SAND2011-5228C

Sandia National Laboratories

Sandia National Laboratories

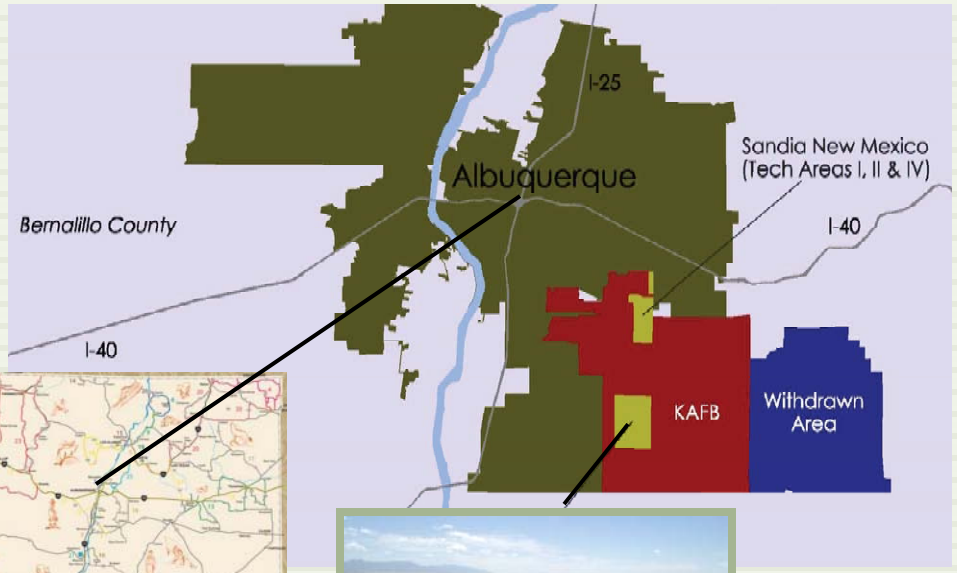
Resource Management

Jack H. Mizner, P.E., LEED AP, CEM
Manager, Strategic Partnerships 4853

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

Site Overview

Sandia National Laboratories (Sandia)



Kirtland A.F. Base, Albuquerque, NM

Tonopah, NV

Livermore, CA

Kauai, Hawaii

- **Total site:** 193,000 acres
- **Workforce:** 11,000
- **Major buildings:** 225
- **Space:** 7.4 million gross square feet (gsf)

Sandia Labs/New Mexico

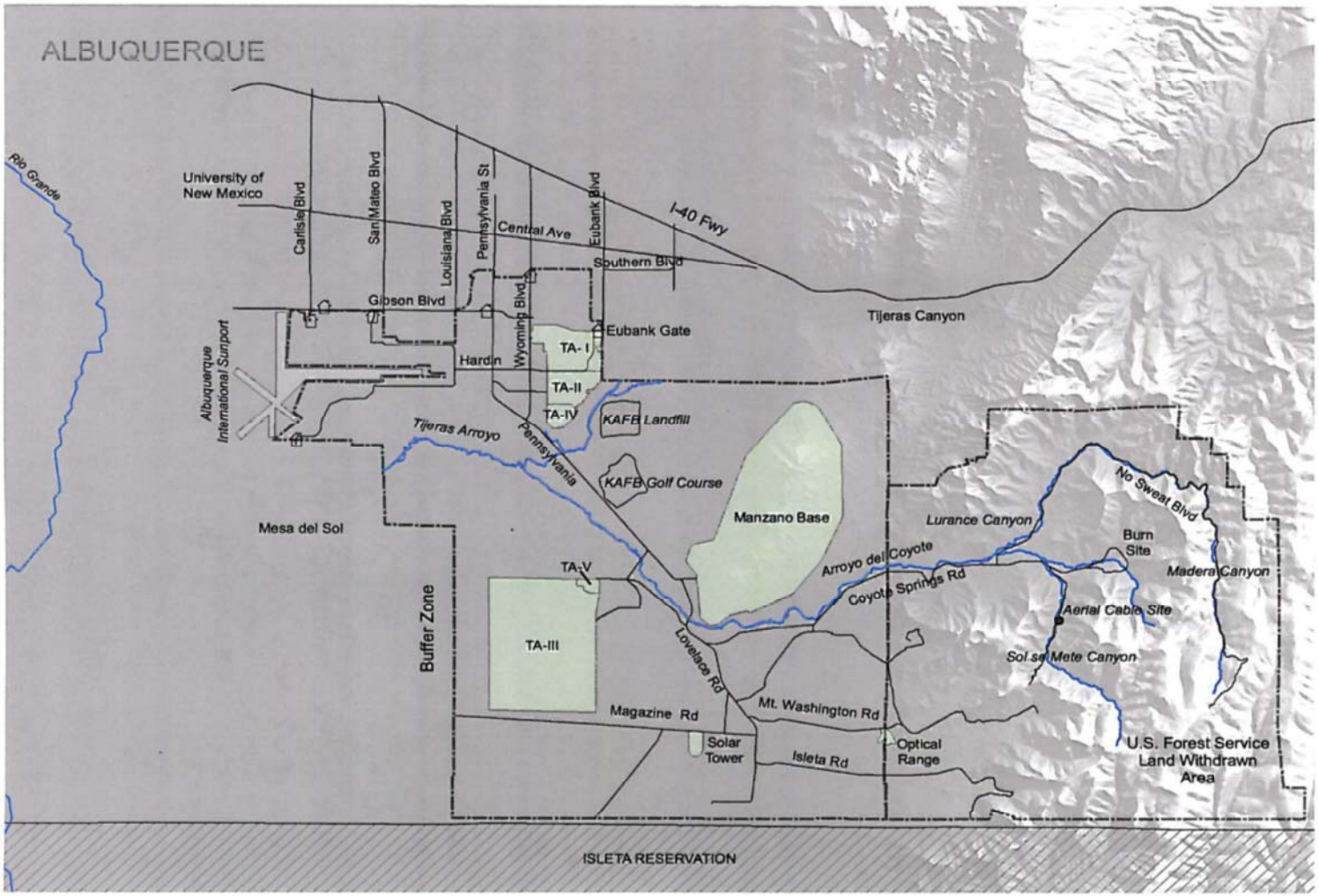
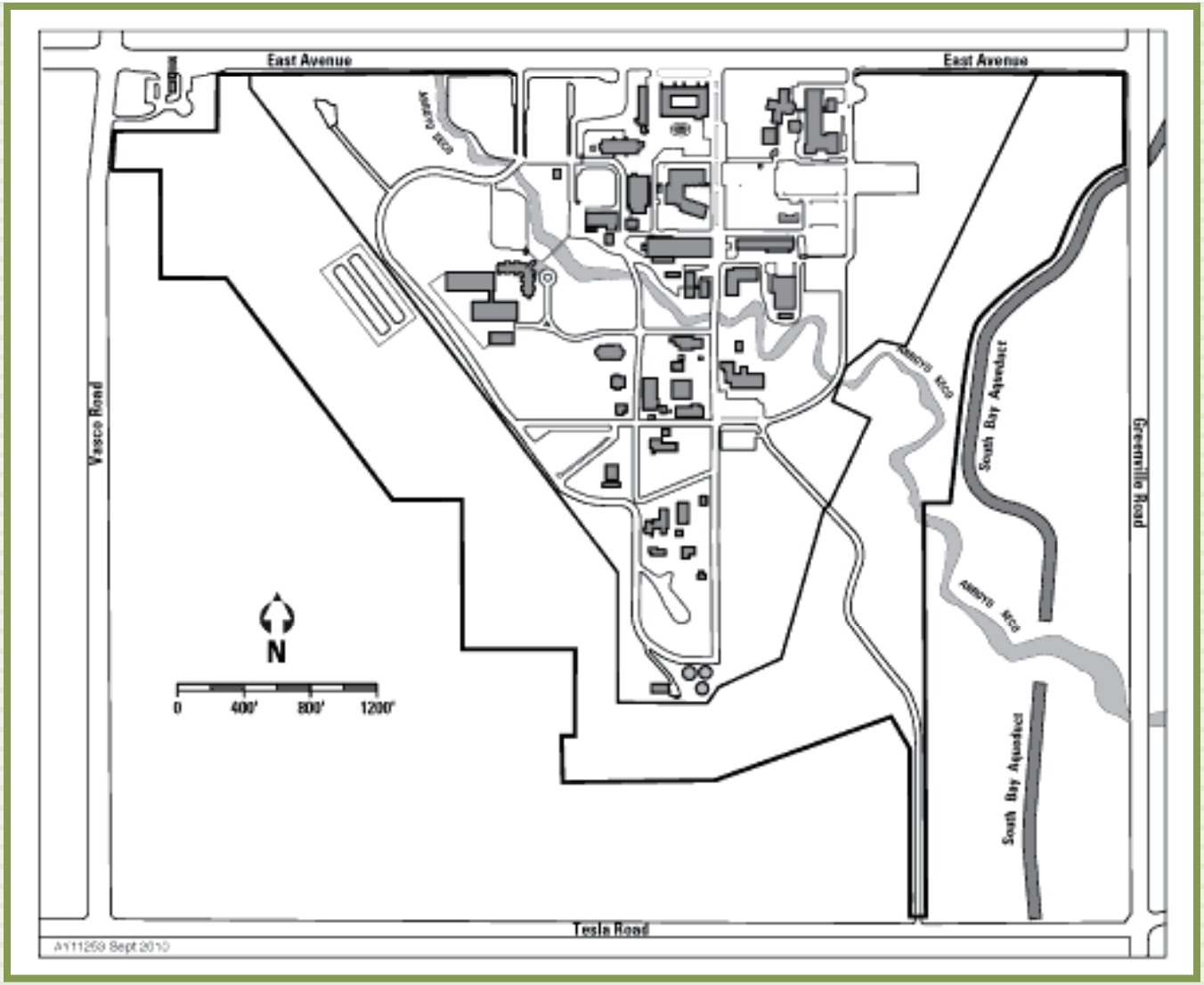


