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Title: Site Sustainability Plan Los Alamos National Laboratory FY 2017

Author(s): Witt, Monica Rene
Ballesteros Rodriguez, Sonia

Intended for: DOE submittal.
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Site Sustainability Plan


Los Alamos National Laboratory FY 2017



Los Alamos National Laboratory
FY 2017 Site Sustainability Plan

Approvals

Prepared by:




Monica Witt, Laboratory Sustainability Officer

11.10.16

Date

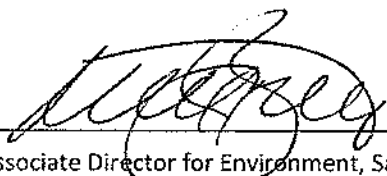
Approved by:



Cheryl Cabbil, Associate Director for Nuclear and High-Hazard Operations

11/15/2016


Date



Michael Brandt, Associate Director for Environment, Safety, and Health

11/10/16

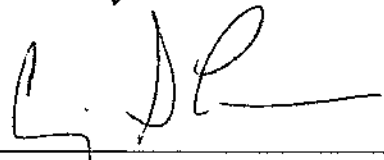
Date



Carolyn Zerfle, Associate Director for Business Innovation

11/15/16

Date



Craig Leasure, Principal Associate Director for Operations and Business

11/18/2016

Date

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EXECUTIVE SUMMARY

INTRODUCTION

Los Alamos National Laboratory (LANL) is taking actions to implement sustainable solutions as part of doing business – focusing on making changes driven by deep analysis and new technology. Major actions include replacing the original Steam Plant with a new, more energy efficient, Combined-Heat and Power Plant. In addition, LANL is preparing a proposal to develop a 10 Mega Watt (MW) Photovoltaic (PV) installation to support increasing power needs for high performance computing.

Executive Order (EO) 13693, Planning for Federal Sustainability in the Next Decade, and The United States (U.S.) Department of Energy (DOE) Strategic Sustainability Performance Plan (SSPP) detail sustainability goals for the Department, including:

- Planning, executing, evaluating, and continually improving operations to maximize sustainable use of energy and water
- Developing cost-effective energy efficiency and renewable energy (RE) projects
- Improving the performance of existing facilities and planning for net-zero energy, water, and waste in facilities
- Using low-greenhouse gas (GHG)-emitting energy sources to replace existing grid energy
- Preventing pollution and reducing or eliminating the generation of waste
- Planning for climate resiliency

LANL prepared the fiscal year (FY) 2017 Site Sustainability Plan (SSP) to describe progress toward the goals established in this new EO and the DOE SSPP. In addition, per the requirements of DOE Order 436.1, Departmental Sustainability, LANL uses its International Organization for Standardization (ISO) 14001:2004 certified Environmental Management System (EMS) to establish objectives to improve compliance, reduce environmental impacts, increase operational capacity, and meet long-term sustainability goals.

SITE SUSTAINABILITY MANAGEMENT VISION

The Laboratory's vision for Sustainability is as an integral part of our mission to meet the Nation's scientific challenges. The annual Site Sustainability Plan is one of the institution's key plans to focus on three primary objectives: make targeted investments that improve our efficiency and resource utilization, transparently track our progress through metrics, and engage employees and programs at all levels in the organization. The intent of the Sustainability Program is to include energy and water conservation and cleaner production measures into everyday business practices. The program manages, implements, and tracks progress toward meeting DOE SSPP's goals.

LANL's sustainability successes support and encourage efficient business practices. Investments in local, economically viable, renewable energy systems, facility improvements, pollution prevention, footprint reduction, analytics, and sound metrics form a firm foundation to advance sustainability. In addition, just as critical to success, is the partnership between the science to advance sustainability and the operations responsible for implementing sustainability. The synergy between the scientific and

operational staff provides a unique capability that can cultivate a new environment to bridge the gap between mission growth and resource use beyond existing capacity.

PLANNING

The Sustainability Program coordinates planning efforts with organizations responsible for developing the Laboratory's major infrastructure improvements and site upgrades. LANL has made significant improvements in energy and water efficiency; however, increasing energy and water use is forecast due to significant growth in high performance computing and MaRIE (Matter-Radiation Interactions in Extremes), a facility designed to support key NNSA goals. The Laboratory may quadruple its energy use in high performance computing facilities, significantly increase its water use in cooling towers, and cannot reasonably meet the SSP goals without major infrastructure and utility investments.

The challenges presented by the sustainability goals established in DOE's SSPP requires innovative solutions, additional resources, and specialized technical skills. Laboratory management acknowledges the conflict in forecast mission growth and the SSPP energy, water, and GHG reduction goals. The Laboratory will focus efficiency measures within facilities that have a potential to successfully impact energy and water reduction goals and allow the Laboratory to successfully compete for mission growth opportunities. In addition, to make progress toward the water reduction goals, the Laboratory will continue to operate SERF and implement small water reduction projects. The Sustainability Program's funding strategy includes projects that require a diverse set of funding mechanisms including indirect, direct, Energy Savings Performance Contracts (ESPCs), and Power Purchase Agreements (PPAs).

PEOPLE AND PROCESS

The Sustainability Program is managed through the Principal Associate Director for Operations and Business. The Laboratory issued a Sustainability Program description document, which defines the established framework the Laboratory has built to meet the sustainability goals prescribed by the DOE SSPP. LANL management is engaged and very supportive of the program and projects such as the proposed Steam Plant Replacement Project, financed as an ESPC. This project will significantly reduce greenhouse gas emissions and will also reduce energy intensity.

Staffing levels for the Program include four full-time employees for executing the metering program, energy and water conservation project implementation, energy and water audits, program reporting and communication, and program management. In addition, a number of additional staff from Engineering Services, Construction Management, and Utilities and Institutional Facilities (UI) Operations and Maintenance supports project execution for the Sustainability Program. The Sustainability Program established the Building Automation and Data Acquisition Team within the UI Division in order to implement energy efficiency strategies, such as night-setbacks and analyze building mechanical and operating systems using energy analytics software.



Picture 1. LANL Building Automation and Data Acquisition Team

While the Sustainability Program focuses on energy, water and GHG reduction goals of the SSPP, it collaborates with the Environmental Protection & Compliance Division to achieve a number of the Sustainability goals, including waste reduction and diversion, effluent and emission discharge reductions, the Hazardous Waste Facility Operating Permit, the EMS, and the Long Term Strategy for Environmental Stewardship and Sustainability.

SUCSESSES AND CHALLENGES

The FY 2017 SSP builds on the FY 2016 accomplishments and outlines FY 2017 actions that enable LANL to continue progress toward DOE's sustainability goals and reporting requirements. Successes include the following:

- 34 HPSB-candidate facilities with an average of 90% Guiding Principles (GPs) compliance
- 10 of the 33 HPSB-candidate facilities are 100% compliant with the GPs
- Completed Building Automation System upgrades from old pneumatic to digital control systems in 3 facilities
- Completed recommissioning efforts in 4 facilities
- SERF sent over 23 million gallons of reclaimed wastewater to the Strategic Computing Complex for reuse within its cooling towers
- Implementation of SkySpark software in five buildings to implement continuous automatic analyses
- Achieved a cost avoidance of \$3.4M through pollution prevention projects

- Initiated a new Smart Labs Program for energy efficiency in Laboratory space modeled after the University of California, Irvine
- Piloted new tablet software for Energy and Water audits called EMAT
- Defined the scope for the Steam Plant Acquisition Project and down-selected to three final ESCOs to perform the preliminary assessment for an ESPC project

LANL reduced its water intensity by 9% compared to FY 2007 and reduced its energy intensity (BTU/sq. ft.) by 1% compared to last fiscal year (the baseline year). Although, LANL did not meet its annual target of a 2.5% energy intensity reduction, major emphasis was placed on the Smart Labs Program, modeled after the University of California, Irvine's successful energy efficiency program for laboratory facilities. Time and effort spent to grow these long term initiatives that will drive the Laboratory closer to meeting the FY 2025 GHG emissions reduction goals and will better position the Laboratory to adapt and compete for future mission work. In addition, data shows no baseload energy growth, although over 500 new employees were hired. LANL's Sustainability investments, including increased power production capability, are designed to maintain limited baseload growth, allowing for hiring and mission growth. Strategically planned energy efficiency projects combined with a phased approach to increase renewable power purchases can support a commitment to an additional 1% reduction during FY 2017.

Through investments in building automation systems, lighting, and other efficiency projects, LANL plans to achieve the following goals in FY 2017:

- Reduce energy intensity by 2% compared to the FY2015 baseline
- Maintain water use at or below FY 2016 levels

Figure 1, below, shows steady energy reduction since 2003, and a significant decline in square footage due to footprint reduction efforts.

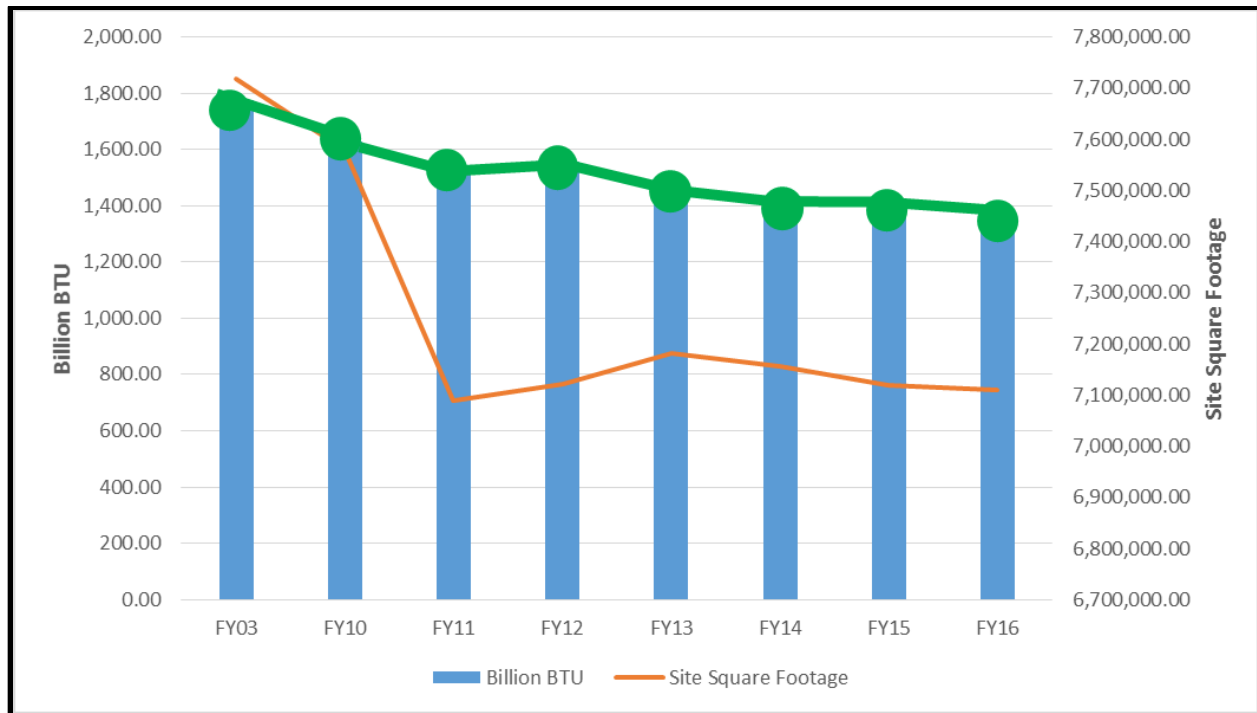


Figure 1. Site Energy Use Compared to Site Growth

The Sustainability Program is working through the EMS program to institute cultural change across the Laboratory to reach sustainability goals. Outreach efforts drive cultural change, and this change requires the use of a sustainability lens in all corporate management decisions: planning, executing, evaluating, and improving operations to maximize and support sound business practices.

FUNDING

In FY 2016, the Laboratory invested:

- \$3.4M in indirect program funding for the Sustainability Program
- \$3M in indirect funding to operate the Sanitary Effluent Reclamation Facility (SERF) to maintain water reductions
- \$1.7M indirect program funding for the Pollution Prevention Program

The Laboratory is also investing in facility renovation and rehabilitation to improve facility condition in and consolidate operations. These efforts are being conducted in conjunction with the footprint reduction efforts at the Laboratory to right-size available institutional space. Many of the facility renovation, rehabilitation, or footprint reduction efforts have a corresponding benefit to reduce overall energy and water consumption.

LANL will leverage direct funding from the NA-50 Asset Management Program (AMP) and the Recapitalization Program to optimize energy efficiency opportunities. For FY17, LANL has planned approximately \$38M in Recapitalization projects that will have the added benefit of reducing

energy consumption; and the projects prioritized for the AMP will focus on replacement of common building systems (i.e. roofing, heating and cooling) with more modern and efficient units. It is anticipated that this program will expand to other systems with sustainability elements, such as water conservation.

LANL provides institutional funding to implement pollution prevention (P2) projects to ensure compliance with DOE O 436.1, DOE O 435.1, DOE O 458.1, and the New Mexico Environment Department (NMED) Hazardous Waste Facility Permit. The funding covers P2 program and projects, core subject matter expert (SME), institutional support staff, EMS program and compliance reporting.

