SAND2010-4913C

Sustainability & SNL

An Overview of Sandia National Laboratories' Sustainability Efforts

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Albuquerque, NM

Kauai, HI

Pantex, TX

Livermore, CA

Tonopah, NV

Yucca Mountain, NV

Carlsbad, NM

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Sandia Overview: New Mexico Site

- Located on Kirtland Air Force Base in Albuquerque, NM
- Almost 12,000 personnel
- 2,937 acres of DOE-owned land, 5,633 acres of permitted land (totaling 8,570 acres)
- 952 buildings totaling 6.9 million gross square feet
- 49 miles of paved roads, 38 miles of unpaved roads; 206 acres of roads and walkways
- Other utilities include high voltage and standby electrical; steam; natural gas; potable water and fire protection; sanitary and process waste water; storm drainage; chilled water; communications; landscaping; and site access control

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Energy Usage: The Hard Facts

- Last year SNL spent $13,500,000 in combined gas & electric usage
- Last year SNL used a total of 550,000,000 gallons of water
- Energy use is increasing
  - Programmatic missions are increasing (24/7operations)
- Cost of energy is rising
  - Sandia does not control the cost of utilities (Kirtland Air Force Base, DOE/NNSA, Government-owned facilities) – Rate increased 50%

Energy Management Requirements

Rules have changed over the years:

- DOE Order 430.2A required a 30% energy reduction by 2005 relative to 1985 baseline
- The Energy Policy Act of 2005 required a 2% energy reduction over 10 years relative to 2003 baseline
- Executive Order 13423 requires a 3% energy reduction over 10 years relative to 2003 baseline

Sustainability: A Campus Approach

- Planning & Construction Documents
- Energy audits & Retro-Cx
- Purchasing
- Solid waste management
- Green cleaning

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Sustainable Design at Sandia

- Leadership in Energy and Environmental Design (LEED) rating system
- Almost 10% of SNL NM square footage certified "green"
- 5 LEED New Construction (NC) Certified/Silver buildings
- 1 LEED NC Gold building in construction (certification pending)
- 1 LEED Existing Building Operations and Maintenance (EBOM) Silver registered building
- Certification are awarded by the United States Green Building Council (USGBC)

Communication

Cambridge University:

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Progress & Accomplishments

Energy Management Program Savings:

- $2.2 million energy savings from FY85-FY01 due to increased awareness, energy projects, improved designs, etc.
- Lighting program saved additional $452K/year in lighting costs
- 23% reduction in water usage since 1994
- 39% reduction of energy use in office-type buildings from FY85-FY01

- Variable Frequency Drive (VFD) installations
- Thermostat Setback
- Chilled Water Loop
- Lighting Retrofits
- Awareness Campaigns
- Computer Monitor Shut-off
- Chemical-Mechanical-Polishing
- Solar Projects (PV, Heating)
- Retro-commissioning
- Central Irrigation Control (CICS)
- Hybrid Lighting Project

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EMP: Additional Accomplishments

- Modified ~20,000 computer monitors to transfer to low energy standby mode when not in use, saving more than 2,008 MWH/year

- 56kW PV system being currently installed will put energy into the grid and produce a monthly credit on the Laboratories' electricity bill, saving energy and money

Campus Projects: Retro-commissioning

- Implementation of the retro-commissioning and building energy audit plans
- Focusing on performing retro-commissioning on approximately 25% percent of our square footage per year
- Retro-commissioning performed on buildings: 701, 880 and 6585. Conservative yearly savings estimates for 6585, 880, & 701 are $30k, $47k, and $50k respectively

Sandia Retro Challenges

- Building owners are focused on meeting mission/programmatic needs
- Outside of the fence, building owners are focused on lowering utility bills/ over head
- Everyone believes that energy is free
- These projects are great… As long as they are done in someone else's building
- Please don't touch my system, you might break it

LEED Case Studies: CINT

- 97,294 GSF
- 153 Occupants
- LEED Certified

- Over 40% of the building materials and products were manufactured within 500 miles of site
- High levels of recycled content in materials and products
- Integrated storm water management features retain all storm water
- Over 60% of landscaping is native and adaptive plants