FIGURE 1-1. SNL/NM Technical Areas and the U.S. Forest Service Land Withdrawn Area

Sandia Labs/California



Strategic Vision

Sandia National Laboratories leads the Department of Energy (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.

Land Ethic

The land ethic simply enlarges the boundaries of the community to include soil, waters, plants, and animals or collectively: the land. – Aldo Leopold, *Sand County Almanac*

- **Sandia's "land ethic" in practice**
  - Limiting site footprint
  - Reducing energy and water consumption
  - Xeric landscaping and vegetation monitoring
  - Protecting habitat and species living on the Sandia site

Drivers

- National Environmental Protection Act (NEPA)
- Endangered Special Act
- Migrating Bird Treaty Act (MBTA)

Red Tail Hawk

- Energy Policy Act of 2005
- Executive Order 13423
- Executive Order 13514
- Energy Independence & Security Act of 2007 (EISA 2007), section 432
- DOE Strategic Sustainability Performance Plan (SSPP)

It's the right thing to do!

Corporate Strategies


Variable Frequency Drives

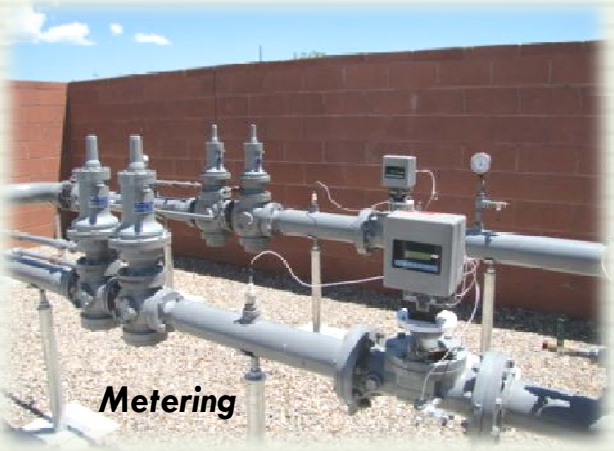

PV-Grid


PV Lighting

- Reduce current demand; use less.
- Eliminate current demand; turn off or remove.
- Use resources efficiently; use fewer resources for the same task.


Sustainable Design


Harmony with Nature


Metering

Corporate Strategies

- Manage new demand.
- Reduce transportation fossil-fuel use.
- Migrate to noncarbon-emitting energy sources.
- Deliver resources to mission-critical activities reliably and securely.