GOAL TARGETS SUMMARY TABLE

SSPP Goal #	DOE Goal	Performance Status through FY 2016	Planned Actions & Contribution	Risk of Non-attainment
Goal 1: Greenhouse Gas Reduction				
1.1	50% Scope 1 & 2 GHG reduction by FY 2025 from a FY 2008 baseline (2015 target: 19%)	LANL exceeded the annual target of 22% reduction and achieved 32% reduction in Scope 1&2 GHG emissions compared to the FY 2008 baseline.	LANL plans to reduce GHG emissions by replacing the central steam plant with a CHP. LANL is also pursuing an option for a 10MW photovoltaic installation. Pollution Prevention efforts in FY16 will focus on reducing Scope 1 SF ₆ emissions.	Low
1.2	25% Scope 3 GHG reduction by FY 2025 from a FY 2008 baseline (2016 target: 7%)	LANL exceeded the annual target of 7% reduction and achieved a 22 % reduction in Scope 3 GHG emissions.	LANL is evaluating telecommuting as an option to reduce overall employee commuting.	Low
Goal 2: Sustainable Buildings				
2.1	25% energy intensity (Btu per gross square foot) reduction in goal-subject buildings, achieving 2.5% reductions annually, by FY 2025 from a FY 2015 baseline	LANL did not meet the annual target of 2.5% reduction compared to 2015. LANL reduced its energy intensity 1% compared to 2015. This reduction is due to decrease in electricity usage and facility energy efficiency projects.	LANL will continue to invest in energy reduction initiatives, including BAS upgrades, Heating, Ventilation, and Air Conditioning (HVAC) recommissioning in facilities, HVAC and lighting upgrades, Smart Labs Initiative, and footprint reduction.	High
2.2	EISA Section 432 energy and water evaluations	LANL met the annual target of 25% energy and water assessments completed in the EISA07 "covered" facilities.	LANL will continue to evaluate "covered" facilities on a 4-year cycle to identify energy and water conservation measures and prioritize and implement energy and water conservation projects.	Low

2017 Site Sustainability Plan

SSPP Goal #	DOE Goal	Performance Status through FY 2016	Planned Actions & Contribution	Risk of Non-attainment
2.3	Meter all individual buildings for electricity, natural gas, steam and water, where cost-effective and appropriate ¹	LANL has 365 meters: 270 electric meters, 53 natural gas meters, 2 steam meters and 40 water meters.	LANL plans to install meters during major renovations and in facilities with planned “Smart Lab” upgrades. Under the SEP LANL Potable Line Replacement project, approximately \$1-1.75 million will be used to install water metering equipment to more fully assess the demand in high use facilities and to meter several segments of the distribution piping network to monitor for abnormal water usage and high flows to help identify potable water supply losses.	High
2.4	At least 17% (by building count or gross square feet) of existing buildings greater than 5,000 gross square feet (GSF) to be compliant with the <i>revised</i> Guiding Principles for HPSB by FY 2025, with progress to 100% thereafter ²	LANL has achieved an average of 90% Guiding Principles implementation for HPSB in 34 selected facilities across the site. Five percent (10 buildings) of existing buildings greater than 5,000 gsf are 100% compliant with HPSB.	LANL will continue to focus on high-ROI elements of the Guiding Principles, such as re-commissioning and developing a continuous commissioning program to maintain energy savings.	Medium
2.5	Efforts to increase regional and local planning coordination and involvement	The Laboratory sponsors and engages interactive and ongoing relationships with all neighbors to promote common goals and interest, as well as resolving cross-jurisdictional issues. The Laboratory participates as a positive partner in many community efforts and, as large stakeholder, has the ability to bring diverse entities together in a common effort.		Low
2.6a	Net Zero Buildings: 1% of the site’s existing buildings above 5,000 gross square feet intended to be energy, waste, or water net-zero buildings by FY 2025	LANL is benchmarking other DOE facilities with existing net-zero facilities in order to review site Engineering Standards for net-zero inclusion.		Medium

¹ Per NECPA (42 U.S.C Section 8253) the term “buildings” includes industrial, process, or laboratory facilities.

² HPSB targets cited in this SSP Guidance correlate with previous Executive Orders. Revised Guiding Principles will be published in the near future that will amend these targets through 2025. Until those updates are completed and distributed, report progress in this goal area using the previously established targets.

2017 Site Sustainability Plan

SSPP Goal #	DOE Goal	Performance Status through FY 2016	Planned Actions & Contribution	Risk of Non-attainment
2.6b	Net Zero Buildings: All new buildings (>5,000 GSF) entering the planning process designed to achieve energy net-zero beginning in FY 2020	LANL is evaluating its 10-Year Site Plan for opportunities to engage net-zero design elements. LANL is also benchmarking other DOE facilities with net-zero facilities in order to review site Engineering Standards for net-zero inclusion.		Medium
Goal 3: Clean & Renewable Energy				
3.1	“Clean Energy” requires that the percentage of an agency’s total electric and thermal energy accounted for by renewable and alternative energy shall be not less than: 10% in FY 2016-2017, working towards 25% by FY 2025.	LANL exceeded the annual target of 10% and obtained 15% of its total energy, electrical and thermal, from renewable or alternative sources.	LANL is pursuing an onsite 10MW photovoltaic installation through a Power Purchase Agreement.	Low
3.2	“Renewable Electric Energy” requires that renewable electric energy account for not less than 10% of a total agency <u>electric</u> consumption in FY16-17, working towards 30% of total agency <u>electric</u> consumption by FY 2025.	LANL exceeded the annual target of 10% and attained 24% renewable energy due to the 3 megawatt Abiquiu Low Flow Turbine, the addition of the megawatt-scale PV plant to its generation profile, and will purchase over 100,000 RECs.	LANL will continue to purchase RECs and utilize available renewable sources. LANL is also pursuing an onsite 10MW photovoltaic installation through a Power Purchase Agreement.	Low
Goal 4: Water Use Efficiency & Management				
4.1	36% potable water intensity (Gal per gross square foot) reduction by FY 2025 from a FY 2007 baseline. (2016 target: 18%)	LANL achieved a 9% reduction in water intensity compared to FY 2007.	LANL will continue SERF operations and implementing small, targeted water conservation measures. LANL will also increase water metering in order to better track water consumption in high-use facilities.	Medium

SSPP Goal #	DOE Goal	Performance Status through FY 2016	Planned Actions & Contribution	Risk of Non-attainment
4.2	30% water consumption (Gal) reduction of industrial, landscaping, and agricultural (ILA) water by FY 2025 from a FY 2010 baseline. (2016 target: 10%)	Currently, all of LANL’s water use is potable water and is, therefore, considered part of the 36% water intensity reduction goal reporting.	LANL will not report on ILA goal but will focus efforts in total potable water intensity reduction	N/A
Goal 5: Fleet Management				
5.1	30% reduction in fleet-wide per-mile greenhouse gas emissions reduction by FY2025 from a FY 2014 baseline (2016 target: 3% 2017 target: 4%)	LANL exceeded the annual target of 3% and achieved a 6% reduction compared to the FY 2014 baseline.	LANL will continue to order more fuel efficient vehicles, low-GHG emitting vehicles.	Low
5.2	20% reduction in annual petroleum consumption by FY 2015 relative to a FY 2005 baseline; maintain 20% reduction thereafter. (2016 target: 20%)	LANL exceeded the annual target of 20% and achieved a 25% reduction in fleet petroleum usage compared to the FY 2005 baseline.	LANL will continue to order more fuel efficient vehicles, low-GHG emitting vehicles.	Low
5.3	10% increase in annual alternative fuel consumption by FY2015 relative to a FY2005 baseline: maintain 10 increase thereafter (2016 target: 10%)	LANL exceeded the annual target of 159% and achieved 378% alternative fuel consumption.	LANL will continue to order more fuel efficient vehicles and offer E-85 for operations vehicles.	Low
5.4	75% of light duty vehicle acquisitions must consist of alternative fuel vehicles (AFV). (2016 target: 75%)	LANL did not meet the annual target of 75% but achieved a 62% acquisition rate of AFVs.	LANL will continue toward expanding the use of alternative fuel in the current fleet.	High
5.5	50% of passenger vehicle acquisitions consist of zero emission or plug-in hybrid electric vehicles by FY 2025. (2016 target: 4%)	LANL did not meet the annual target and has 2% electric vehicles. Currently, LANL has 3 zero emission or plug-in hybrid electric vehicles.	Improved affordability of plug-in hybrid vehicles through GSA is necessary before LANL can cost effectively expand the plug-in hybrid fleet. Significant infrastructure costs associated with plug-in charging stations for the LANL fleet.	High

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SSPP Goal #	DOE Goal	Performance Status through FY 2016	Planned Actions & Contribution	Risk of Non-attainment
Goal 6: Sustainable Acquisition				
6.1	Promote sustainable acquisition and procurement to the maximum extent practicable, ensuring Bio-Preferred and bio-based provisions and clauses are included in 95% of applicable contracts.	All new construction contracts contain a new "Green, Sustainable Products" clause.	Other major contracts will be updated to include sustainability clauses.	Low
Goal 7: Pollution Prevention & Waste Reduction				
7.1	Divert at least 50% of non-hazardous solid waste, excluding construction and demolition debris.	LANL diverted 50% of solid, nonhazardous waste in FY 2016.	LANL will work to sustain performance levels above 50%.	Low
7.2	Divert at least 50% of construction and demolition materials and debris.	LANL exceeded the annual target of 50% and diverted a 100% of construction and demolition activities.	LANL will work to sustain performance levels above 50%.	Low
Goal 8: Energy Performance Contracts				
8.1	Annual targets for performance contracting to be implemented in FY 2017 and annually thereafter as part of the planning of section 14 of E.O. 13693.	LANL is working with the Los Alamos Field Office on an ESPC process.		Low
Goal 9: Electronic Stewardship				
9.1	Purchases – 95% of eligible acquisitions each year are EPEAT-registered products.	LANL exceeded the 95% goal and, when available, purchased 100% EPEAT registered products.	LANL plans to continue this performance.	Low

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SSPP Goal #	DOE Goal	Performance Status through FY 2016	Planned Actions & Contribution	Risk of Non-attainment
9.2	Power management – 100% of eligible PCs, laptops, and monitors have power management enabled.	LANL did not meet this goal but achieved 92% compliance. Currently, only 65% of eligible PCs and 90% of monitors have power management features enabled.	Nearly all LANL Windows computers have power settings in place, but only roughly 30% of these systems are set to sleep on a regular schedule. LANL suspended operation of its power management system through its SCCM software due to a conflict with cybersecurity scans to evaluate vulnerabilities on LANL Windows computers. LANL will evaluate new power management software that meets its cyber security requirements.	High
9.3	Automatic duplexing – 100% of eligible computers and imaging equipment have automatic duplexing enabled.	Windows computers do not have the automatic duplex capability. This goal is managed through the EMS action plans.	LANL will continue to promote and request that workers prioritize duplex printing as a priority and set up copiers to automatically duplex as part of their EMS action plans.	High
9.4	End of Life – 100% of used electronics are reused or recycled using environmentally sound disposition options each year.	The Laboratory’s IT equipment is disposed of in accordance with its internal <i>Sanitizing Information System Storage Media, Memory Devices, and Other Related Hardware Procedure</i> , and the Laboratory’s Information Systems Destruction and Recycle Plan approved by the NNSA-Los Alamos Field Office. The Laboratory works with a certified recycler for IT equipment recycling.	LANL will continue to recycle to the maximum extent possible while still complying with site security requirements.	Low

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SSPP Goal #	DOE Goal	Performance Status through FY 2016	Planned Actions & Contribution	Risk of Non-attainment
9.5	Data Center Efficiency. Establish a power usage effectiveness target in the range of 1.2-1.4 for new data centers and less than 1.5 for existing data centers.	LANL met the annual PUE target of 1.4 in its existing and largest data center, the SCC. The SCC received a significant upgrade to provide 15 MW of warm water cooling and 19.2 MW of power. The LDCC, the second largest data center, achieved a PUE of 1.6. The CCF, the third largest and oldest data center, achieved a PUE of 1.8.	LANL will continue to increase server virtualization efforts and retire existing, legacy systems.	High
Goal 10: Climate Change Resilience				
10.1	Update policies to incentivize planning for, and addressing the impacts of climate change.	No policies currently are in place.	No policies currently are in place.	Low
10.2	Update emergency response procedures and protocols to account for projected climate change, including extreme weather events.	Emergency response procedures are reviewed every two years and updated as needed. No review was required in FY15.	The procedures will be reviewed in FY 2017.	Low
10.3	Ensure workforce protocols and policies reflect projected human health and safety impacts of climate change.	Existing protocols for fire conditions, evacuations, and shelter-in-place were communicated and followed.	If an active wildland fire season occurs in FY 2017, all LANL outdoor work safety documents (IWDs) will be reviewed to ensure employee health and safety.	Low

