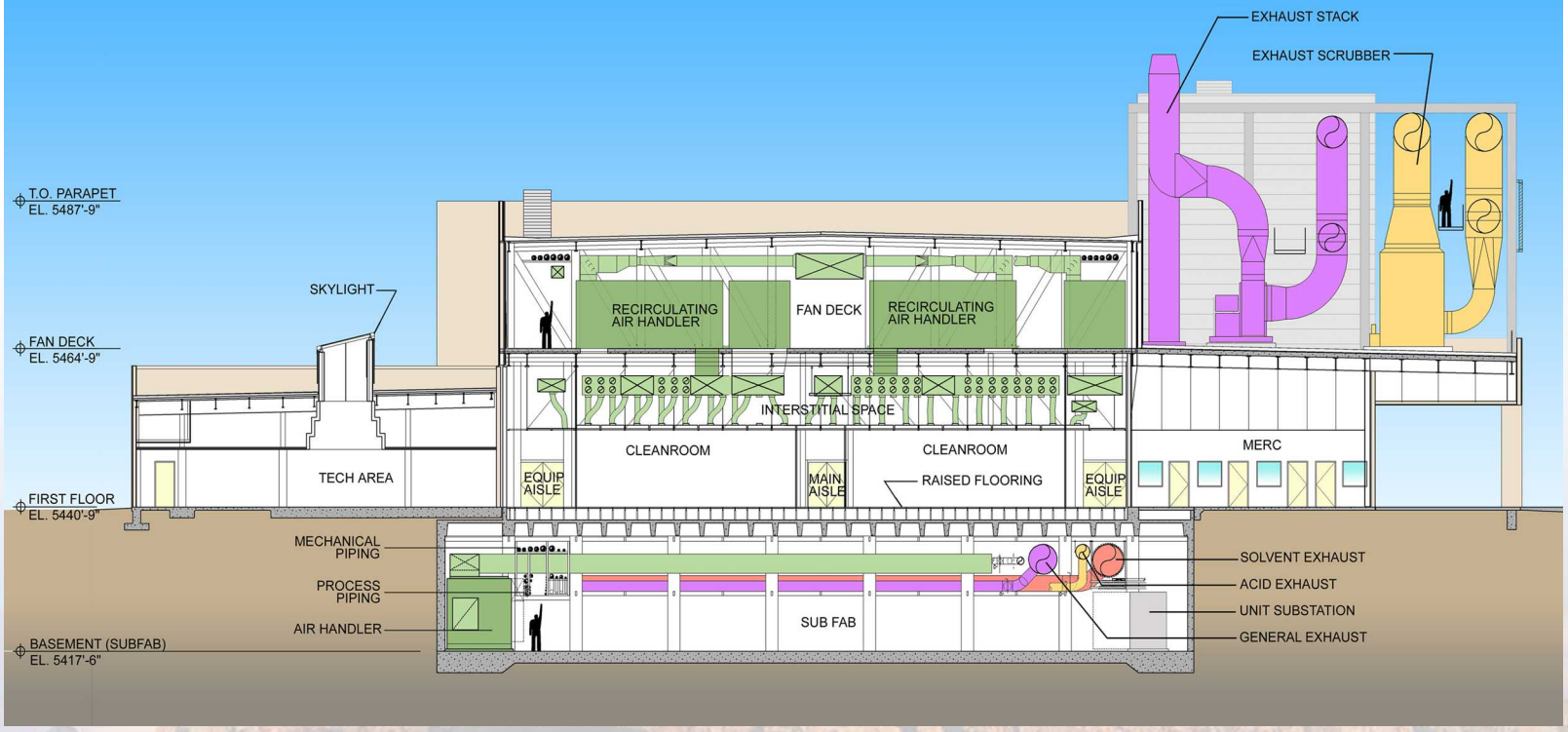


Landscape And Plumbing

- Native, xeric plantings with efficient irrigation
- Low flow urinals, restroom faucets and water closets
- Reclaim Water used in Water Feature