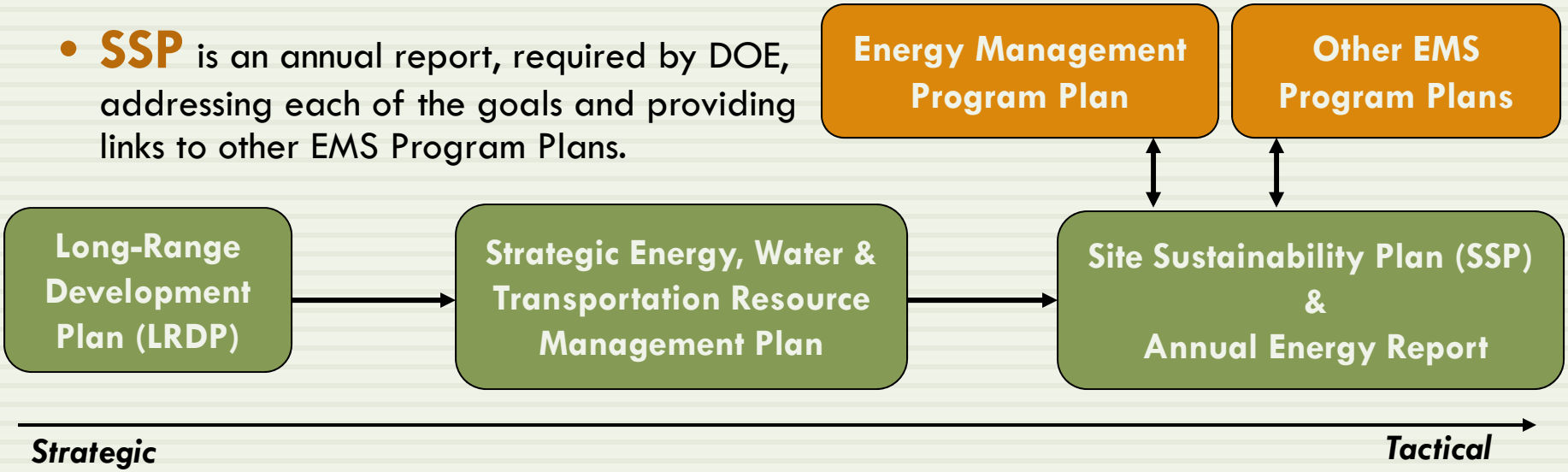
- Expand metering and control systems.
- Showcase SNL R&D activities.
- Promote a sustainable business model.
- Improve partnerships.

Strategic Planning

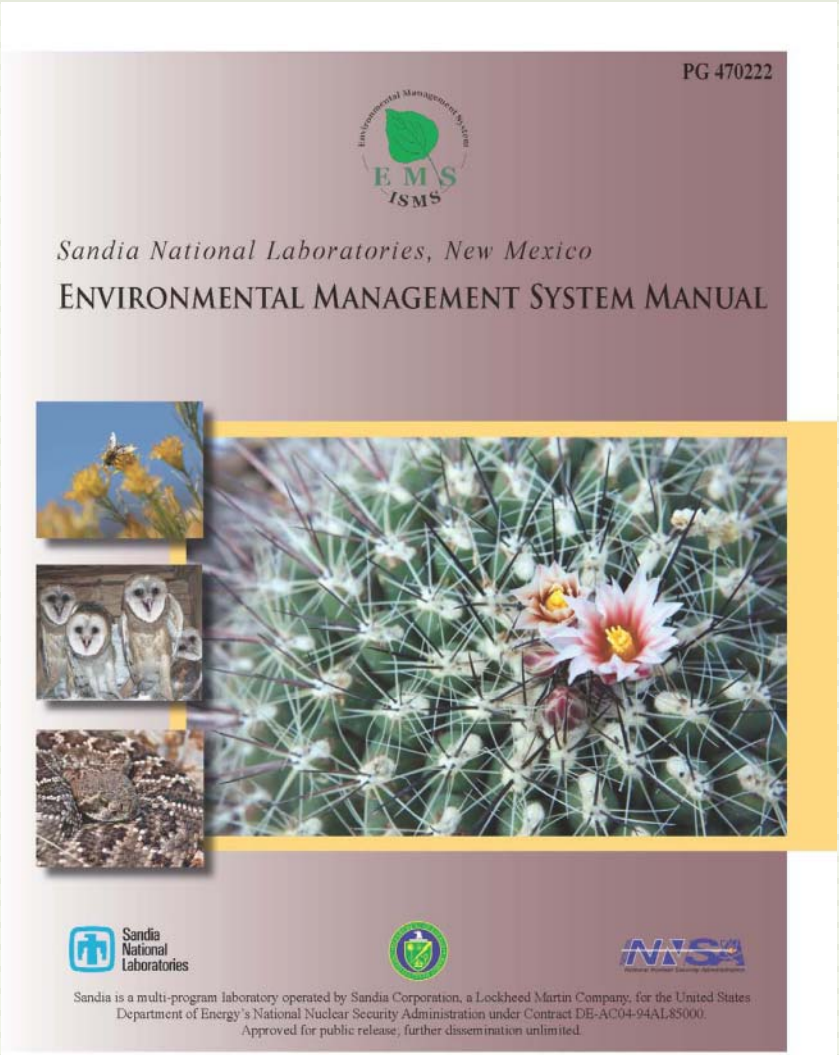
- **Strategic Plan**
  - Links R&D initiatives, site planning, project planning, selection, and execution
  - Addresses EO 13514 goals and develops long-term strategies to meet them
  - Directs Energy, Water and Green Building portions of the Site Sustainability Plan (SSP)

- **Energy Management Program Plan** describes the energy, water and green buildings programs with Sandia's Environmental Management System (EMS).

- **SSP** is an annual report, required by DOE, addressing each of the goals and providing links to other EMS Program Plans.



Environmental Management System



- **EMS Manual Contents**
  - Resource use: water, energy, natural gas
  - Plant & animal life
  - Land use
  - Water: rainwater harvesting, ground water, stormwater & wastewater
  - Sustainable design and building principles
  - Environmental policy, long-term stewardship, aspects & impacts
  - Preferable purchasing
  - Pollution prevention
  - Waste generation, handling & disposal
  - Reuse & recycling
  - Safety
  - Transportation

Species Protection & Monitoring

- **Monitoring Avian Productivity & Survivorship (MAPS)**
  - Systematic way to track migration and age of small migratory birds
  - Banding of birds with unique I.D. number
  - Central coordinated database
  - MAPS network stations from South American to Alaska

Gray Vireo

- **Example of tracked NM species**
  - ***Gray vireo*** – State-listed threatened species
  - Kirtland Air Force Base has excellent habitat for the gray vireo
- **Sandia's Participation in MAPS**
  - Ecology Program MAPS
  - Data contributes to scientific community and to the centralized database

Species Protection & Monitoring

Bear Sows & Cubs

Golden Eagle

Pumas

- **Tijeras Arroyo Wildlife Corridor**

  From Manzano Mountains to Río Grande Memorandum of Understanding signees:
  - Sandia National Laboratories
  - Kirtland Air Force Base
  - City of Albuquerque

Deer

- **Water "Guzzlers"**
  - Built by U.S. Forest Service on Withdrawn Lands
  - Maintained by Sandia Ecology Program