SSPP Goal #	DOE Goal	Performance Status through FY 2016	Planned Actions & Contribution	Risk of Non-attainment
10.4	Ensure site/lab management demonstrate commitment to adaptation efforts through internal communications and policies.	<p>Wildland fire danger and work restrictions were routinely posted on the LANL home web page.</p> <p>New project review were routinely screened for the impacts of climate change. Laboratory management communicated these issues to project leaders through the PRID system.</p> <p>The Laboratory Long-Term Strategy for Environmental Stewardship and Sustainability documented climate change impacts to LANL mission and operations. This plan was distributed to LANL managers.</p> <p>The conceptual model for climate change impacts at LANL was reviewed in 2016. This report was distributed to LANL managers.</p>	<p>Wildland fire danger will be routinely posted on the LANL home web page.</p> <p>Work restrictions under Stage 3 wildland fire danger conditions will be posted on the LANL home web page when required.</p> <p>New project review will be routinely screened for the impacts of climate change. Laboratory management will communicate these issues to project leaders through the PRID system.</p> <p>Collaboration with NREL to conduct a climate vulnerabilities assessment and resilience strategy for LANL will occur in FY 2017.</p>	Low
10.5	Ensure that site/lab climate adaptation and resilience policies and programs reflect best available current climate change science, updated as necessary.	<p>The Wildland Fire Management Plan was updated using the most up to date Landsat vegetation data.</p> <p>Pilot program completed to model soil erosion risk across LANL using GIS.</p> <p>Completed the LANL land cover map based on August 2014 satellite imagery.</p>	<p>The Wildland Fire Management Plan will be updated using the most up to date Landsat vegetation data.</p>	Low

Table 1. Site Sustainability Plan Goal Targets Summary Table

PERFORMANCE REVIEW AND PLAN NARRATIVE

1 GREENHOUSE GAS EMISSIONS REDUCTIONS AND COMPREHENSIVE GREENHOUSE INVENTORY

1.1 Scope 1 & 2 Greenhouse Gas Inventory and Reduction

Goal: 50% Scope 1 & 2 GHG reduction by FY 2025 from a 2008 baseline (2016 Target: 22% reduction)

Performance Status:

LANL met this goal and achieved a 32% reduction in Scope 1&2 GHG emissions compared to the FY 2008 baseline. This reduction was achieved mainly through purchase of renewable energy credits (RECs). In FY 2016 LANL purchased over 105,000 MWhr of RECs. In addition, the Sustainability Program’s energy reduction projects contributed to Scope 2 greenhouse gas emissions reductions. LANL’s energy use is expected to steadily increase over the next 10 years as high performance computing and expanded programmatic activities at LANSCE consume greater quantities of electrical power. LANL will also pursue a 10 MW Solar Photovoltaic installation to increase on site power production and reduce GHG Scope 1&2 emissions by 12,500 MTCO₂.

Figure 2 shows the GHG emissions projections for the next 10 years including the proposed Combined Heat and Power Plant.

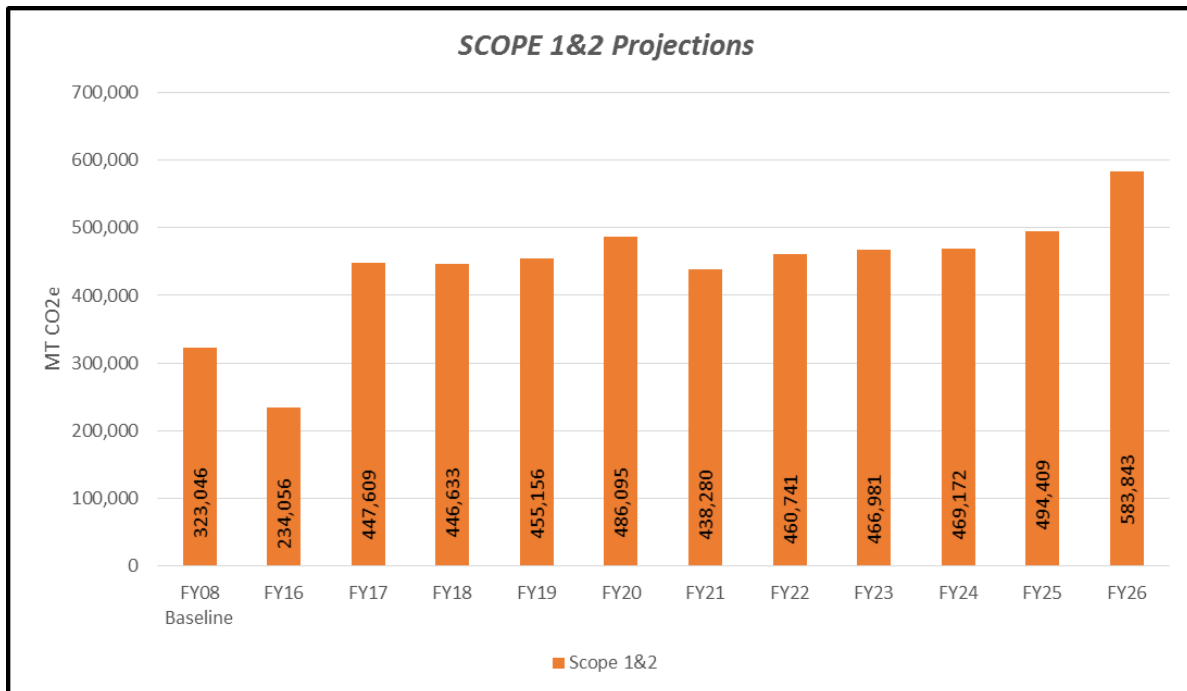


Figure 2. Scope 1&2 GHG emissions projections

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Since 2010 LANL has calculated SF6 emissions using the conservative method of assuming that all purchases of SF6 are emitted at the time of purchase. Air emissions have historically been calculated for the EPA and NMED using this method and used purchasing records as a data source. However, an internal investigation from June through October of 2016 revealed that purchasing records are not a comprehensive and consistent data source for SF6 emissions reporting. Two alternative data sources were analyzed as possible alternatives and also found to be inadequate.

LANL has begun to resolve these issues of data quality and data availability by:

- Establishing an administrative procedure that requires all SF6 users be on a “Registered Users” list
- Establishing an operating procedure at the Gas Facility to weigh all outgoing and incoming SF6 cylinders and record those weights in the “Footprints” database maintained by the Gas Facility
- Establishing a new baseline for SF6 use by weighing all SF6 cylinders in use and in inventory at all SF6 user sites
- Improving labeling and tracking of all SF6 cylinders at all stages of transport and use

The internal investigation of SF6 use involved walk downs at the sites of all users, and resulted in the development of two source reduction projects with the potential to eliminate 10-20% of LANL SF6 use. More source reduction projects will likely be developed in FY 2017. The analysis conducted during the internal investigation will also be used to create and begin implementing a Capture and Management Plan for SF6 during FY 2017.

Upgrades to facilities are critical in order to meet the energy efficiency goal and reduce greenhouse gas emissions. Building Automation System (BAS) upgrades, recommissioning of building systems and lighting upgrades have had the highest effect on the energy intensity goal. If FY 2016 LANL completed 5 BAS upgrade projects in facilities with old, pneumatic or non-existent control systems. These upgrades enable a night-setback setting to achieve significant energy reduction. Figure 3 shows the GHG emissions projections for the next 10 years including mitigation actions to meet the 50% reduction goal by FY 2025. This scenario includes the proposed combined heat and power plant to replace the existing steam plant to reduce Scope 1&2 GHG emissions.

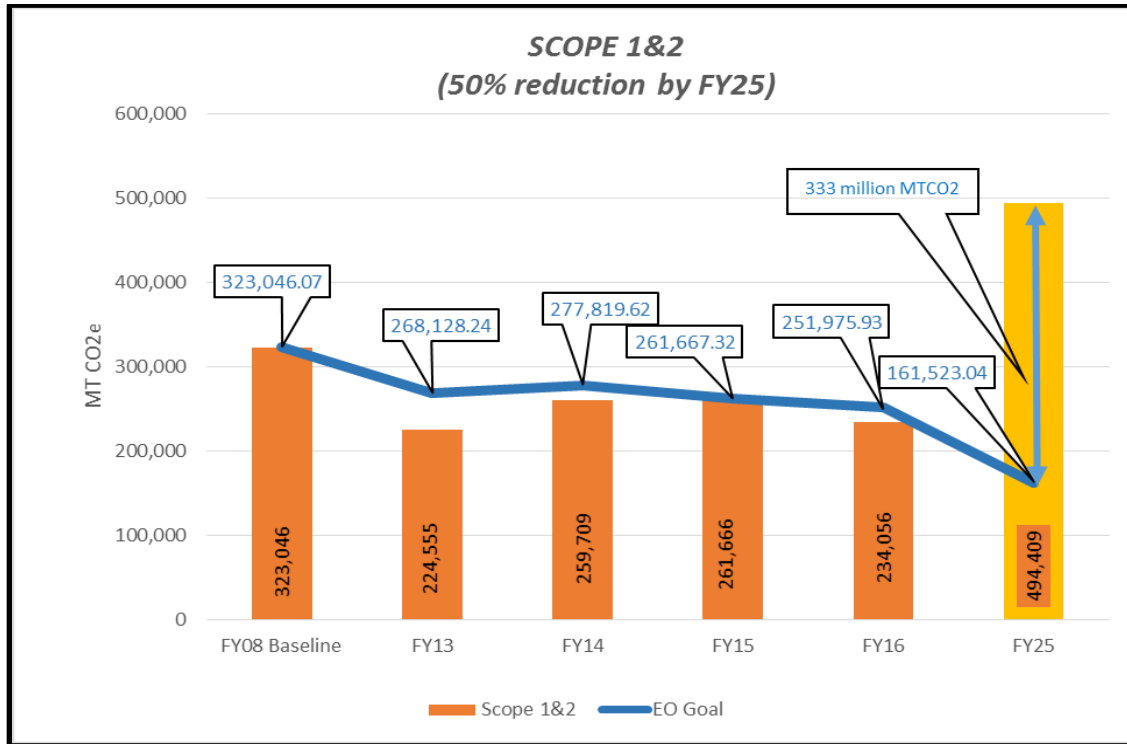


Figure 3. Scope 1&2 GHG emissions status and projections based on EO 13693

Table 2 shows detailed Scope 1&2 GHG emissions, comparing FY 2016 to FY 2015 and to the baseline year (FY 2008).

Categories	Baseline	FY 2105	FY 2016
Energy Production	299,328.00	237,018.70	262,562.50
Fugitive Emissions	18,490.74	91,119.35	44,523.90
Industrial Processes	0.00	0.00	0
On-Site WWT	20.59	9.33	8.6
On-Site Landfill	0.00	0.00	0
Fleet Fuel	5,207.10	4,338.40	4,494.60
Purchased Renewables	0.00	0.00	0
RECs	NA	71,795.00	77,533.90

Table 2. Scope 1&2 GHG Emissions Breakdown, MtCO₂

Projected Performance:

In FY 2017 LANL will continue purchasing RECs to meet its renewable energy and greenhouse gas reduction goals. LANL plans to reduce GHG emissions from heating energy by modifying its electrical generation profile to include less carbon-intensive sources and by improving the efficiency of the on-site central heating and distribution system. The proposed project is to replace the central steam plant with a combined heat and power (CHP) plant that uses the existing combustion turbine as the primary heat source. The combustion turbine will be retrofitted with a steam-generating heat exchanger that will drive a new steam turbine. Steam for heating will be extracted from this turbine when needed to power a refurbished campus heating system in the cogeneration mode. The new unit will be operated as a base-load machine and will provide 40MW on average and its net effect will be to meet the growing demand of LANL’s high-performance computing program with a lower carbon resource when compared to coal-fired electricity. The following table shows GHG emissions avoided by upgrading to a CHP as described above using it to displace coal generated power.

<i>Meeting the Same Energy Demand</i>	<i>Primary Energy Consumed (Billion Btu/Yr.)</i>	<i>Effective Use of Primary Energy (Percent)</i>	<i>Green House Gas Generated (Metric Tons CO₂/Yr.)</i>
<i>Continued on Current Path</i>	3,400	31.40%	312,000
<i>Proposed Combined Heat and Power Upgrade</i>	2,000	53.80%	106,000

Table 3. Emissions avoided with new CHP plant

In addition, the Laboratory has developed a strong Building Automation System (BAS) Team to monitor and support the digital building control systems. More effective BAS controls has reduced energy use in facilities by up to 50% in conjunction with HPSB recommissioning efforts. The BAS Team is working to implement an analytics program of continuous commissioning program to maintain energy savings in facilities in 7 additional facilities. This effort and the resulting energy reductions directly reduce Scope 1 & 2 GHG emissions.

In conjunction with the efforts mentioned above, LANL and the NNSA are seeking opportunities to collaborate with a solar energy project developer for the purpose of developing a solar electricity generation project for LANL. The project could provide 10MW of solar energy and would reduce GHG emissions by 12,500 MtCO₂/year.



1.2 Scope 3 Greenhouse Gas reduction

Goal: 25% Scope 3 GHG reduction by FY 2025 from a 2008 baseline (2016 Target: 7% reduction)

Performance Status: LANL achieved a reduction of 22% in Scope 3 GHG emissions. This reduction exceeds the 2016 Target of 7% reduction.