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LEED Case Studies: FAB

- 97,050 GSF, including a CUB
- 50 Occupants
- First LEED Certified Semi-conductor plant in the world

- **Over 75% of construction waste diverted from landfill**
- **Employed innovative water reduction strategies**
- **Water recycling and reuse strategies save up to 60 million gallons per year**

LEED Case Studies: LAB

- 128,125 GSF
- 226 Occupants
- LEED Silver

- **Achieved alternative transportation credits (bike racks/ changing rooms, car and van pools)**
- **Features day lit spaces with fixed shade louvers**
- **Exterior of the building surrounds a core of laboratory spaces**

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LEED Case Studies: WIF

- 164,539 GSF
- 376 Occupants
- LEED Silver

- Rehabilitated a former Brownfield site
- Reduced heat island effect through use of a highly reflective, light colored roof and paving materials
- Features a PV demonstration shade structure
- Water feature utilizing recycled water

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LEED Case Studies: JCEL

- 66,143 GSF, plus 3,962 GSF CUB
- 175 Occupants
- First LEED Silver in NM

- **Energy efficient under floor air distribution system**
- **Water efficient landscaping**
- **Unique storm water infiltration system**
- **Landscape design that doubles as a security feature**

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Existing Buildings

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Greening Existing Buildings: Benefits

Reduce building operating costs

- Energy reduction
- Water use reduction

Improve worker satisfaction and productivity

- Indoor environmental quality

Showcase facilities

- SNL has the first LEED-EBOM building at Sandia and in New Mexico

LEED for Existing Buildings: (EB)

- Emphasis on Operations and Maintenance
- Rates building performance vs. design intent
- Period of Performance
- Must meet minimum energy performance to qualify
- Lends itself to a campus approach

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LEED EB: Credit Overview

Energy

- Commissioning, performance measurement (metering, BAS, staff training)

Green Cleaning Policy

- Covers products, materials, equipment, entryway systems, pest management

Sustainable Purchasing

- Covers low mercury lamps, facility alterations & additions

Solid Waste Management Policy

- Covers reuse, recycling or composting of waste

Outdoor maintenance

- Building exterior, landscape waste management, pest management

Indoor Air Quality

- Best practices management, monitoring, filtration, facility alterations & additions

LEED EB Case Study: Building 750

- 14,683 GSF
- 59 Occupants
- LEED Gold (pending)

- **SNL first use of LEED for EBOM**
- **Standard office occupancy similar to city office buildings**
- **Emphasis on O&M, Occupant Participation**
- **Achieved a 25% reduction in commuting**
- **47% reduction in indoor water usage**
- **78% reduction in outdoor water usage**
- **25% overall reduction in energy consumption**