Bobcat

Species Protection & Monitoring

Sandia National Laboratories/New Mexico
Common Plants & Animals at KAFB

BIRDS			
American robin	*Turdus migratorius*	Horned lark	*Eremophila alpestris*
American kestrel	*Falco sparverius*	Killdeer	*Charadrius vociferus*
Black-chinned hummingbird	*Archilochus alexandris*	Loggerhead shrike	*Lanius ludovicianus*
Black-headed grosbeak	*Pheucticus melanocephalus*	Mountain bluebird	*Sialia currucoides*
Broad-tailed hummingbird	*Selasphorus platycercus*	Red-tailed hawk	*Buteo jamaicensis*
Dark-eyed junco	*Junco hyemalis*	Rufous-sided towhee	*Pipiloerythro melanocephalus*
MAMMALS			
Black bear	*Ursus americanus*	Deer mouse	*Peromyscus maniculatus*
Bobcat	*Felis rufus*	Gunnison's prairie dog	*Cynomys gunnisoni*
Banner-tailed kangaroo rat	*Dipodomys spectabilis*	Gray fox	*Urocyon cinereoargenteus*
Black-tailed jackrabbit	*Lepus californicus*	Mule deer	*Odocoileus hemionus*
Desert cottontail	*Sylvilagus audubonii*		
REPTILES AND AMPHIBIANS			
Collared lizard	*Crotaphytus collaris*	Great plains skink	*Eumeces obsoletus*
Chihuahuan spotted whiptail	*Aspidoscelis exsanguis*	Great plains toad	*Bufo cognatus*
Round-tailed horned lizard	*Phrynosoma modestum*	Western diamondback rattlesnake	*Crotalus atrox*
Prairie lizard	*Sceloporus consobrinus*	Side-blotched lizard	*Uta stansburiana*
Gopher snake	*Pituophis catenifer*	Short-horned lizard	*Phrynosoma hernandesi*
PLANTS			
Apache plume	*Fallugia paradoxa*	Goathead	*Tribulus terrestris*
One-seed juniper	*Juniperus monosperma*	India ricegrass	*Achnatherum hymenoides*
New Mexico needlegrass	*Hesperostipa neomexicana*	Ring muhly	*Muhlenbergia torreyi*
Purple three-awn	*Aristida purpurea*	Bush muhly	*Muhlenbergia porteri*
Shrub live oak	*Quercus turbinella*	Soapweed yucca	*Yucca glauca*
Spectacle pod	*Dithyrea wislizenii*	Black grama	*Bouteloua eriopoda*

Species Protection & Monitoring

In 2000, Sandia/California established an integrated approach to wildlife and habitat management that merges long-term management of ecological resources with site planning and operations.

Photo credit:
Joyce Gross

- "Indicator species"
- Threatened and endangered species

California Red-Legged Frog
Rana aurora draytonii

Species Protection & Monitoring

- **Birds protected by federal or California law and found at Sandia/California:**
  - Bank swallow (*Riparia riparia*)
  - *Northern harrier (Circus cyaneus)*
  - *Nuttall's woodpecker (Picoides nuttallii)*
  - *Song sparrow (Melospiza melodia)*
  - *Yellow warbler (Dendroica petechia)*
  - *White-tailed kite (Elanus leucurus)*
  - *Golden eagle (Aquila chrysaetos)*
  - *Loggerhead shrike (Lanius ludovicianus)*
  - *Western burrowing owl (Athene cunicularia hypugaea)*

Photo Credit: Chris. Christie

- **"Specially protected mammal" under California law:**
  - Mountain lion (*Puma concolor*)