MicroFab

- First microchip fabrication facility to obtain LEED-NC Certification



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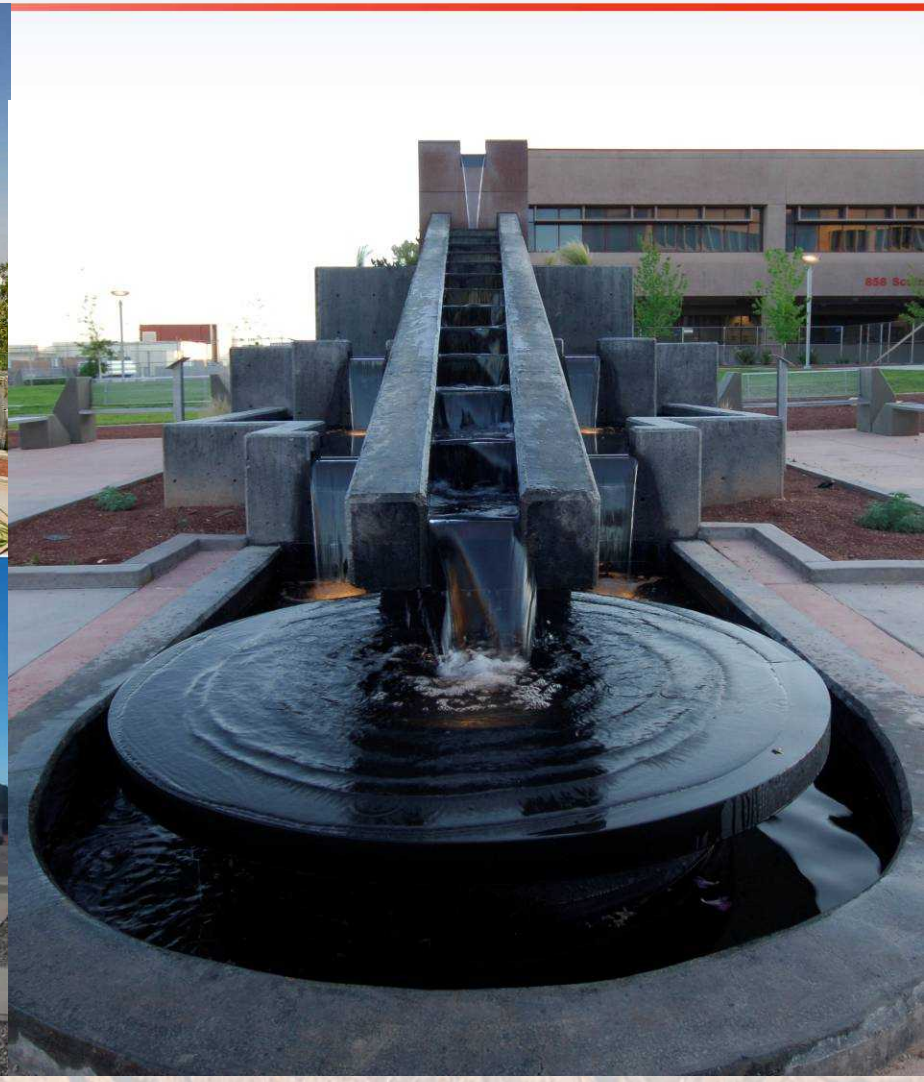
MESA - Before and After



Materials and Resources

- > 75% construction waste recycling
- > 10% recycled content
  - ✓ Ceiling tiles
  - ✓ Concrete
  - ✓ Metals
  - ✓ Carpet and flooring
  - ✓ Insulation
- > 20% locally manufactured
- > 50% locally harvested
  - ✓ Concrete
  - ✓ Wall board

- Developed LEED submittal tracking process

Indoor Environmental Quality

- Construction Indoor Air Quality Plans
- Low-emitting materials (required by spec)
  - ✓Adhesives
  - ✓Paints
  - ✓Sealants
  - ✓Carpet
  - ✓Wood

IBL Achieves LEED-NC Gold Certification!

IBL is the First . . .

1. IBL is the FIRST Sandia building to obtain the GOLD level of certification under the LEED-NC rating system.
2. IBL is the FIRST Sandia building to implement a rainwater harvesting system to supplement landscape irrigation requirements. Following a 2-year period to establish plantings, landscape irrigation will be provided solely by natural rainfall and rainwater harvested from the roof.
3. IBL is the FIRST Sandia building to be constructed using the new network management system (Gigabit Passive Optical Network – or GPON), which reduced associated power consumption by 94% relative to previously used network equipment.

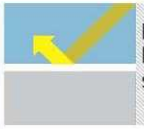
Occupant access to natural day lighting, skylights and window sunshades.

Environmentally preferable materials including use of recycled content building materials, regionally manufactured materials, and wood products certified as derived from sustainably managed forests.