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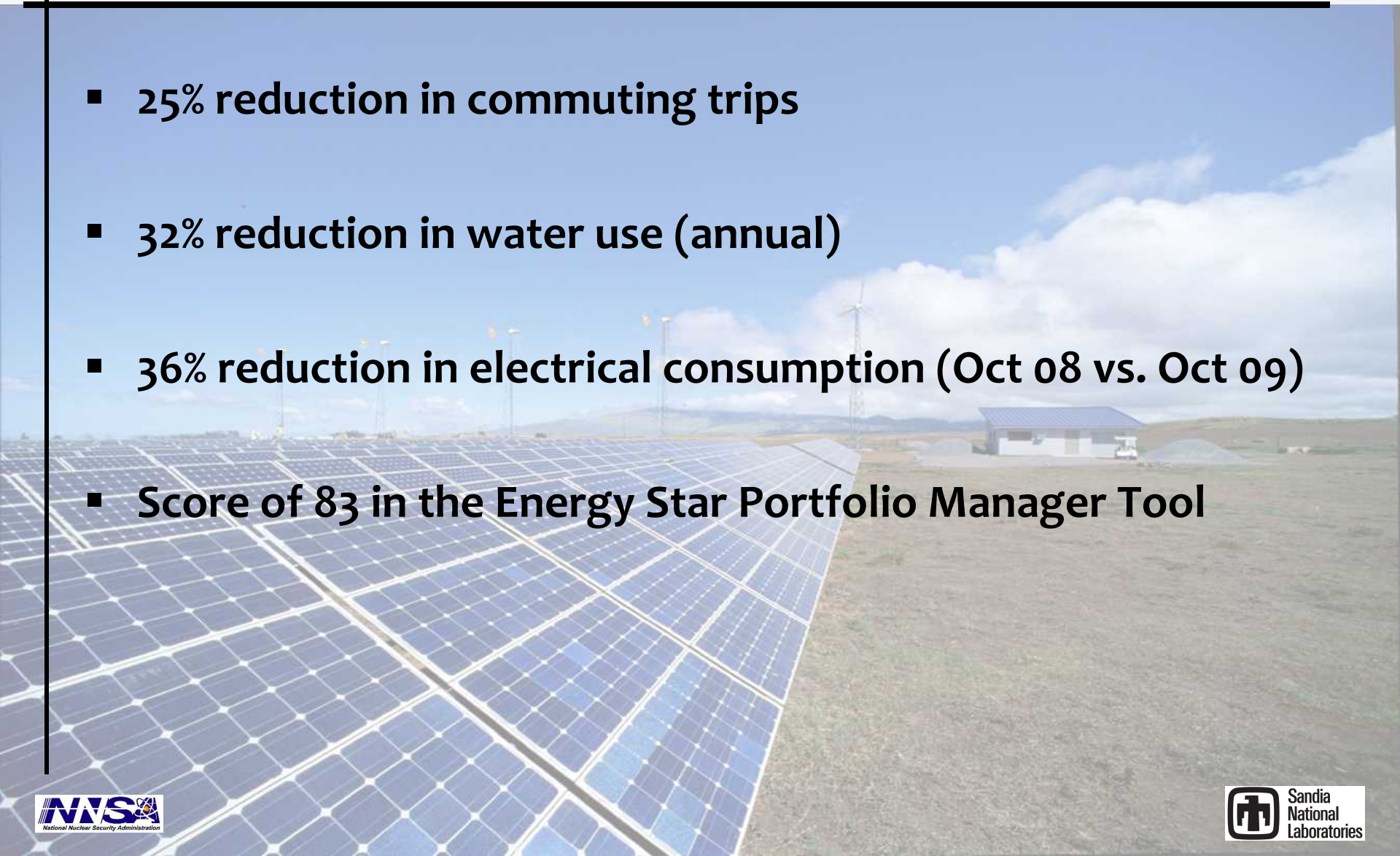
750 LEED EBOM: Period of Performance

- 25% reduction in commuting trips
- 32% reduction in water use (annual)
- 36% reduction in electrical consumption (Oct 08 vs. Oct 09)
- Score of 83 in the Energy Star Portfolio Manager Tool



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750 Project: Successes & Challenges

Marketing

- Management support & occupant participation is key

Campus Issues

- Green Cleaning/Procurement/
- Solid Waste Policies
- Site wide data vs. building level data

Energy performance

- Many non-standard, high process load facilities

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Roofing at Sandia

Greening the Site: Roofing Projects

- One of the primary objectives of the SNL/NM Roofing Team Program is to incorporate environmental sustainability features into the roofing system

- Reflective roofing can reduce the peak cooling demand of the building by 10-15%

Material Type	Bright White Material	Rough White Surface	Light Color	Intense light color (green, red)	Medium Gray	Built-up with gravel	Asphalt Shingle	Black Material
Roof Temp. (F)(Delta)	15F	35F	15-55F	79-83F	52F	50-65F	72-90F	90F

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Greening the Site: Roofing Projects

Roof Life Extension: Bio-based coatings are utilized (containing low VOC) preserve and extend the life of the roofs by 15 years