Species Protection & Monitoring

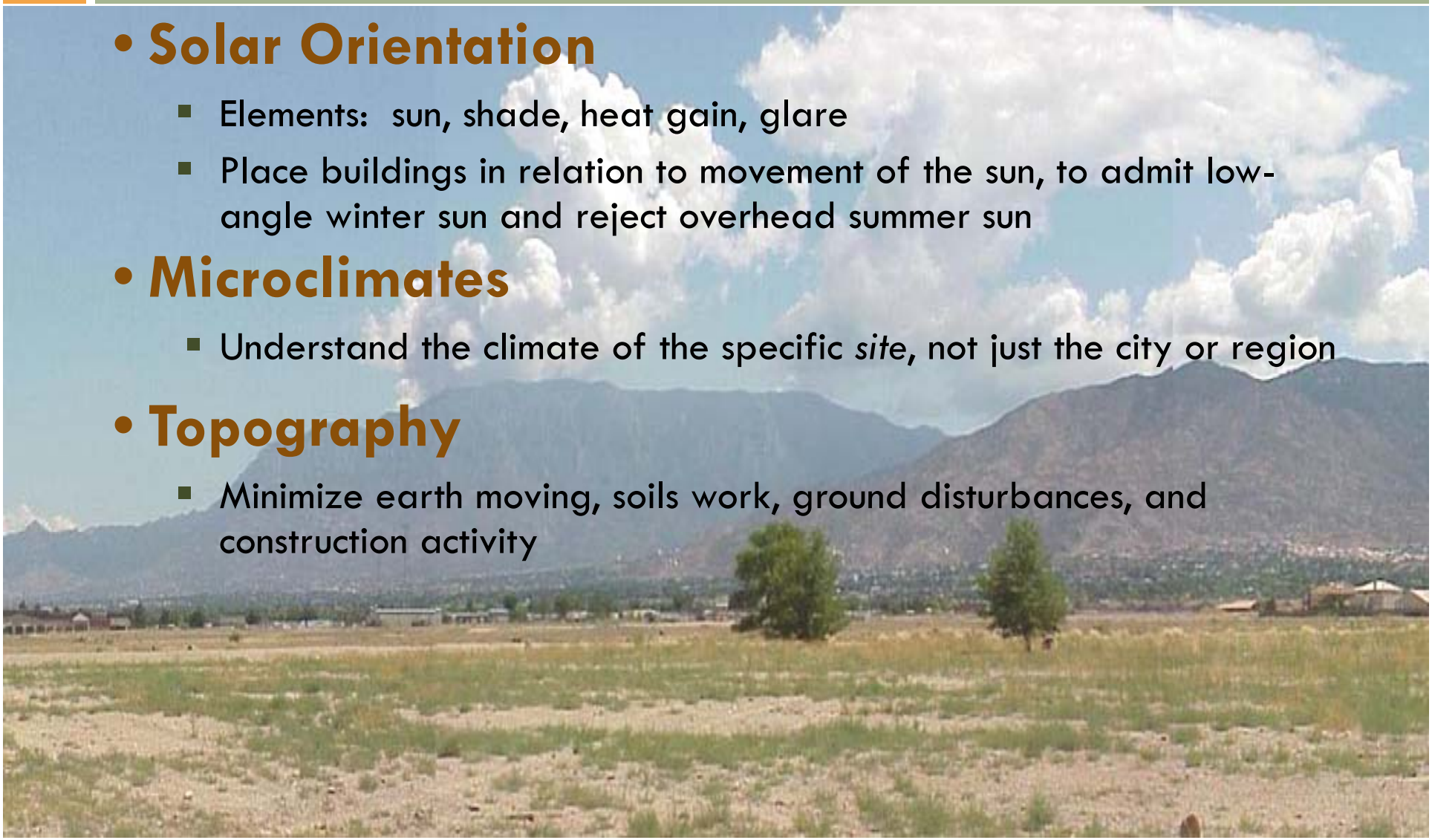
Sandia National Laboratories/California

Arroyo Seco Habitat Restoration Success Criteria		
Metric	**Success Criteria**	**Monitoring**
Overall survival of trees and shrubs planted (includes replants)	85%	Monitoring will continue until criteria met for 5 consecutive years - Running count of trees planted - Running count of shrubs planted - Annual count of number of trees surviving - Annual count of number of shrubs surviving
Tree cover (at 2 years)	40%	Sampling of random plots using densiometer
Tree cover (at 5 years)	60%	Sampling of random plots using densiometer
Tree cover (at 10 years)	75%	Sampling of random plots using densiometer
Shrub cover (at 2 years)	20%	Sampling of random plots using line intercept method
Shrub cover (at 5 years)	30%	Sampling of random plots using line intercept method
Shrub cover (at 10 years)	45%	Sampling of random plots using line intercept method
Native trees	75%	Annual count of native trees
Native shrubs	75%	Annual count of native shrubs
Riparian grass / ground cover (native)	90%	Sampling of random plots using Daubenmeyer technique
Wildlife and avifauna use	species richness and density comparable to other site areas along Arroyo Seco	Annual wildlife survey for types and numbers of individuals and nest / den sites

Planning Considerations

- **Site Development**
  - Plan for the use of land and development in a manner sensitive to site elements to reduce environmental impacts
  - Preserve natural resources, greenfields, and habitats
  - Locate buildings in response to environmental context
  - Minimize development footprint:
    - Reuse existing space
    - Promote infill
    - Use multistory buildings
    - Locate future development near existing infrastructure and transit routes

Planning Considerations



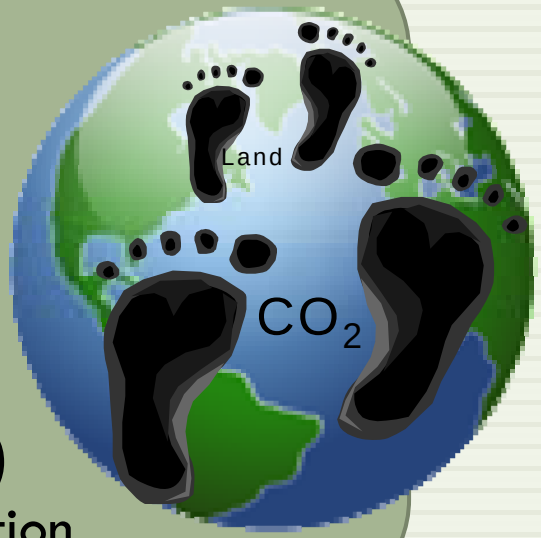
- **Solar Orientation**
  - Elements: sun, shade, heat gain, glare
  - Place buildings in relation to movement of the sun, to admit low-angle winter sun and reject overhead summer sun
- **Microclimates**
  - Understand the climate of the specific *site*, not just the city or region
- **Topography**
  - Minimize earth moving, soils work, ground disturbances, and construction activity

Planning Tools

- **Defining Sandia's Ecological Footprint**

Ecological Footprint Concept

- Measures human demand on nature
- Compares consumption of natural resources with Earth's regeneration capacity
- Estimates the land area required to support resource consumption, greenhouse gas (GHG) emissions, and waste generation of a population