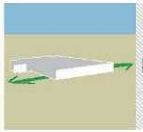
Stormwater runoff detention/retention ponds.

Low-water use landscape design.

Diversion from landfill disposal of nearly 90% of construction waste generated.



Reflective surfaces associated with the building's roof and site hardscape surfaces .



East/West building orientation.

Energy efficiency measures include centralized mechanical equipment, variable frequency drives, economizer controls, high efficiency motors, improved building insulation and lighting controls.

Low emitting paints, adhesives, sealants, carpet systems, and non-urea-formaldehyde composite wood products.

Water conserving plumbing fixtures.

Sustainable Design

- Since 1998, actively/formally implemented into new construction
- All Line Item Projects and Major Renovations (>$5M)
- Included sustainable design language in Request for Proposals
- Design criteria included language for design charettes, sustainable design report, and LEED certification
- Part of contractor selection criteria (design and construction)
- 2001 - Sustainable Design Communique to architects, engineers, & construction contractors
- 2001 – Reviewed/revised standard construction specifications
- Conducted Integrated Education Series on Sustainable Design Workshops (2003, 2004, 2005)
- Lessons learned captured and addressed in next project

LEED-NC Recap

Sandia National Laboratories has:

- Two facilities designed/constructed with Sustainable principles
- Seven LEED Certified Facilities;

  (3) LEED – NC Certified

  (3) LEED SILVER

  (1) LEED GOLD
- More than any other organization in New Mexico
- 9% of building square footage is LEED certified

LEED Existing Building (EBOM) Case Study

- SNL's first LEED EBOM (Silver) Building
- Chosen based on meeting energy pre-requisite and interested occupants
- Added occupancy sensors, upgraded efficient water fixtures and gave smart strip to all occupants during POP
- Auditing/Commissioning identified faulty zone sensor and broken damper.
- Reduced energy usage an additional 28%

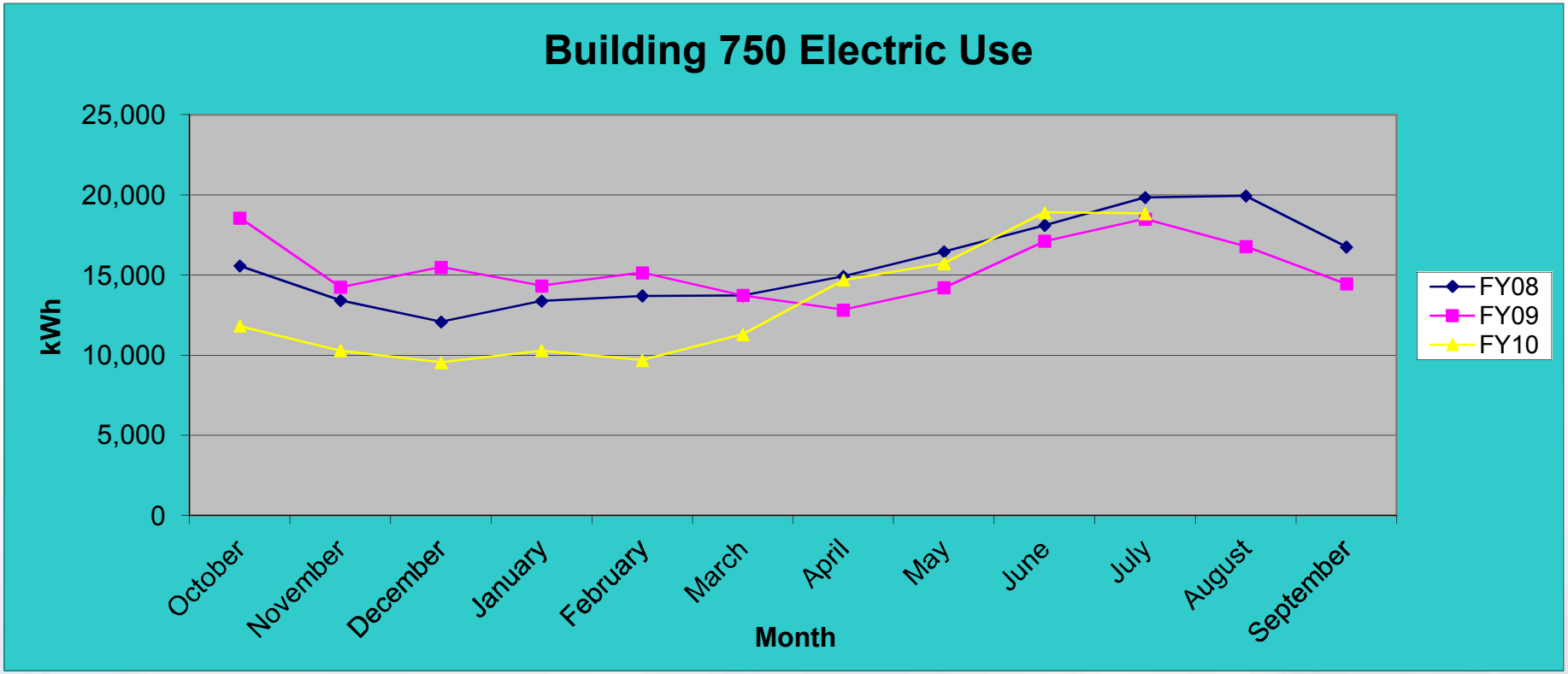
What are the Guiding Principles?