Reuse and Recycling

- A new TPO roof can be 100% recycled if replacement is necessary
- Gravel is given to maintenance to be used as landscaping gravel and erosion control. Total: 219 tons of recycled gravel

Enhancing the energy efficiency, R-30 insulation

Greening the Site: Roofing Projects

Maximized principles to all aspects of Roofing:

- **Meet California South Coast Air Quality Management District, Rule 1168, Adhesive and Sealant Applications and Regulation 8, Rule 51, Organic Compounds**
- **All contractors are required to submit manufacturer's documentation of Energy Star**
- **All contractors are required to submit Material Safety**
- **Data Sheets (MSDS) and documentation of Volatile**
- **Organic Compound (VOC) content**
- **Documentation of recycled content (minimum 9%) for polyisocyanurate insulation and each project must meet an average R-value of 30**

Greening the Site: Roofing Projects

- 60-mil single-ply TPO bright white membrane
- Cost effective to install
- R-30 insulation
- Ease of condition assessment
- Repairs/modification are done very easily
- Hot-air welding is required on all projects
- Roof life expectation of 20+ years

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Greening the Site: 833 BIPV

The SNL/NM Roofing Program is pro-active, efficient, and demonstrates leadership. Building 833 was recently re-roofed with a new Thermal Propylene Olefin (TPO) membrane which has embedded Photovoltaic (PV).

- PV roof is the first of its kind at Sandia
- Offsets some of the commercial electric power
- Higher insulation values (R-30)
- 3.0 kW of power for the building

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PV Systems at Sandia

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Greening the Site: Solar Lighting

Why Use Solar Lighting?

- Environment Friendly
- Operate independent of electric grid
- No trenching required
- Cost-effective
- Constant operation during blackouts
- Low operating costs

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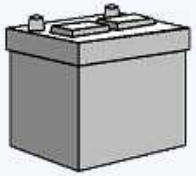
Greening the Site: Solar Lighting

How do they work?

Sun provides energy to the solar panel

Solar panel converts sunlight into electricity



Battery stores energy during the day

Battery releases energy at night to power light

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Conventional vs. Solar Costs

	Conventional (250W light with 25' Pole)	Solar LED (Includes fixture, panel, pole, batteries)
Unit cost	**$3,050**	**$4,500**
Trenching ($/ft)*	**$66**	**$0**
Wiring ($/ft)	**$10**	**$0**
Total Trenching/ Wiring Cost	**$7,600**	**$0**
Concrete Base	**$950**	**$950**
Light Installation	**$300**	**$300.00**
Total Installed Cost	$11,900	$5,750
Energy Usage	Conventional	Solar LED
kWh/yr	**1,186.25**	**0**
kWh rate	**$0.08**	**$0.08**
Total Energy Cost	$94.90	$0.00

***Reflects site which has no existing underground utilities**

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Greening the Site: PV Lighting

- Buildings 957 & 9981 Parking Lots
- The total cost of energy for Solar LEDs is $0.00
- Conventional fixtures cost $94.90 to power
- Solar LED fixtures cost $5,750 to install compared to the $11,900 it costs to install a conventional fixture

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Greening the Site: PV Bollards

- Prototype on Sandia – NM
- 2,000 kWh of energy production per year
- Projected energy savings of 6,824,000 BTU per year
- Significant Infrastructure cost savings

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Greening the Site: PV Shade Structure

A 3.15kW PV shade structure for the Innovation Corridor was successfully implemented in January 2008

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Greening the Site: PV Carts

- Currently 350 Carts at SNL-NM
- Carts used in place of larger gas powered vehicles for campus transportation
- Electric Carts share cord reels 2 to 1
- Cart no longer need to be plugged in to charge
- PV Carts share cord reels 5 to 1
- Infrastructure savings: $10,000 each
- Solar panel collects sunlight and trickle charges batteries
- Longer battery life

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Greening the Site: PV Carts

The PV Cart offsets

- Average 375 kWh of electricity annually
- 787 pounds of coal burned each year
- 528 pounds of CO_2 per year