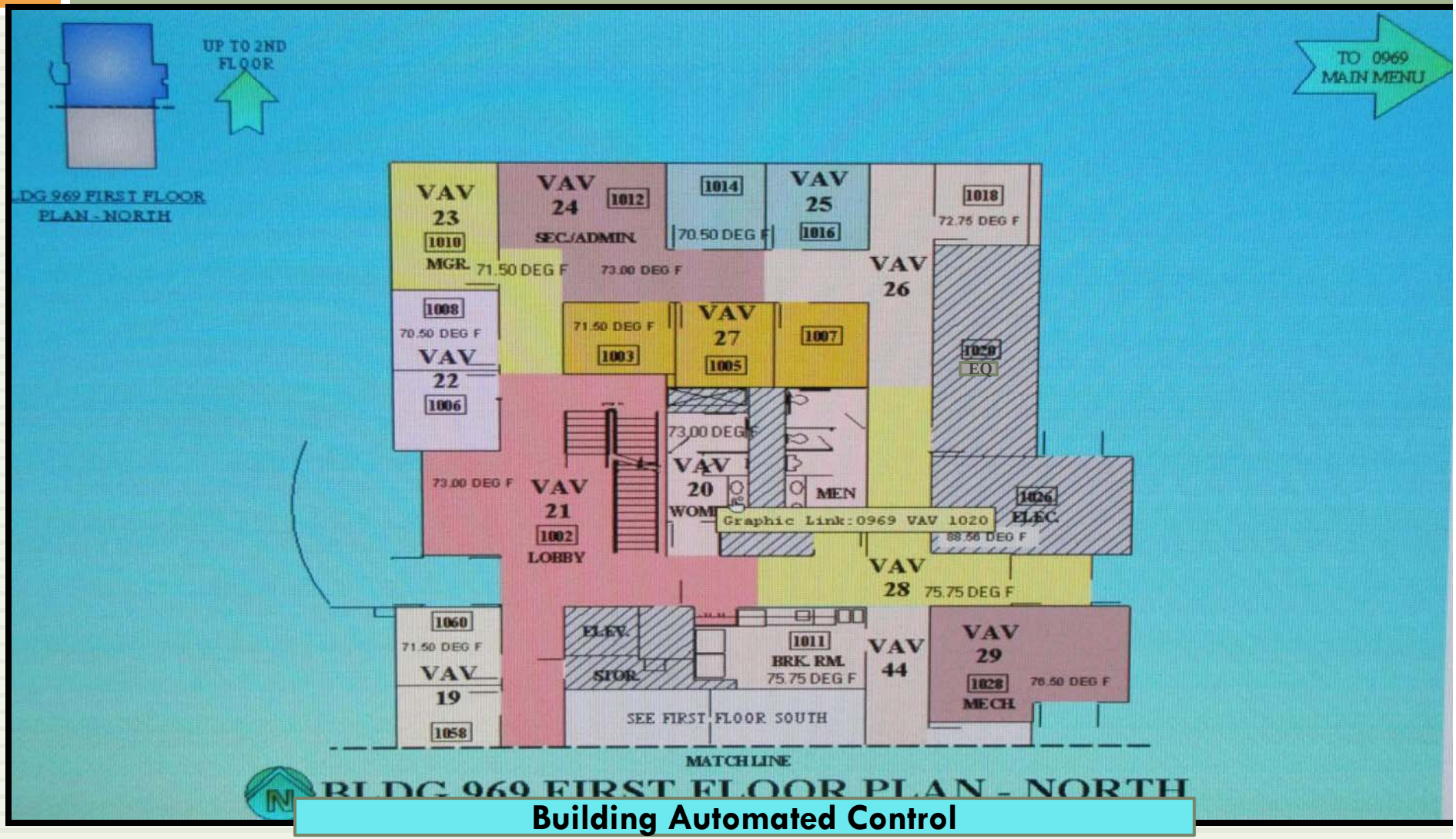
Green Buildings

- **Reduce Overall Impacts to the Built Environment**
  - Efficiently use energy, water, and other resources
  - Protect occupant health and improve employee productivity
  - Reduce waste, pollution, and environmental degradation
- **By these means and methods:**
  - Feature xeric native landscaping to minimize water use and preserve natural habitats
  - Use sustainable construction materials: reused items, recycled content, or materials made from renewable resources
  - Create healthy indoor environments with minimal pollutants or product emissions

SNL's Approach to Green Building

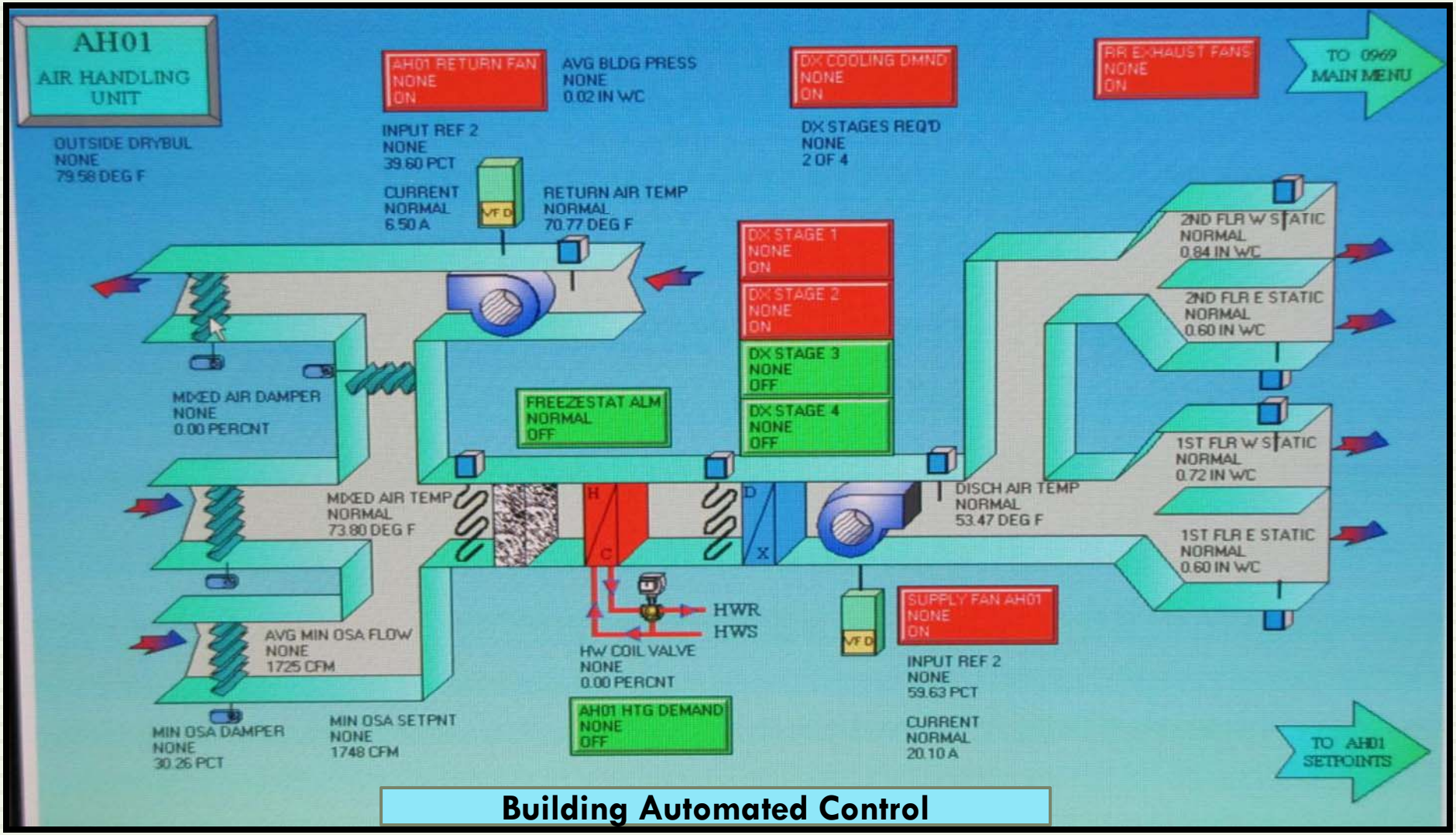
Federal Mandates	Sandia National Laboratories (SNL)	U.S. Green Building Council (USGBC) Leadership in Energy and Environmental Design (LEED®)
• Executive Orders • Department of Energy Directives • High-Performance Sustainable Building (HPSB) Guiding Principles for existing buildings	• Staff certified as CEM & LEED AP • Specifications • Design guides • Manuals • Plans	• Certifications ▪ Platinum ▪ Gold ▪ Silver