Employ Integrated Design	■ Integrated Team ■ Operational Performance Goals; Building Management Plan ■ Tenant Education; Occupant Satisfaction Survey ■ Commissioning
Optimize Energy Performance	■ Building Performance; Efficient Products ■ Renewable Generation ■ Measurement and Verification; Benchmarking
Protect and Conserve Water	■ Indoor and Outdoor water use ■ Storm Water Management ■ Water Efficient Products
Enhance Indoor Environmental Quality	■ Ventilation and Thermal Comfort; Moisture Control ■ Daylighting and Lighting Controls ■ Low-Emitting Materials; Tobacco Smoke Control ■ Integrated Pest Management
Reduce Environmental Impact of Materials	■ Recycled Content; Environmentally Preferable Materials ■ Waste and Materials Management ■ Ozone Depleting Substances

LEED - EB	GUIDING PRINCIPLES
Prerequisites + flexible credit choice (Certified to Platinum levels)	Pass/Fail (must meet all or seek exemption)
Energy requirement – 69 points (Energy Star Portfolio Manager)	Energy requirement – based upon 30% reduction – 75 points (Energy Star Portfolio Manager)
Specific criteria, requirements, and templates to document credit compliance; Building centric; campus credits are negotiable	More flexibility in format; Some map to LEED documentation; others don't. Campus approach is encouraged
Third party validation	Internal assessment and approval

Building 750 LEED EB Oct 2009 – Jul 2010

What happened?



1. VAV box 007 damper actuator failed
   - Zone ran hot
   - Fan VFD static set point at “Max”
   - Discharge air set point at “Min”
2. Both AH set points manually overridden
3. Outside mixed-air linkage improperly repaired
4. Building occupancy changed

HPSB GP - From Strategy to Implementation

	LEED	FY 10	FY 11	FY 12	FY 13	FY 14	FY 15	FY 15 +
Bldgs	518, 720, 898, 899, 858EL, 858EF, 750	750, 753, 6584, 6587	752, 755, 971	770, 954, 957, 969	758, 811, 886, 1090	809, 856, 859, 861, 885	836, 875, 876, 905	703, 751, 808, 825, 827
# for GP	6	4	3	4	4	5	4	6
Total GP	6	10	13	17	21	26	30	36
% Bldgs	3	5	7	9	11	14	16	19
% GSF (> 5000)	9.7	10.6	11.4	13.3	14.1	15.1	18.4	20.2
% GSF Total	8.8	9.5	10.3	11.9	12.7	13.6	16.6	18.1