Converting all carts on site to PV will have significant positive impacts on the environment

Future Projects

- Building 956 BIPV-50kW system
- PV Cart Charging Stations
- Building 887, PV Shade Structure
- PV Parking/Pedestrian Lights
- Eco-planning
  - PV Farm
  - Campus water harvesting

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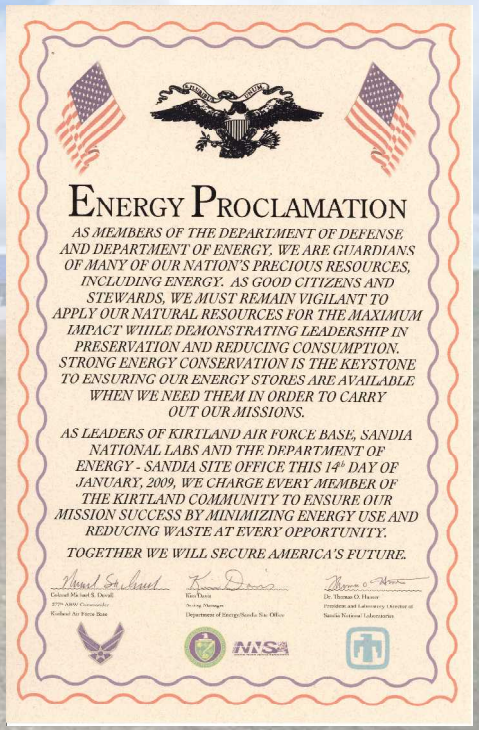
Energy Partnering

Energy Awareness

- Energy Proclamation signing and associated events with KAFB, DOE/NNSA

- KAFB/SNL Energy Competition



ENERGY PROCLAMATION

AS MEMBERS OF THE DEPARTMENT OF DEFENSE AND DEPARTMENT OF ENERGY, WE ARE GUARDIANS OF MANY OF OUR NATION'S PRECIOUS RESOURCES, INCLUDING ENERGY. AS GOOD CITIZENS AND STEWARDS, WE MUST REMAIN VIGILANT TO APPLY OUR NATURAL RESOURCES FOR THE MAXIMUM IMPACT WHILE DEMONSTRATING LEADERSHIP IN PRESERVATION AND REDUCING CONSUMPTION. STRONG ENERGY CONSERVATION IS THE KEYSTONE TO ENSURING OUR ENERGY STORES ARE AVAILABLE WHEN WE NEED THEM IN ORDER TO CARRY OUT OUR MISSIONS.

AS LEADERS OF KIRTLAND AIR FORCE BASE, SANDIA NATIONAL LABS AND THE DEPARTMENT OF ENERGY - SANDIA SITE OFFICE THIS 14th DAY OF JANUARY, 2009, WE CHARGE EVERY MEMBER OF THE KIRTLAND COMMUNITY TO ENSURE OUR MISSION SUCCESS BY MINIMIZING ENERGY USE AND REDUCING WASTE AT EVERY OPPORTUNITY.

TOGETHER WE WILL SECURE AMERICA'S FUTURE.