Energy Management



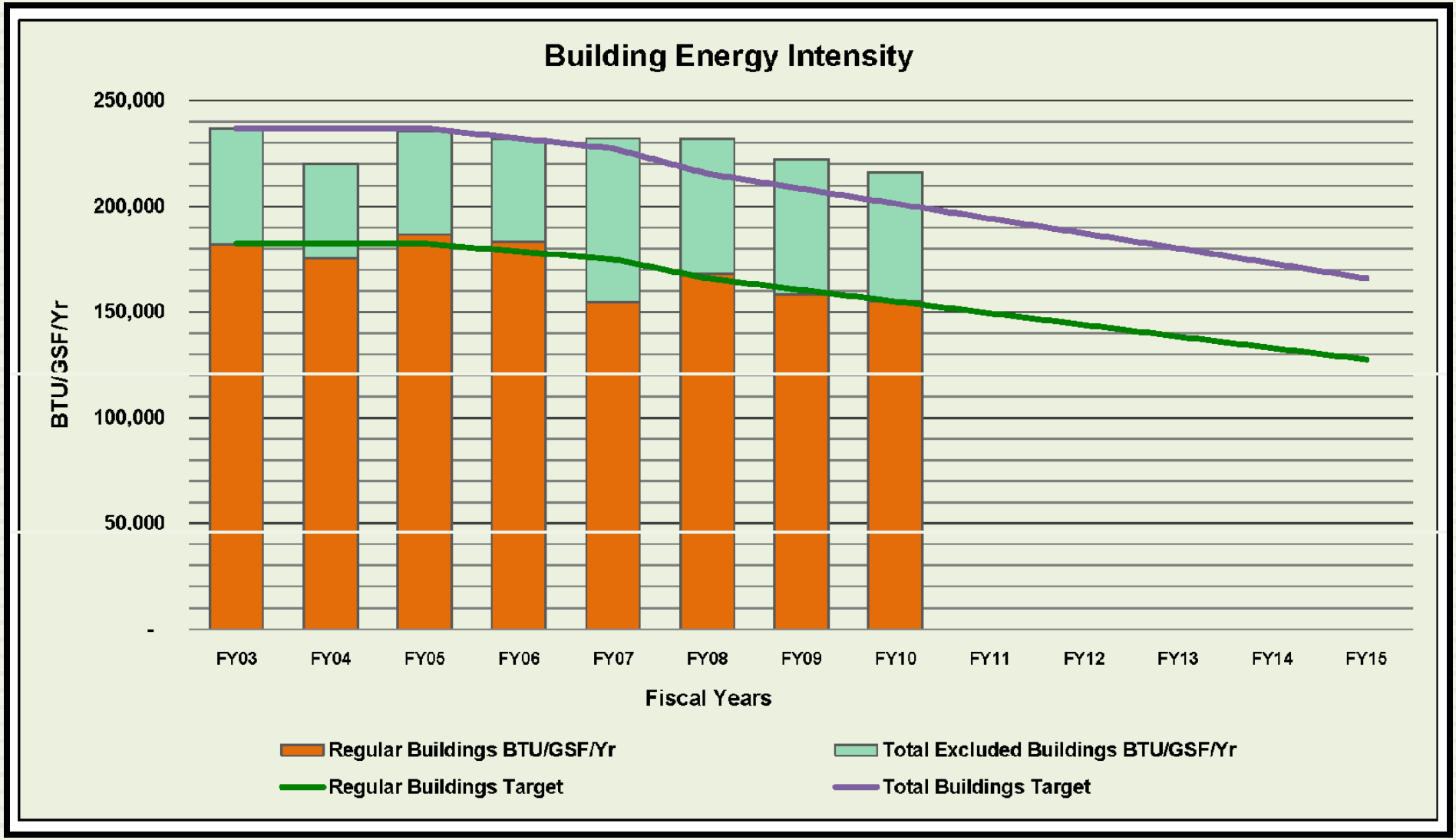
Building Automated Control

Energy Management

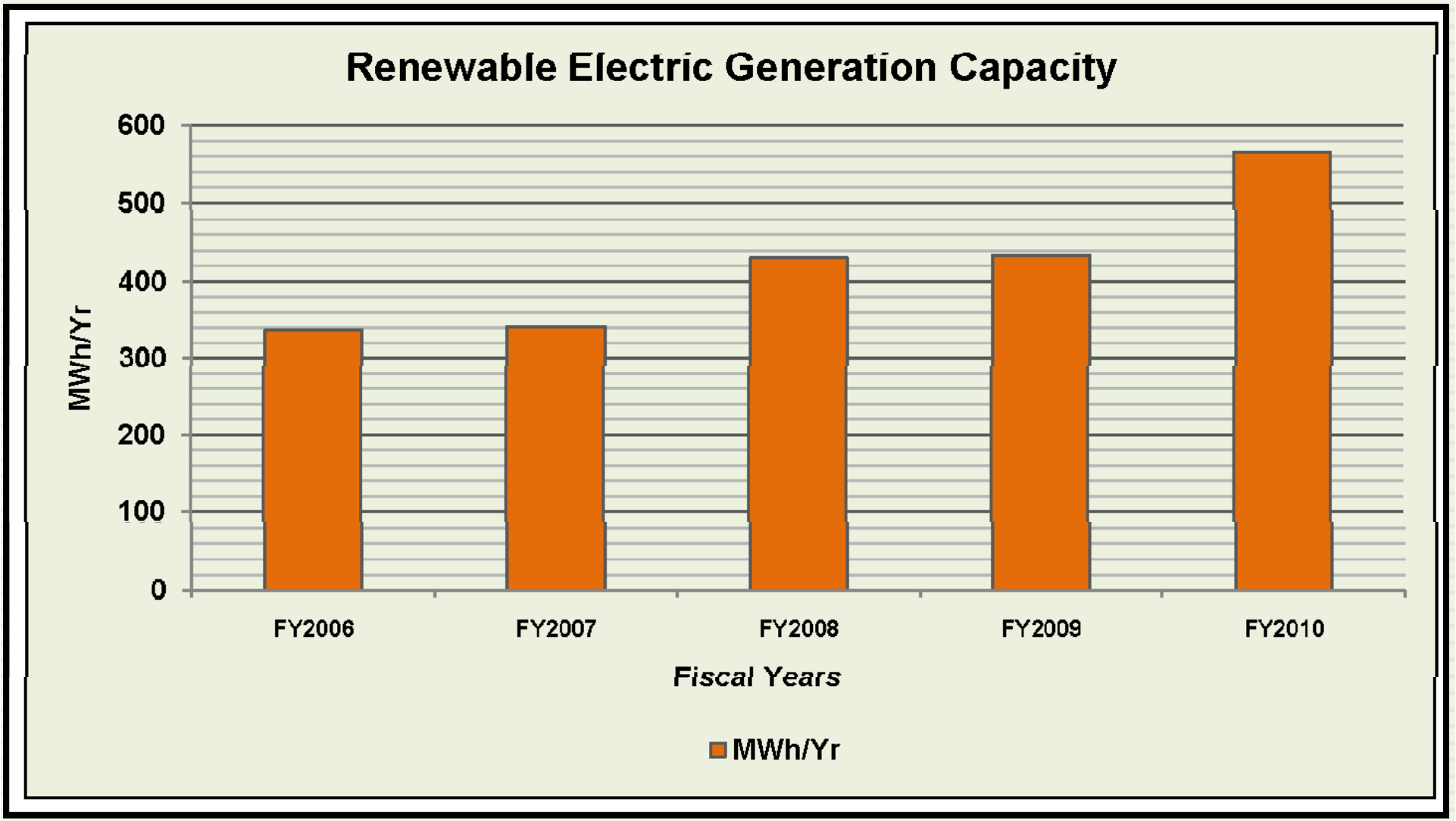


Building Automated Control

Energy Management



Renewable Energy



Resource Management

Conservation versus Renewables

NightWatchman software

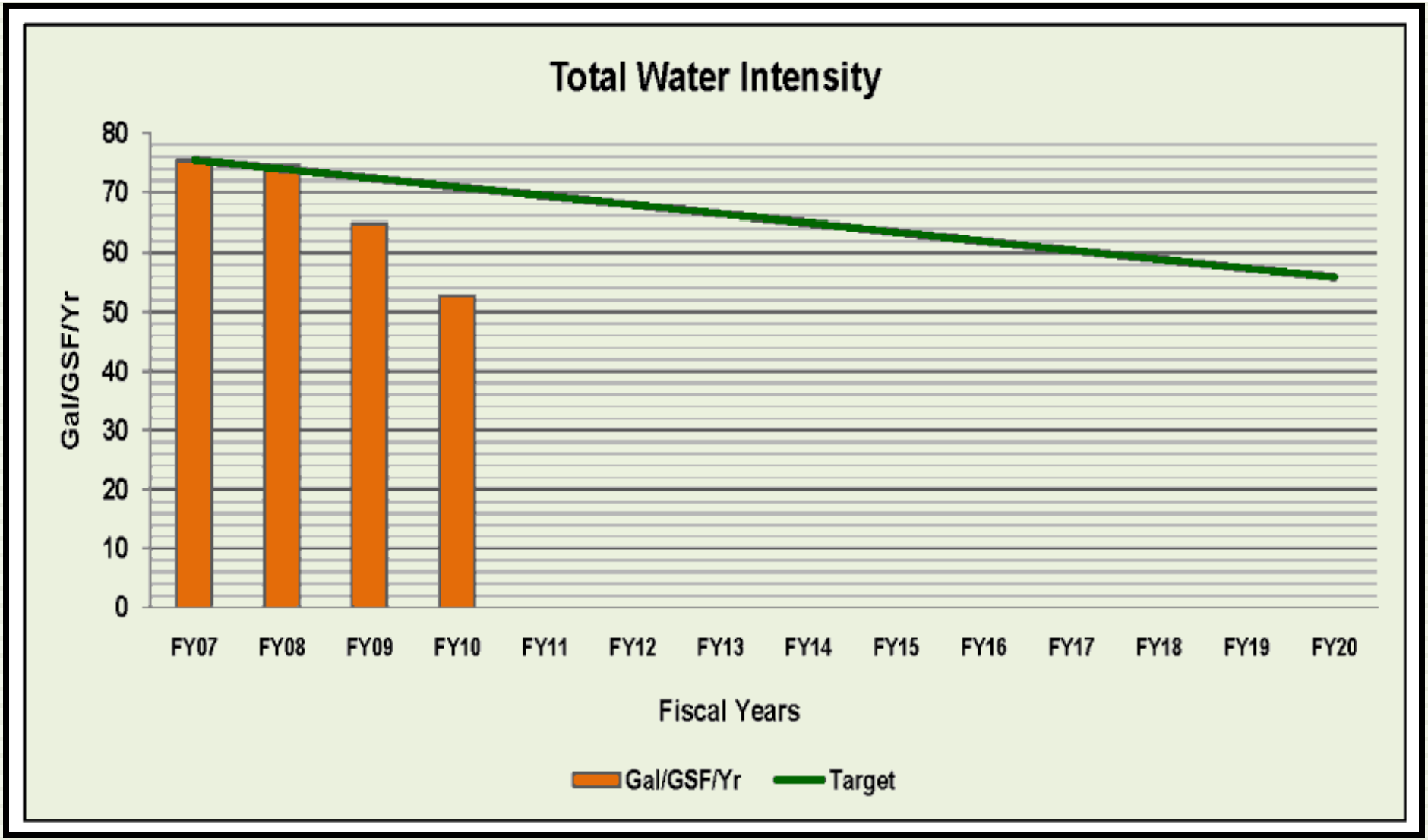
- Automatically puts computers during nonworking hours into stand-by or hibernate mode
- Electrical use reduction: 6088 MWh/yr
- Initial cost: $410,000
- Maintenance cost: $55,000
- Simple payback: <1 year

Photovoltaics

- To produce 6088 MWh of electricity per year, requires 2.5 MW of installed PV
- Cost of installed PV is coming down:
  - At $8/W, $20M, Payback = 44 years
  - At $6/W, $15M, Payback = 33 years
  - At $4/W, $10M, Payback = 22 years

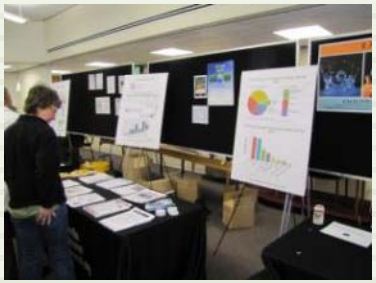
Every watt saved is a watt that doesn't need to be generated.

Water Management



Awareness

Events



Earth Day 2011

New!
Presentations on Request

Create Your Life, Your Nation, Your Planet
Safe Secure Sustainable

2010

October 2010
Energy-Awareness Month
7 exhibits on campus

New!
Monthly Exhibits

Resource Management

- **Accomplishments**
  - 7 LEED-certified buildings
  - Reduced water consumption
  - Reduced energy consumption
  - "Free cooling" system: 30%–40% energy reduction
  - Heating System Modernization: 216 million SCF of natural gas = 55%
  - Lighting controls: expect 10%–15% electric reduction per building