In FY 2016, overall commuting patterns were similar to those found during FY 2015, but GHG emissions related to commuting were slightly higher since there were more employees at LANL. Some LANL employees are occasionally allowed to work from home at the discretion of their group-level management. In addition to GHG reductions, telecommuting may also contribute to a reduction in infrastructure operating costs, enable LANL's footprint reduction initiative, and improve employee work/life benefits.

LANL maintains and allows public access to a central transit station facility within TA-3 on NNSA property. This central station allows four transit systems to converge at this point: the Laboratory taxi and bus system, the County of Los Alamos Atomic City Transit, the State of New Mexico's Department of Transportation Park and Ride that contracts with All-Aboard America to provide a regional bus service, and the North Central Regional Transit District buses. The County's Atomic City Transit provides transportation to and from the White Rock town-site, and to and from the Los Alamos town site. Mass public transit to LANL via bus has been expanded from the surrounding communities of Santa Fe and Española and also within Los Alamos and White Rock. In addition, the New Mexico Rail Runner Express train provides employees from the Albuquerque area the option to connect with buses from Santa Fe to Los Alamos instead of driving personal vehicles. LANL provides taxi service for employees to travel

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between sites during the day so that fewer people require their personal vehicles. For many years, LANL has organized a special section on its internal website to connect potential carpoolers with each other.

Employee commuting is a significant fraction of overall Scope 3 GHG emissions at LANL. Prior to 2008 and the establishment of the FY 2008 baseline, LANL implemented a 9/80 schedule, which gave employees the option to work 80 hours during nine days in a two-week period. This schedule option allowed employees to cut their commute distance and time by 10 percent. About 70% of the LANL workforce is on the 9/80 schedule.

There was slightly more business air travel at LANL in FY 2016 compared with FY 2015. Business use of rental cars was slightly higher in FY 2016 compared with FY 2015. The increase is mostly related to a higher number of employees at LANL in FY2016. Eliminating travel and using video or teleconferencing when possible is one of the easiest ways for LANL to cut costs. In addition, LANL is using an instant messaging and desktop teleconferencing system called Skype and WebEx. Using the Skype system can reduce travel on site and WebEx has the potential to preclude long-distance travel with advanced video teleconferencing and web meeting capabilities.

Employees in LANL leased space utilize a County-owned wastewater treatment plant with aerobic and denitrification treatment. LANL operates its own centralized wastewater treatment plant. The GHG emissions from the LANL plant are related to the number of employees working at LANL. GHG emissions from municipal solid waste and offsite and onsite wastewater treatment make up a very small fraction of LANL's Scope 3 emissions.

LANL has actively participated in pollution prevention for over two decades, and one of the targets has always been reduction of volume of municipal solid waste generated at LANL. All municipal solid waste from LANL is disposed of offsite. Many kinds of unwanted materials can be recycled at LANL, including toner cartridges, aluminum cans, plastic bottles, brush, paper, asphalt, concrete, and cardboard. LANL started accepting paperboard and all numbered plastics for recycling in mid FY 2015. Figure 4 shows Scope 3 GHG emissions performance compared to the new Executive Order 13693 goals.

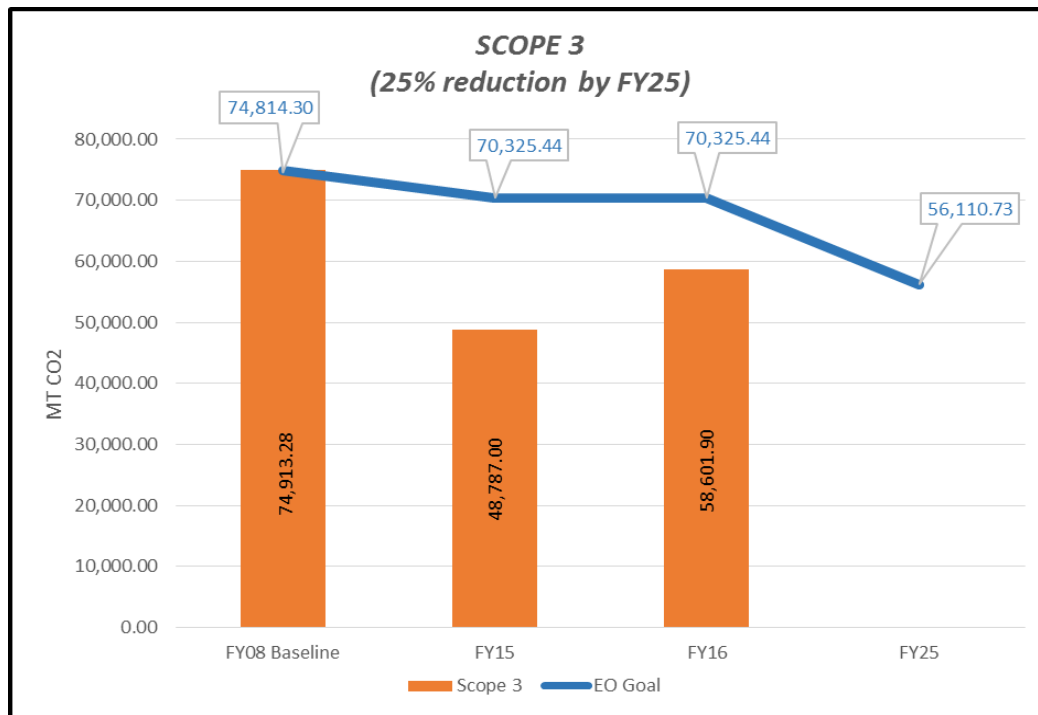


Figure 4. Scope 3 GHG emissions performance compared to EO13693 Goals

Table 4 shows Scope 3 GHG emissions breakdown for FY 2016 compared to last FY 2015 and to the baseline (FY 2008).

Categories	Baseline	FY 2105	FY 2016
T&D Losses (includes RECs)	15,817.18	9,730.00	10,794.40
Air Travel	6,768.10	5,385.00	12,438.50
Ground Travel	2,140.00	325.00	355.90
Commute	48,656.00	32,030.00	32,508.40
Off-Site WWT	0.00	3.00	1.00
Off-Site Landfill MSW	1,532.00	1,314.00	2,503.70
Purchased Renewables	0.00	0.00	0.00
TOTAL	74,913.28	48,787.00	58,601.90

Table 4. Scope 3 GHG emissions Breakdown, MtCO2e

Projected Performance:

LANL is working to evaluate the cost-benefit of telecommuting and other options to reduce overall employee commuting. Depending on the number of employees approved to telecommute, miles driven and GHG emissions from commuting would drop accordingly. Reducing the number of miles commuted by LANL employees would make a significant reduction to Scope 3 GHG emissions. LANL hopes to

conduct a statistical commuting survey every 2-3 years to track changes in commuting behavior over time. The most recent commuting survey was completed in FY 2014 and the next survey is planned for FY 2017.

To a lesser extent, other ongoing activities will also reduce Scope 3 greenhouse gas emissions. LANL’s recycling programs are ongoing, and the Pollution Prevention team is always looking for new ways to minimize the amount of municipal solid waste that is generated onsite. Recycling as much as possible will reduce GHG emissions related to municipal solid waste generation.

2 SUSTAINABLE BUILDINGS

2.1 Energy Intensity

Goal: Reduce Energy Intensity in Federal buildings by 25% by FY 2025 from a 2015 baseline (2.5% reduction annually through the end of FY 2025)

Performance Status:

LANL reduced its energy intensity (BTU/sq. ft.) by 1% compared to last fiscal year (the baseline year).

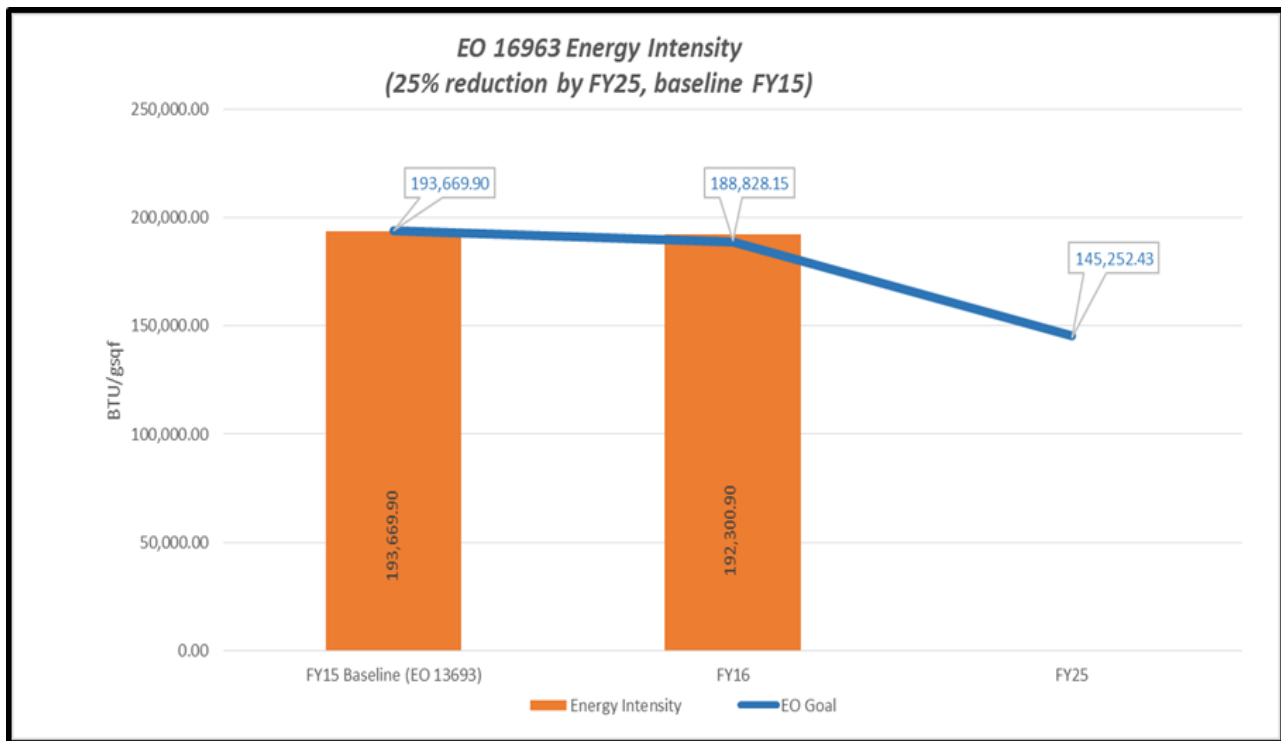


Figure 5. Energy Intensity Performance compared to EO13693 Goal

Although, LANL did not meet its annual target of a 2.5% energy intensity reduction, major emphasis was placed on the Smart Labs Program, modeled after the University of California, Irvine’s successful energy efficiency program for laboratory facilities. Time and effort spent to grow these initiatives will drive the Laboratory closer to meeting the FY 2025 GHG emissions reduction goals and better position the Laboratory to adapt and compete for future mission work. In addition, data shows no baseload energy

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growth, although over 500 new employees were hired. An additional metric to highlight energy efficiency, shown below, is energy use per person. The data shows a steady reduction in energy used per person within the last five years.

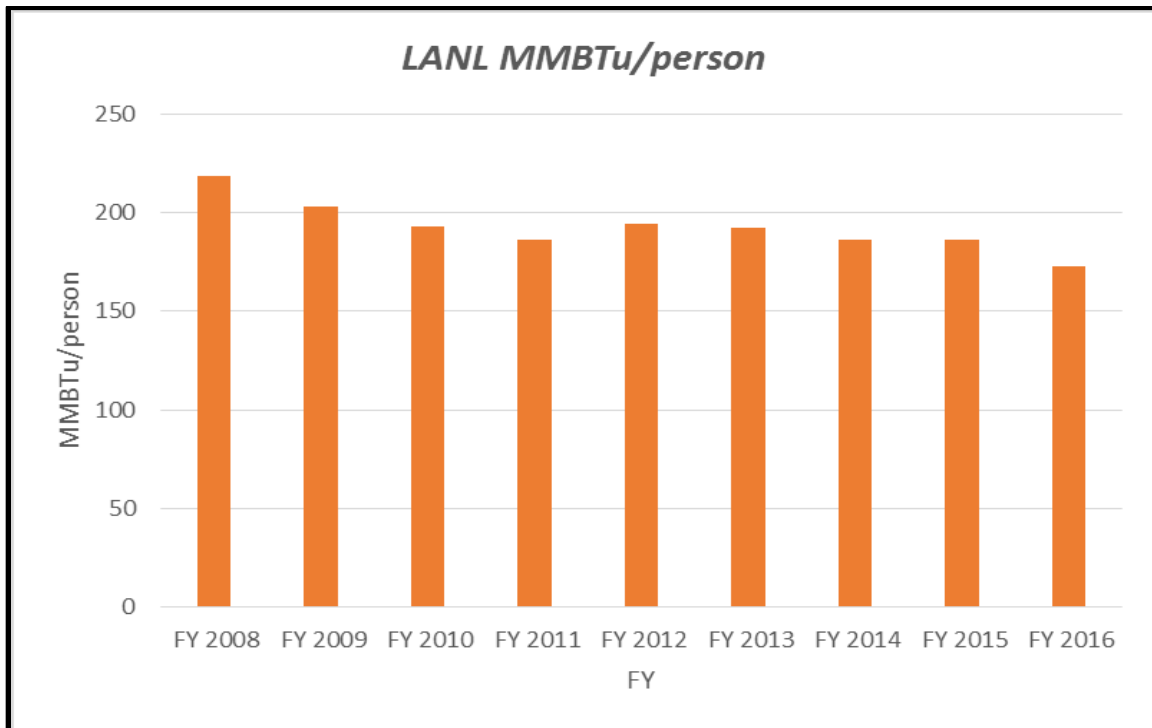


Figure 6. LANL MMBTu/person

LANL's Sustainability investments, including increased power production capability, are designed to maintain limited baseload growth, allowing for hiring and mission growth. Strategically planned energy efficiency projects combined with a phased approach to increase renewable power purchases can support a commitment to an additional 1% reduction during FY 2017. The figure below shows a slight reduction in non-mission critical (goal subject facilities) energy use within the last ten years. This energy use is mainly within traditional office space or laboratory space across the site.