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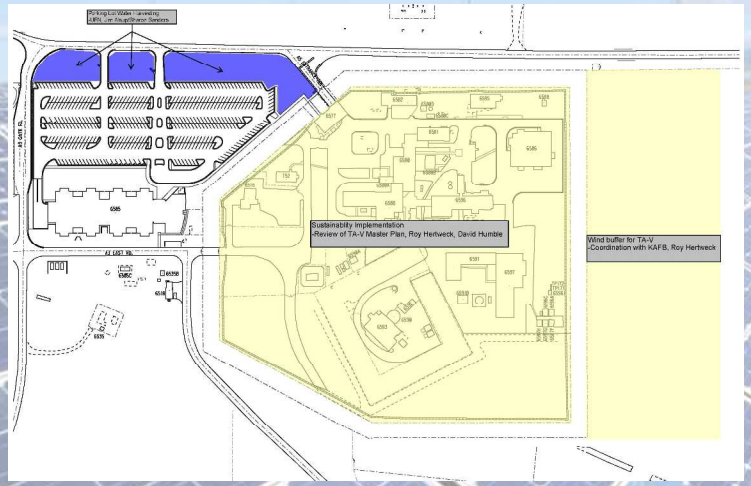
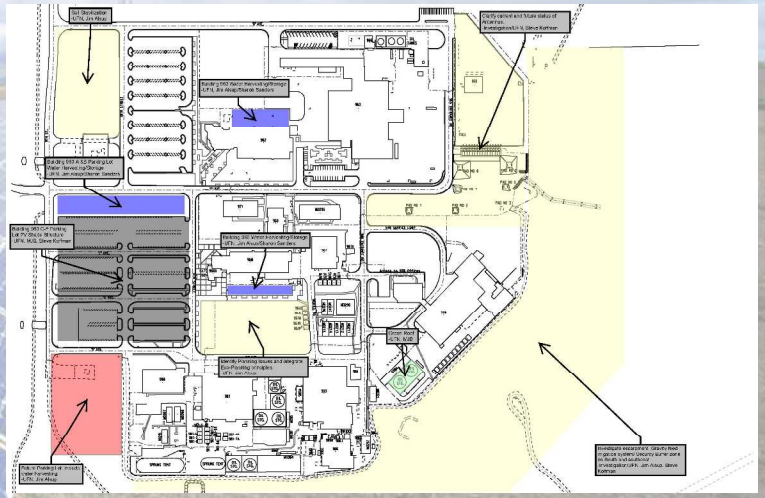
Eco Planning: Site Analysis

Continued analysis of the SNL site to explore renewable and sustainable potential. Phase-II, which will explore the south portion of TA-I, TA-III and TA-V began in Nov. 2009.

- **Wind**
- **PV**
- **Water Harvesting**
- **LEED**





Questions & Comments

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Additional Information

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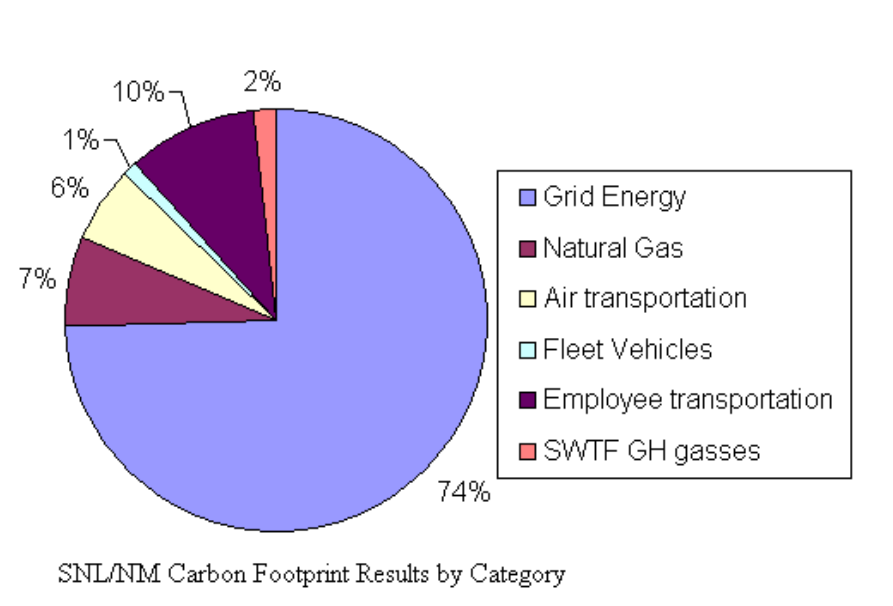
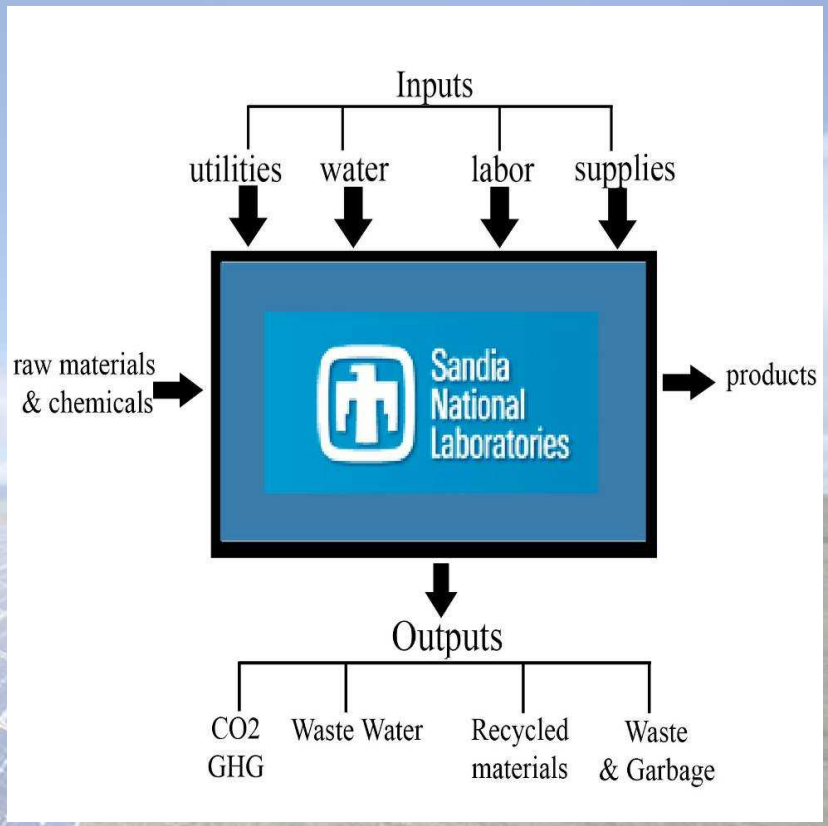
Ecological Footprint