  - Lab exhaust optimization
  - NightWatchman® computer power-management system, to reduce site energy consumption by 2%

Resource Management

- **Challenges**
  - Sustainability and many aspects of long-range planning are not addressed in a systemic manner.
  - Sustainable design is still considered "optional" and not an integral part of the cost and way of doing business.
  - Generational divide: generally, younger staff are more flexible and willing to make changes.
  - Corporate approach: accustomed to a "project-centric" culture, not "program-centric."

Like safety, sustainability will occur most effectively when:
- it is integrated into all aspects of the business
- it becomes a natural way of thinking and acting

Campus Commons

- **Influenced by Sustainability Considerations**
  - Minimize site footprint to maximize corporate, DOE/NNSA, and environmental benefits.
  - Concentrate redevelopment within Technical Area 1.
  - Establish Campus Center and Innovation Corridor for mission-support services and to support outside partnerships.
  - Focus development along existing transit and utilities.

  - Preserve undeveloped land in Tech Area 2.

Thank you for your time!

Please feel free to contact me:

Jack Mizner
jhmizne@sandia.gov
505.845.3576

**Conservation is
a state of harmony
between men and land.
– Aldo Leopold
*Sand County Almanac***

**Someone has to do something,
and it's just incredibly pathetic
that it has to be us. – Jerry Garcia**