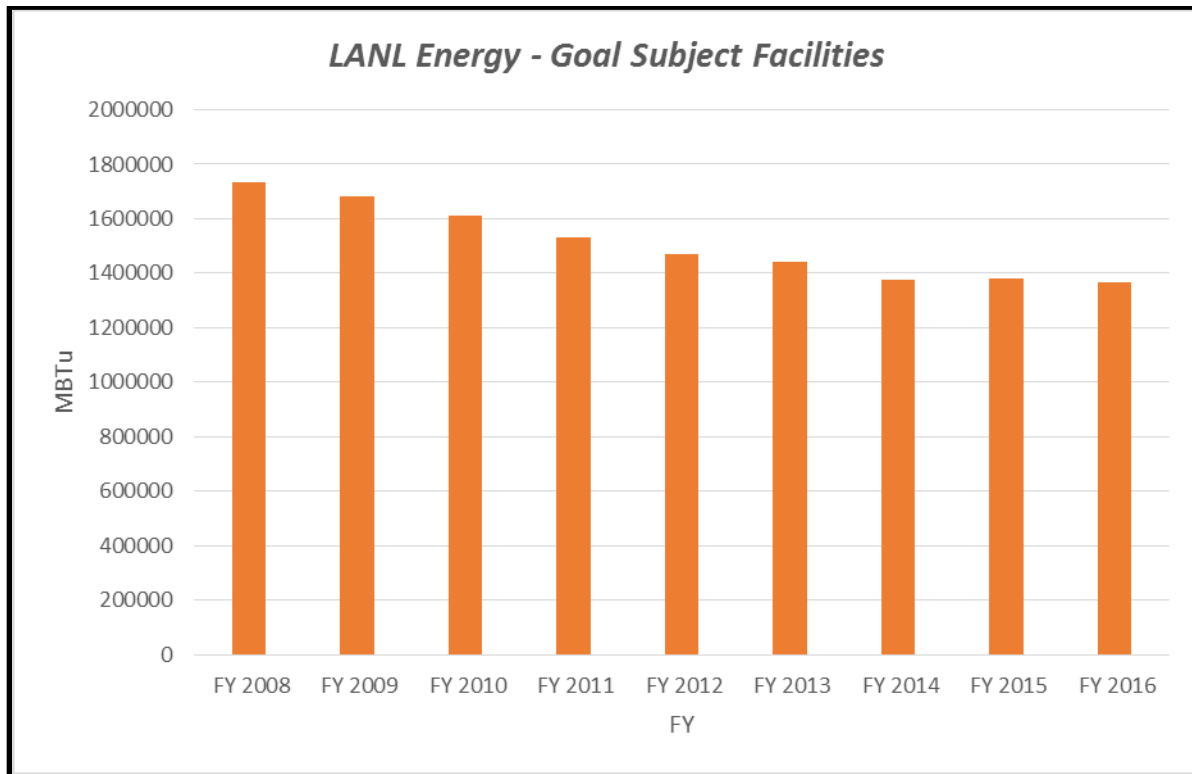


Figure 7. LANL Energy-Goal Subject Facilities

LANL invested in a number of energy reductions initiatives in FY 2016 as it has in previous years. These include BAS upgrades, monitoring using energy analytics software, HVAC recommissioning, and LED lighting upgrades. As an example of the energy reduction initiatives performed during FY 2016, the next table shows a list of buildings and the energy savings from FY 2016 compared to FY 2015.

BUILDING	MWh (FY15)	MWh (FY16)	SAVINGS (MWh)	(%, FY 2015 baseline)	SAVINGS (\$)
03-0207	1,277,984.00	1,077,867.00	200,117.00	15.66%	\$16,009.36
48-0001	5,695,120.00	5,039,323.00	655,797.00	11.52%	\$52,463.76
03-1405	741,729.00	689,110.00	52,619.00	7.09%	\$4,209.52
46-0535	345,932.00	324,550.00	21,382.00	6.18%	\$1,710.56
60-0245	288,845.00	235,882.00	52,963.00	18.34%	\$4,237.04

Figure 8. Building Specific Energy Savings (FY 2016 vs. FY2015)

LANL has successfully reduced energy intensity each year over the past 5 years. This accomplishment is due to focused energy efficiency by the Sustainability Program, increased attention to energy use in facilities, and focused conversations regarding long term energy supply.

Projected Performance:

LANL will continue investing in a number of energy reduction initiatives, including BAS upgrades, recommissioning in facilities, HVAC and lighting upgrades, and footprint reduction. As shown in figure 6,

if the Sustainability Program is funded at a constant level of \$2-3M/year, the Laboratory has the opportunity to meet the annual energy intensity reduction targets.

In FY 2016, LANL initiated a “Smart Labs” Program designed by the University of California, Irvine (UCI). The Program targets energy reduction in Laboratory space. The Smart Labs Program has seven key elements and can be described in three Phases: Planning and Assessment, System Optimization and Performance Management. UCI was successful in achieving up to 60% energy savings in Lab facilities once all seven key elements were implemented.



Figure 9. 7 Key Elements of a Smart Lab

During the last half of FY2016, LANL initiated the first Phase, Planning and Assessment, by hiring the company Exposure Controls Technology, Inc. to perform a Rapid Energy Laboratory Assessment (RELSA) in eight of the top ten highest energy consuming Laboratory facilities. In order to finalize the first phase of the initiative, five of the eight buildings, with the highest potential energy savings were selected for the second and last stage of the first phase, a Demand Ventilation Assessment (DVA). The DVA for these five facilities will be performed by the same company, during the first part of FY 2017 and it will provide the project scope of work and the feasibility analysis for each of the five assessed facilities. By performing the scope of work in all five facilities, LANL will be able to save 26,300 MBtu/year.

RELSA Rank	Building	Potential Energy Reduction	
		%	kBTU
1	Target	20%	6,720,030
2	Laser	19%	1,809,711
3	RLUOB	18%	13,355,082
4	MSL	17%	3,280,374
5	SIGMA	16%	11,049,867
6	Detonator	15%	1,135,790
7	CINT	14%	1,917,465
8	BTF	14%	2,216,830
Totals		17% Average	41,485,149

Table 5. RELSA Potential Energy Reduction

RELSA ERP Rank	Building	Total Annual Utility Cost	RELSA % Utility Reduction	Annual Savings \$
1	Target	\$506,795	20%	\$101,359
2	Laser	\$129,362	19%	\$24,579
3	RLUOB	\$826,362	18%	\$148,745
4	MSL	\$176,134	17%	\$29,943
5	SIGMA	\$898,012	16%	\$143,682
6	Detonator	\$87,602	15%	\$13,185
7	CINT	\$194,826	14%	\$27,276
8	BTF	\$260,573	14%	\$36,480
Totals		\$3,079,966	17% Average	\$525,249

Table 6. RELSA Ranking for Potential Utility Reduction Costs

In FY 2016, LANL signed the Smart Labs Accelerator Partnership agreement under the U.S Department of Energy Better Buildings Initiative. Through the Smart Labs Accelerator, DOE will work with university, federal agencies and national laboratories, hospitals and corporations, to advance strategies that rapidly improve energy efficiency in laboratory buildings. Accelerator partners will set a target to improve energy efficiency across their portfolio of laboratory buildings by at least 20% in ten years or less. LANL

selected 8 laboratory facilities to participate in the Smart Labs Accelerator Partnership and is investing FY 2017 Sustainability funding in two of the selected facilities.



2.2 EISA Section 432 Energy and Water Evaluations, Benchmarking, Project Implementation, and Follow-up Measures

Performance Status:

LANL has 84 covered facilities that receive energy and water audits to comply with EISA's benchmarking requirements. In FY 2016 LANL completed energy audits in 21 buildings or approximately 25% of these covered facilities. LANL's EISA 07 facility evaluations generate a list of energy and water conservation measures. All proposed measures are entered into a searchable "Energy Management Database", which was initially developed in 2012 and captures improvement measures at the building level. Energy and water conservation measures are categorized using a return on investment or simple payback calculation. Maintenance staff can use the list of measures for their annual maintenance planning and include any necessary maintenance in the deferred maintenance reports.

Projected Performance:

LANL is scheduled to perform energy and water conservation audits within approximately 25% of the covered facilities in FY 2017. Often times, these audits coincide with the HPSB assessments, and both can be accomplished.

2.3 Individual building metering for electricity, natural gas, steam and water

Goal: Meter all individual buildings for electricity, natural gas, steam and water, where cost-effective and appropriate

Performance Status:

In FY 2011, LANL completed electric meter installations and achieved compliance with the electric meter goal and is metering over 90% of electric consumption on individual buildings and processes loads of the site's total electricity use. All electricity distributed throughout LANL is measured by 131 electric meters at the 13.2-kilovolt level in distribution switchgears.

LANL currently has 365 meters that are read, reported and monitored on in a monthly cycle: 270 electric, 53 natural gas, 2 steam (not including the TA-03 Co-Gen Plant) and 40 water.

Natural gas coming into LANL is metered at two main stations, Tech Meters 1 and 4. There are 53 other gas meters/consumers that are read and usage reported. Of these 47 meters, 10 gas meters are interchange points between LANL and Los Alamos County. Steam is generated at the TA-3 Co-Generation Plant and is metered as it leaves the facility. During FY 2014, two individual building steam meters and five individual facility heating hot water meters were installed, and data begun to be collected. Over the next five years LANL plans to install an estimated 40 steam/heating hot water meters, 120 natural gas meters, and 80 electric meters in addition to the 132 individual building water meters to meet the new metering guidance.

Projected Performance:

Per the new DOE Metering Guidance issued November 2014, the approach to energy and water metering has shifted from percent of utility consumed to number of appropriate buildings based on square footage. LANL has opportunities to install 242 additional meters: \pm 49 electric, \pm 69 natural gas, and \pm 95 water for facilities that are 5,000 GSF and above.

LANL estimates a \$15,000 cost per meter install, which includes the purchase of the meter and the labor for installation. LANL would require a metering budget of just over \$3,000,000 over the next five years to meet the DOE energy and water metering goals. Therefore, LANL has selected to install meters during major renovation projects, new construction, and in selected Smart Lab facilities. LANL plans to install meters on a “per building” approach rather than by meter type. This whole building approach will reduce the number of building outages and down time for both building residents and craft. LANL will select a number of buildings per year for installations. In addition to the square footage requirements, metering is determined by estimated energy consumption for programmatic use of the facility and/or the number of building residents. Metering data per facility is loaded into Portfolio Manager for benchmarking purposes, which is used to determine the facility’s performance based on age and square footage.

Under the SEP LANL Potable Line Replacement project, approximately \$1-1.75 million will be used to install water metering equipment to more fully assess the demand in high use facilities and to meter several segments of the distribution piping network to monitor for abnormal water usage and high flows to help identify potable water supply losses.

The following resources are integral for the site’s utility consumption data and maintenance of the overall systems: system engineers, high voltage electricians, lineman, pipefitters, and the metering program administrator. All resources are tapped to review and troubleshoot new, current, and failed devices for all the distribution systems. The purchase and installation of new advanced meters, the metering program administrator salary, maintenance contract for PME support, several recommissioning and building automation system installations/repairs are funded from the Sustainability Program’s budget.

LANL has a Metering Program Administrator that collects and manages distribution metering consumption data for the site. Other LANL departments utilize metering data for their tracking and reporting requirements such as air quality, environmental impact and recommissioning. Consumption data for several facilities is collected by the Building Automation Team. BAS building specific monitoring/metering data aids with efficiency tuning, temperature/comfort control and night set-backs.

The Laboratory is planning to manage, report, and share energy usage information across the site and is working to develop a database that will collect metering data and create consumption reports for Facility Managers. This database will be used to analyze and trend energy consumption on a facility basis to improve tenant and building management awareness and conservation efforts. Usage information will be communicated to the RADs and programmatic tenants to improve awareness to reduce energy consumption through a quarterly report as well as available through the UI webpage.

2.4 Compliance with the Revised Guiding Principles for HPSB

Goal: At least 15% (by building count or gross square footage) of existing buildings greater than 5,000 gross square feet (GSF) to be compliant with the revised Guiding Principles for the HPSB by FY 2025 with progress to 100% thereafter.