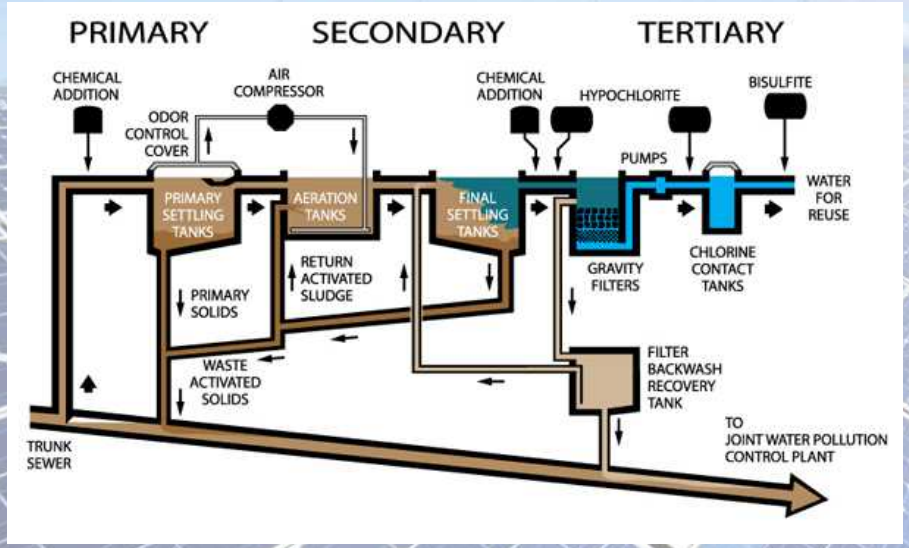
SNL/NM Carbon Footprint Results by Category



SNL Ecological Footprint:

- 76525.63 ha

WAC-Water Reclamation



Weak Acid Cation (WAC) Regeneration Tank

- Tank and piping upgrades
- Water to be diverted for the reclaim system
- Simple piping modifications
  - Approximately 15 million more gallons per year potential savings