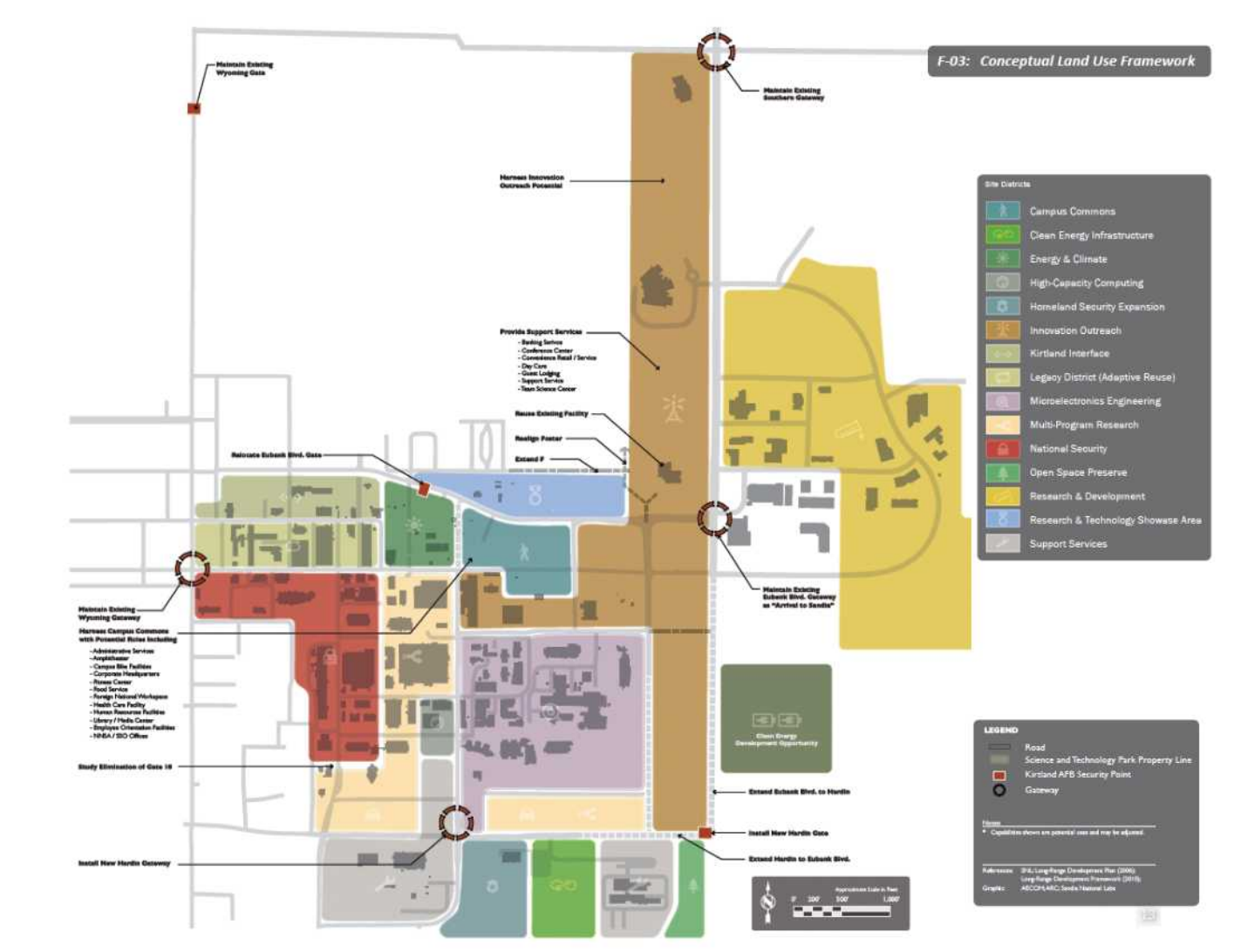
Funding Needs

Funding Source	FY 11	FY 12 – FY 15	FY 15 – FY 20	FY 20 and beyond
Internal (Indirect)	$ 2 M	$ 3M - $ 5M	$3 M - $ 5 M	$ 5 M – $ 10 M
DOE/NNSA (Direct)		$ 3M - $ 5 M	$ 5 M - $ 10 M	$ 5 M - $ 10 M
Line Item		Identify	Develop	Implement
Total	$ 2 M	$ 6 M - $10 M	$ 8 M - $ 20 M	$10 M - $ 20 M

Leverage other funding sources:

- Major Restoration/Renovation
- GPPs
- Alternative Funding Strategies
- Synergy with R&D Opportunities
- Synergy with Energy Security Initiatives

Path to a Sustainable Future



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Sustainability-Related Recommendations

Explore Energy Advancements

- Inventive new technologies and products
- Applications of "distributed" energy generation & renewable energy
- Modular energy production systems

Refine Operational Efficiencies

- Employ net-zero design concepts
- Reduce green house gas emmissions

Promote Sustainability Awareness

- Enhance awareness company wide

Update Environmental Policy Process

- Consider sustainability index to NEPA checklist

Finance Energy Investment

- Provide adequate O&M and up-front capital funds to support clean energy investment