Performance Status:

LANL selected 34 HPSB-candidate buildings that comprise 15% of existing buildings greater than 5,000 GSF. LANL has assessed these buildings on the schedule presented in the table below. These buildings are on average 90% compliant with the HPSB Guiding Principles (GPs) and 10 buildings are fully compliant, including two buildings that are LEED Gold Certified. LANL is lacking a few minor data points and facility upgrades to achieve full compliance, including 12 full months of reliable thermal energy data and automated lighting. Importantly, LANL achieved the site-wide water reduction goal of 20% in FY 2016 for the HPSB-candidate buildings.

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Property Name	Guiding Principles - % Complete (Yes or Not Applicable)	Guiding Principle 1	Guiding Principle 2	Guiding Principle 3	Guiding Principle 4	Guiding Principle 5
03-1400 National Security Sciences Building	88	Yes	In Process	Yes	In Process	Yes
03-1409 Office Bldg	92	Yes	Yes	Yes	In Process	Yes
03-2011 Adv Computer Lab	96	Yes	In Process	Yes	Yes	Yes
03-1410 Los Alamos Site Office	100	Yes	Yes	Yes	Yes	Yes
03-1411 Occ Med Facility	100	Yes	Yes	Yes	Yes	Yes
03-1415 Office Bldg	92	Yes	Yes	Yes	In Process	Yes
16-0824 Office Bldg	88	Yes	Yes	Yes	Not Assessed	Yes
16-0933 Office Bldg	92	Yes	Yes	Yes	Not Assessed	Yes
16-0969 Weapons Plt Support	85	Yes	In Process	Yes	In Process	Yes
22-0120 HDF Hydrotest Des facility	100	Yes	Yes	Yes	Yes	Yes
46-0535 Chem Tech Suppt Bldg	92	Yes	Yes	Yes	In Process	Yes
55-0400 RLUOB Office Bldg	100	LEED GOLD CERTIFIED BUILDINGS				
55-0440 Office Building	100					
60-0175 Communic Ops Bldg	96	Yes	Yes	Yes	Yes	Yes
60-0245 Radio Shop	88	Yes	In Process	Yes	In Process	Yes
63-0111 Office Bldg	100	Yes	Yes	Yes	Yes	Yes
69-0033 Emer Ops Center	100	Yes	Yes	Yes	In Process	Yes
03-0207 Oppenheimer Study	81	In Process	Yes	Yes	In Process	Yes
03-0502 Space Science Lab	81	Not Assessed	Yes	Yes	Not Assessed	Yes
03-1405 Office Bldg	100	Yes	Yes	Yes	Yes	Yes
35-0213 Target Fabrication Bldg	81	Yes	In Process	Yes	Not Assessed	Yes
52-0033 Weapons Support	100	Yes	Yes	Yes	Yes	Yes
53-0001 Lab Office	100	Yes	Yes	Yes	Yes	Yes
53-0006 Accelerator Tech	85	Yes	In Process	Yes	Not Assessed	Yes
53-0031 NPB Technical Support	88	Yes	Yes	Yes	Not Assessed	Yes
55-0066 FITS Office Building	88	Yes	In Process	Yes	Not Assessed	Yes
59-0003 Office	96	Yes	In Process	Yes	Yes	Yes
55-0313 Office Bldg	85	Yes	In Process	Yes	Not Assessed	Yes
03-0261 Otowi	85	Yes	In Process	Yes	Not Assessed	Yes
03-0216 Weapons Test Support	73	Not Assessed	In Process	Yes	Not Assessed	Yes
03-1498 Data Communication	73	Not Assessed	In Process	Yes	Not Assessed	Yes
09-0021 Lab and Office Bldg	69	Not Assessed	In Process	Yes	Not Assessed	Yes
03-0508 Compu Physics Office	81	Yes	In Process	Yes	Not Assessed	Yes
53-0024 Laboratory/Office Building	88	Yes	In Process	Yes	Not Assessed	Yes

Table 7. HPSB Guiding Principle Status

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Recommissioning efforts save, on average, 20% electricity and heating energy per building. Upgrades to facilities are critical in order to meet the energy efficiency goal and GHG reduction goal. For example, during FY 2016, LANL installed LED lights (shown below), which will reduce up to 1.5W/GSF the electricity bill and as a consequence, the energy use in the building.



Picture 2. LEDs linear lighting-Before and after in main Cafeteria

During FY 2016, SkyFoundry SkySpark, a data analytics software, was implemented in 7 buildings to ensure maintained energy savings. SkySpark automatically analyzes data from automation systems, metering systems and other smart devices to identify issues, patterns, deviations, faults and opportunities for improved performance and energy and operational savings. SkySpark allows domain experts to capture their knowledge in “rules” that automatically run against collected data. Employing “semantic tagging”, pattern recognition, functional rules processing and other techniques, SkySpark’s analytics engine provides the ability to automatically identify issues worthy of attention. Figure 7 shows a screenshot of SkySpark implemented in two LANL facilities showing non-conformances or “sparks” sent to the BAS Team when rules are not met, resulting in more streamlined repairs and energy savings.

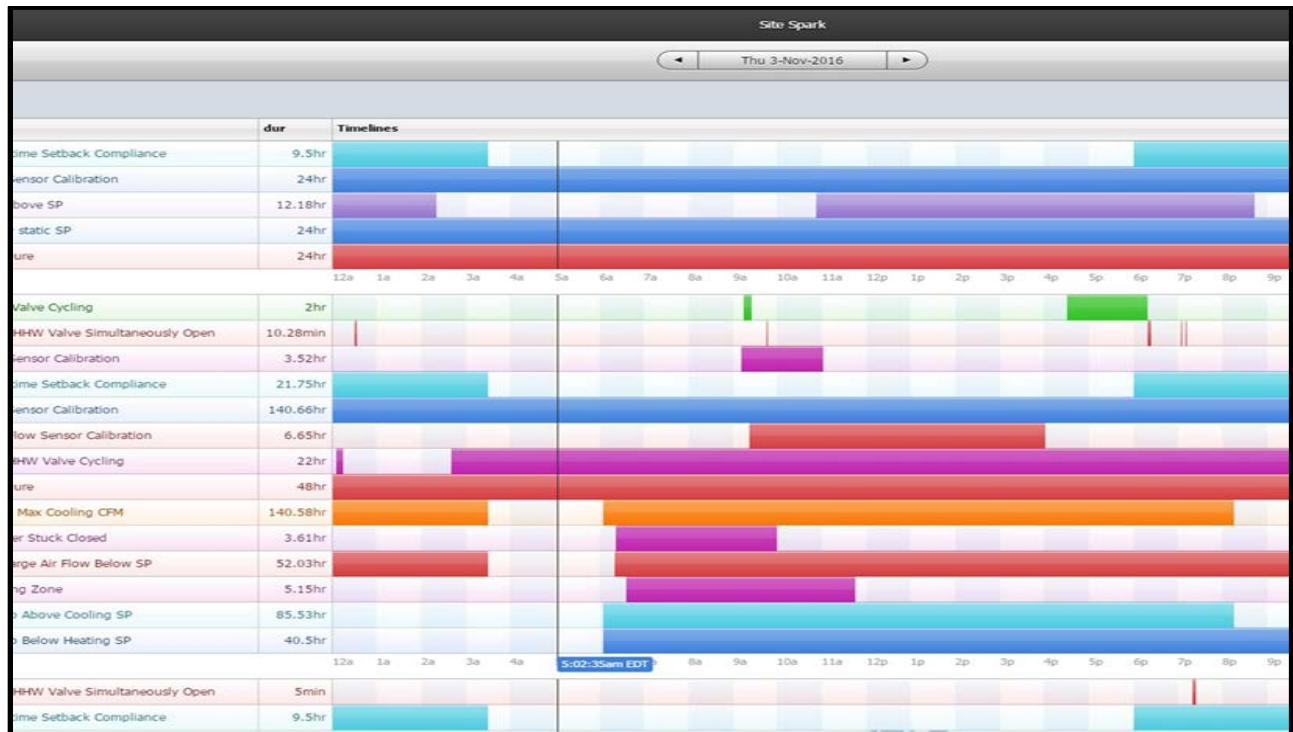


Figure 10. SkySpark screenshot

Projected Performance:

In FY 2017, LANL plans to continue implementing SkySpark in 9 additional facilities: 03-1411, 03-1415, 03-1420, 16-0933, 55-0066, 46-0535, 03-0510, 22-0120, 69-0033; recommissioning efforts in 4 additional facilities: 03-0502, 03-0216, 09-0021, 03-0508; perform the 4 year follow-up of the facilities previously recommissioned to ensure continued energy efficiency, and complete the collection of thermal energy meter data to develop baseline year data for verifying the 20% energy savings.

2.5 Regional and local planning coordination and involvement

The Laboratory is situated on federally-owned property located in northern New Mexico within Los Alamos County and is currently operated by Los Alamos National Security, LLC (LANS) for DOE. The County was formed during World War II by the federal government as the site for Project Y of the Manhattan Project. Since that time, the Laboratory has been transformed through real property conveyances and transfers to tribal and local governments resulting in the current LANL site area of approximately 36 square miles, which comprises a significant portion of the 109 square miles that Los Alamos County now encompasses. The County of Los Alamos governs the communities of Los Alamos and White Rock. The Laboratory's neighbors include among others the tribal governments of the Pueblo de San Ildefonso, Santa Clara Pueblo, Pueblo of Jemez, and Cochiti Pueblo. Other neighbors are Bandelier National Monument, administered by the National Park Service (NPS); and the Santa Fe National Forest, administered by the US Forest Service (USFS). Neighboring counties include Santa Fe, Sandoval, and Rio Arriba counties.

The Laboratory sponsors and engages interactive and ongoing relationships with all neighbors to promote common goals and interest; as well as resolving cross jurisdictional issues. The Laboratory participates as positive partner in many community efforts and as a large stakeholder has the ability to bring diverse entities together in a common effort. As discussed in Section 1.2 the Laboratory maintains and allows use of a central transit station facility within TA-3 on DOE property.

2.6 Net Zero Buildings

LANL is evaluating opportunities to design new facilities to be ultra-efficient, with the goal of being net-zero energy at some point in the future when a large on-site photovoltaic system is installed.

2.7 Data Centers

Goal: Promoting Data Center optimization, efficiency and performance. Installing and monitoring advanced energy meters in all data centers by fiscal year 2018 and establishing a Power Use/Utilization Effectiveness target of 1.2 to 1.4 for new data centers and less than 1.5 for existing data centers.

Performance Status:

LANL is reporting the following PUE for the major data centers on site:

- Central Computing Facility (CCF): 1.8
- Strategic Computing Complex (SCC): 1.4
- Laboratory Data Computing Complex (LDCC): 1.6

The SCC has traditionally used chillers and fans to blow huge volumes of air through the server racks to reach individual components that demand critical temperature control. Water used as a heat-exchange medium is three orders of magnitude more efficient than air-cooling. In 2015 the SCC at LANL underwent a significant upgrade to provide 15MW of warm water cooling and 19.2 MW of power to our data center floor. Cielo, the largest legacy HPC system in the SCC, is being decommissioned. Its replacement, Trinity, is currently being installed and is warm water cooled. The Trinity platform requires 75°F water supplied for cooling the computers. This allows LANL to use highly energy-efficient evaporative cooling towers and eliminates the need for mechanical chillers that are less energy efficient.

As a summary, this is the list of accomplishments at the SCC during FY16:

- The second half of Trinity was installed.
- Cielo and Typhoon (two air cooling machines) were decommissioned
- The installation of a cold isle containment on two air cooled machines was initiated
- Twelve 40 tones AHU's have been shut down.

In order to lower the PUE number at the LDCC, the following actions were taking during FY16:

- Two water cooled machines, +_ 1MW, were installed
- Two Air Cooled machines, +_ 750MW, were decommissioned
- A Cols Isle Containment was installed
- Chiller Water Valves on CRAC's are throttling back (a few CRAC's will be shut down)

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LANL has also upgraded the power, cooling, monitoring, and management infrastructure at the SCC through the installation of smart breakers, meter installation, Tracer Summit ES software and Square D metering software. This will allowed LANL to have a more detailed view of component level power consumption which provides the better resolution of energy consumption within a facility and more.

Migrating physical servers over to virtual machines and consolidating them onto far fewer physical servers' means lowering monthly power and cooling costs in the data center. In addition to saving more of LANL's funding for science with a smaller energy footprint, our server consolidation with virtualization also reduced the overall footprint of the entire data center. As technologies like Software Defined Data Centers continue to mature it will become possible to move a virtual machine from one data center to another no matter the network latency involved.

As the public cloud matures, and the technology around it advances the next step is plan and architect moving data out of the data centers and into a cloud hosting facility, LANL will be well positioned towards that goal.

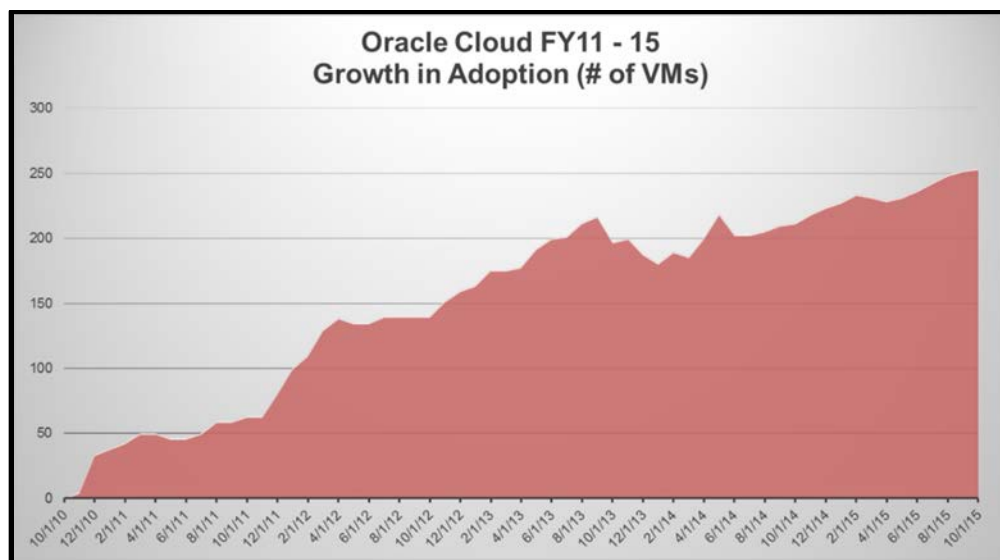


Figure 11. Oracle Cloud Growth FY11-FY15

Projected Performance:

The planned PUE for Trinity will be approximately 1.2. With this upgrade, LANL will meet the PUE goal of 1.5 for the SCC. In addition, LANL management is participating in the DOE Better Buildings Challenge for data centers – and committed to a 20% energy reduction in the LDCC in the next 5 years. Due to facility age, limited investments in the CCF are planned.

At the LDCC, Mustang and Conejo, two legacy clusters, will be decommissioned in FY17. They are being replaced by Grizzly and Snow, which are also both water cooled.

Contingency storage was implemented in the “Yellow Iod” in October, 2015. Customer workloads are actively using this storage. This storage has provided time to work and implement larger storage and

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compute procurements funded by the Office of the Chief Information Officer (OCIO). These larger procurements were required for hardware refresh and to keep up with aggressive customer demand. Once this migration is complete, the contingency storage will be added into our new storage infrastructure for additional capacity.

Virtualization has been in data centers for several years as a successful IT strategy for consolidating servers. Virtualization can also provide the basic building blocks for LANL's private and hybrid cloud environment to enhance agility and flexibility. In FY15, NIE created 311 VMs and decommissioned 150. The annual growth rate in FY15 was 13.74% and we estimating similar growth in FY16. This continuing growth makes cloud computing an obvious next step for many organizations. The virtualized infrastructure that is deployed today at LANL will eventually evolve into a flexible and scalable hybrid cloud infrastructure.

3 CLEAN AND RENEWABLE ENERGY

3.1 Clean Energy Target

Goal: ensure that at a minimum, the following percentage of the total amount of building electric, energy and thermal energy shall be clean energy, accounted for by renewable electric energy and alternative energy:

- ✓ Not less than 10% in FYs 2016 and 2017
- ✓ Not less than 13% in FYs 2018 and 2019
- ✓ Not less than 16% in FYs 2020 and 2021
- ✓ Not less than 20% in FYs 2022 and 2023
- ✓ Not less than 25% in FYs 2025 and each year thereafter

Performance Status:

In FY2016 LANL exceed the 10% clean energy goal and achieved 15% thanks to the on-site renewable energy and the purchase of renewable energy credits. LANL is well on track to meet this goal in FY 2017.

Projected Performance:

Beyond the purchase of RECs, LANL is going to replace its existing central heating plant that consumes about half the site's thermal energy, with a high-efficiency combined heat and power (CHP) plant. CHP plants are considered alternative energy sources and this project will serve as part of the long-term answer to the clean and renewable energy goal.

LANL and the NNSA are seeking as well opportunities to collaborate with a solar energy project developer for the purpose of developing a solar electricity generation project for LANL. The project would provide at least 10MW of solar renewable energy and would avoid GHG emissions by 12,500 MTCO₂/year.

3.2 Renewable Electrical Energy

Goal: ensure that at a minimum, the following percentage of the total amount of building electric energy shall be renewable electric energy:

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- ✓ Not less than 10% in FYs 2016 and 2017
- ✓ Not less than 15% in FYs 2018 and 2019
- ✓ Not less than 20% in FYs 2020 and 2021
- ✓ Not less than 25% in FYs 2022 and 2023
- ✓ Not less than 30% in FYs 2025 and each year thereafter

Performance Status:

In FY 2016 LANL exceeded the 10% renewable electric energy goal and achieved 24%. LANL has made significant progress towards this goal in recent years in collaboration with Los Alamos County with a 3 MW Abiquiu Low Flow Turbine and 1 MW photovoltaic plant at Technical Area 61. LANL will meet these goals in FY 2016 through the purchase of renewable energy credits, which is a long standing method of supporting the renewable energy market.

Projected Performance:

LANL has begun to examine the technical and financial feasibility of future photovoltaic developments on the site or in the surrounding New Mexico communities. A 2007 analysis showed that of the two major renewable electric sources, wind and solar, the LANL climactic conditions favor solar photovoltaic. An update to this study, composed in 2015 for LANL by the National Renewable Energy Laboratory and funded by the DOE Sustainability Performance Office, showed that the recent drop in the price of photovoltaic panels has brought the price of the energy produced within range of LANL's current cost of electricity. Until these projects come to fruition, LANL will continue to meet its renewable electric energy goals through the purchase of renewable energy credits.

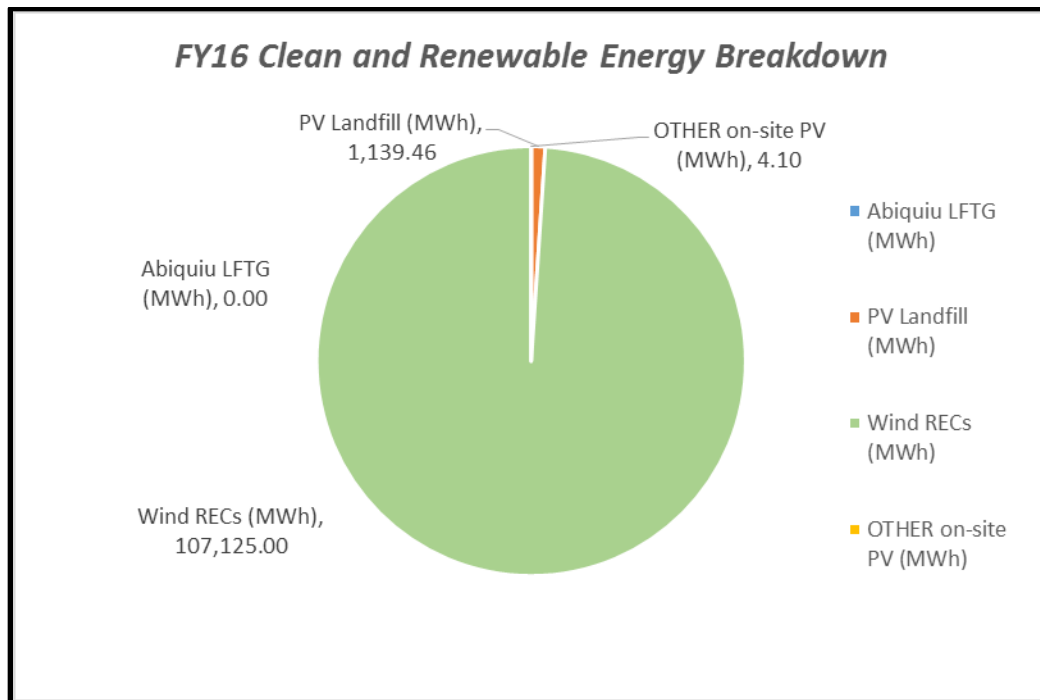


Figure 12. Clean and Renewable Energy Breakdown FY 2016

4 WATER USE EFFICIENCY AND MANAGEMENT

4.1 Potable Water Intensity

Goal: Achieve a 36% reduction in potable water consumption intensity relative to a FY 2007 baseline through reductions of 2% annually (2016 Target: 18% reduction)

Performance Status:

In FY 2016, LANL reduced water use by 9% compared to the FY 2007 baseline year. LANL’s total potable water consumption for the FY 2007 baseline year, was 336.5 million gallons. LANL total consumption for FY 2016 was 287.9 million gallons. LANL remains focused on the PNNL-developed water model, SERF operations, and targeted improvements to facilities to maintain water reductions long term. During FY 2016 the potable water intensity consumption increased by 10% compared to FY 2015 due to operational issues associated with the SERF evaporation pond capacity. Water delivery from SERF to SCC was halted during the winter to reduce the amount of water going to the SERF evaporation ponds to avoid reaching full capacity. Acceptable evaporation at the ponds has resulted in fully re-established service to the SCC. LANL forecasts continued success to maintain consistent water use levels with persistent water use monitoring and SERF sending record high volumes of water to the SCC beginning in July.

LANL’s major categories of water consumers are cooling towers (SCC, LDCC, LANSCE, and SIGMA), steam plants (central and satellite), and buildings. In FY 2016, as in FY 2015 and FY 2014, reclaimed SERF water supplied almost 100% of SCC cooling tower demand. Figure 12 shows LANL’s water consumption by major user in FY 2016.

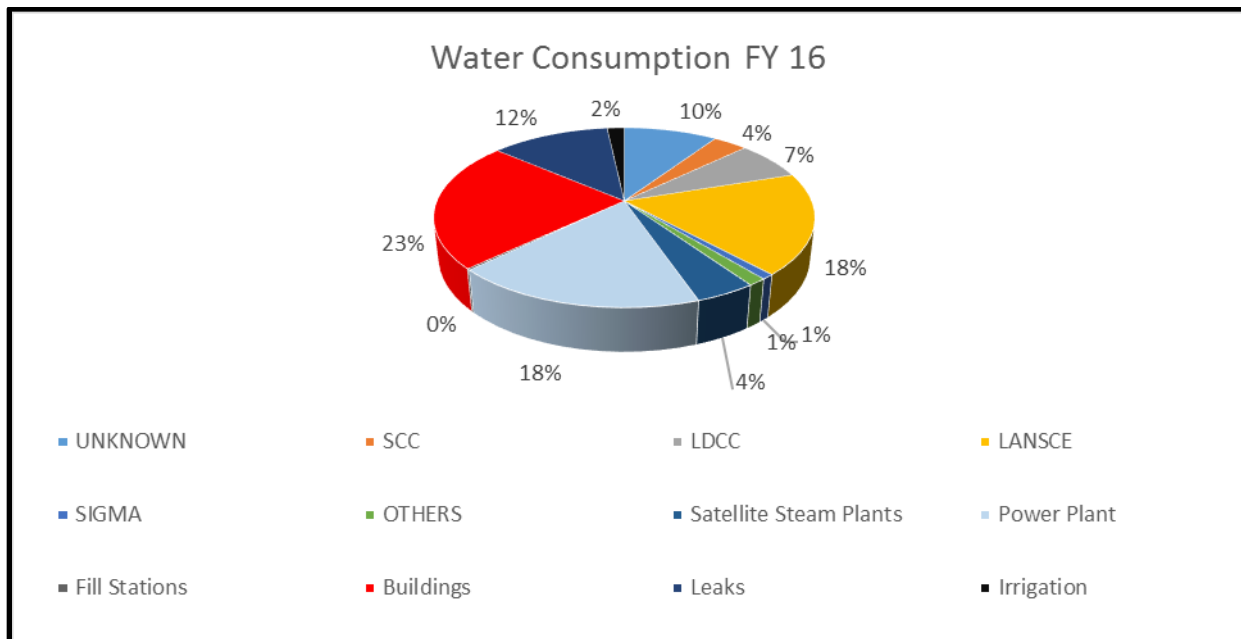


Figure 13. FY 2016 Water Consumption Breakdown

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LANL continues to maintain operation of the water consumption model first developed for the LANL site by Pacific Northwest National Laboratory (PNNL), funded by the DOE Sustainability Performance Office. Calibration and tuning of this model brought water usage reasonably close to meter data.

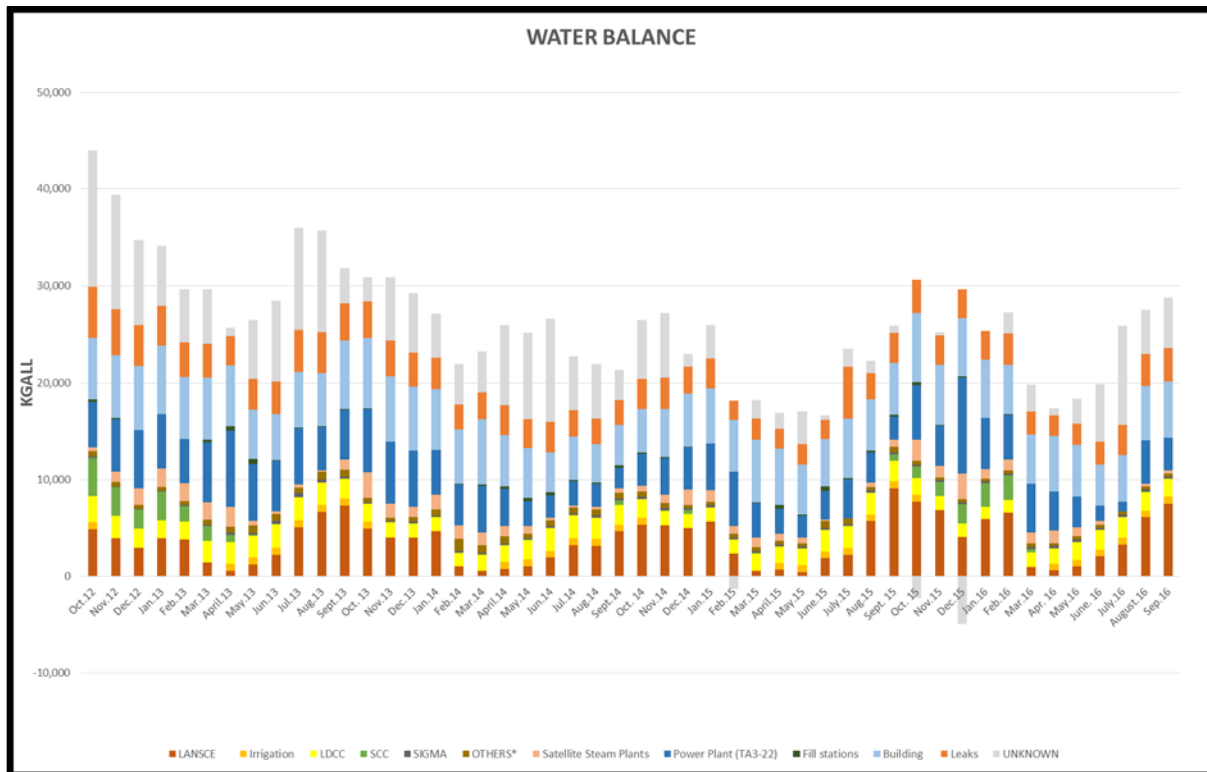


Figure 14. Monthly Water Balance

In order to get a realistic water balance, LANL refined the model in the following ways: Regarding the leak rate, LANL adopted a 12% leak rate target based on the American Water Works Association recommendations for a 40-50 year old water system. To obtain the water usage for the buildings, the blow-down from two of the LANL's cooling towers that discharge to the sanitary system is subtracted from the total amount of water that arrives at the waste water plant.

According to the FY 2016 water balance, LANL had 9% unknown use, a marked improvement from the performance of the model in FY 2014 when this category reached 22% and in FY 2015 when the same category reached 11% of the total water billed.

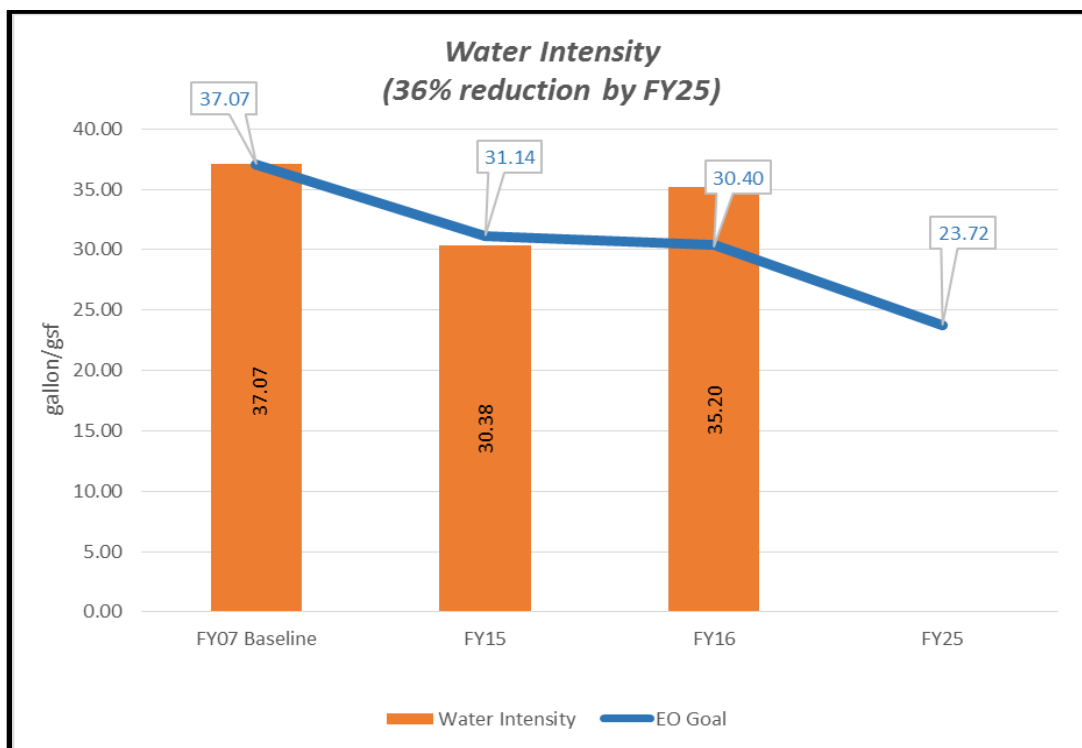


Figure 15. Water Intensity Performance compared to EO13963 Goals

LANL water usage represents approximately one-third of the total water usage from the regional aquifer. The 2008 Site-wide Environmental Impact Statement (SWEIS) measures potential environmental impacts by comparing projections of utility resource requirements against utility system capacities (DOE 2008). LANL’s annual water use ceiling is 542 million gallons through a water contract with Los Alamos County. Any water use exceeding this ceiling can be considered an indicator of an environmental impact, and NEPA further analysis is required. Water use below this ceiling is not expected to have any impacts to the regional aquifer. In addition, as projected in the 2008 SWEIS, trends in water levels in wells reflect a plateau-wide decline in regional aquifer water levels starting in 1977 in response to municipal water production, typically by several feet each year. No unexplained changes in patterns have occurred since this time. The decline is gradual and does not exceed one to two feet per year for most production wells. In areas where pumping has been reduced, water levels show some recovery. When pumping stops, the static water level returns in about six to twelve months. Hence, the water level trends suggest no adverse impacts on long-term water supply production from groundwater withdrawals (LANL 1998, LANL 2003). Based on this analysis additional investment in water reduction beyond those already completed are not anticipated to have a substantive environmental impact.

Projected Performance:

LANL’s sustainability efforts will continue to focus on small, targeted water conservation measures that dovetail with the site infrastructure upgrades. We will also place emphasis on energy efficiency to reduce LANL’s regional impact on water use associated with energy generation. In addition, we plan to work to expand the use of reclaimed waste water in cooling towers and steam plants.

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LANL is planning to install 'zone' water meters that will segment the campus into six zones of approximately equal consumption along with up to 65 building water meters using funding that is anticipated as part of the proposed DOE settlement with the State of New Mexico. Our long-term plan is to use the zone consumption data as input to a real time monitoring system that will more quickly identify water main breaks or unusual building usage. Building meters are planned to be installed as well, starting in FY 2017.

Under the SEP LANL Potable Line Replacement project, approximately \$1-1.75 million will be used to install water metering equipment to more fully assess the demand in high use facilities and to meter several segments of the distribution piping network to monitor for abnormal water usage and high flows to help identify potable water supply losses

4.2 Industrial, Landscaping and Agricultural Water

Goal: Achieve a 30% reduction water use by FY 2025 from a FY 2010 baseline through reductions of 2% annually

Performance Status:

All of LANL's water use is potable water and is, therefore, part of the 36% water intensity reduction goal reporting.

During FY15, four sections of the LANL Engineering Standards Manual (ESM) were updated to include EISA 438 requirements. These updates included identification of the regulatory requirements and provided design guidance on methods for appropriate implementation. To achieve maintenance of predevelopment hydrology conditions at a site, as required by EISA 438, either runoff from the 95th percentile storm must be retained or a site-specific hydrologic analysis must be performed. Using site-specific precipitation data spanning a 30 year period, a LANL site-specific hydrologic analysis was performed to establish a 2-year, 24-hour design storm (1.14 inch event) to be utilized to meet EISA 438 requirements. This data was also included into the ESM updates to be used to evaluate pre and post-development runoff hydrology. In addition, EISA 438 requirements are also included in the review comments associated with LANL internal excavation permits and the Permits & Requirements Identification planning tool required for use prior to execution of new projects. Incorporation of EISA 438 into both these review comments and the ESM will help insure the future identification and incorporation of appropriate Low Impact Development features required to maintain EISA 438 compliance.

Projected Performance:

LANL does not report on the ILA goal, but will continue to implement and monitor EISA 438 storm water management requirements.

5 FLEET MANAGEMENT

5.1 Petroleum Consumption

Goal: 20% reduction in annual petroleum consumption by FY 2015 relative to a FY 2005 baseline, and maintain 20% thereafter

Performance Status:

As of the end of FY16 LANL has reduced fleet petroleum use by 25% when compared to the FY 2005 baseline. Currently, LANL to include Los Alamos Fire Department, has 109 LANL-owned vehicles, and 1,502 GSA-leased vehicles operating on site.

In FY 2016, LANL acquired 30 additional Low-GHG emitting vehicles and increased its sedans by 6. The increase of these types of vehicles is the result of LANL's continuing effort to right-size its fleet and order more fuel efficient vehicles which reduces its overall fleet costs. Additionally, during the FY 2016 replacement cycle, LANL down-sized 16 vehicles to smaller, more fuel efficient vehicles.

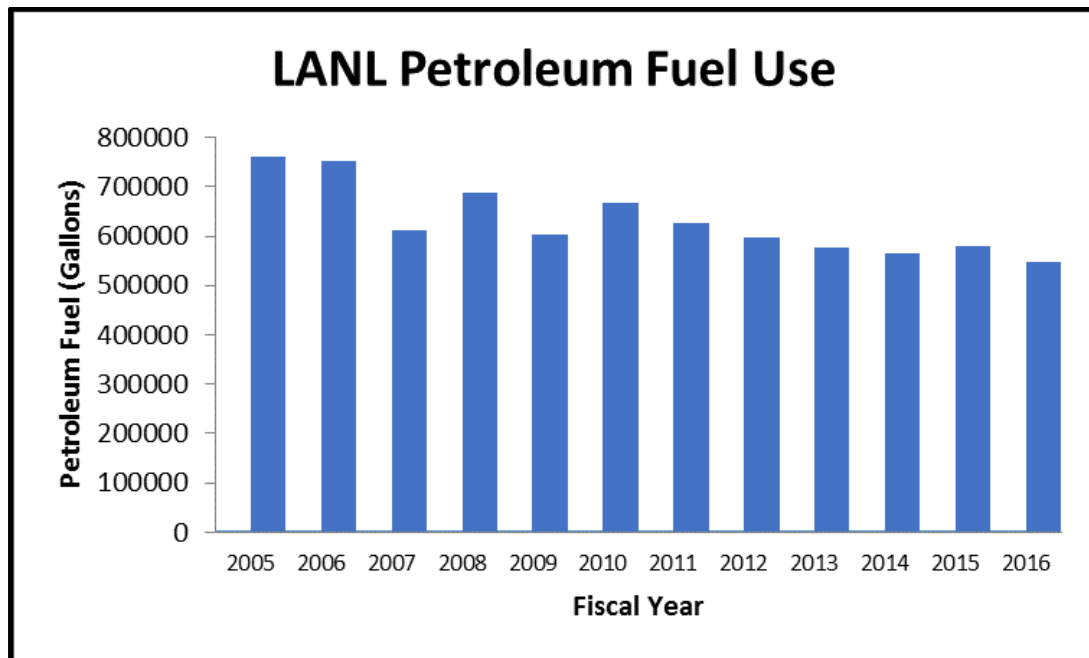


Figure 16. LANL Petroleum Fuel Reductions Since 2005

Projected Performance:

LANL continues to research and test alternative fuel vehicles (AFVs) including Plug-in Hybrids and electric cars as available. LANL continues to collect data on E-85 and Hybrid vehicles and is working with management to downsize and right size the Laboratory’s fleet.

During the FY 2017 annual replacement cycle, LANL will continue to order more fuel efficient vehicles, low-GHG emitting vehicles, where practical to meet the fleet sustainability goals. In FY 2014 LANL purchased two Chevrolet Electric Volts (plug-in hybrids) which were assigned to organizations within the Lab that had expressed an interest in supporting and promoting alternative vehicle use at the Laboratory.

5.2 Alternative Fuel Consumption

Goal: 10% increase in annual alternative fuel consumption by FY 2015 relative to a FY 2005 baseline; maintain 10% increase thereafter

Performance Status:

LANL continues the use of E-85 fuel in flex-fuel vehicles using Security vehicles and within the Utilities and Institutional Facilities organization. LANL subcontracts with a northern New Mexico pueblo-owned business to provide bulk E-85 and Bio-diesel fuel which is transported to the site in a LANL mobile fuel tanker. LANL has three fuel trucks that provide site wide service at the Laboratory. In FY 2016, alternative fuel consumption was 42,447 gallons, primarily E-85. Alternative Fuel consumption in FY 2016 has increased by approximately 378% compared to FY 2005 consumption.

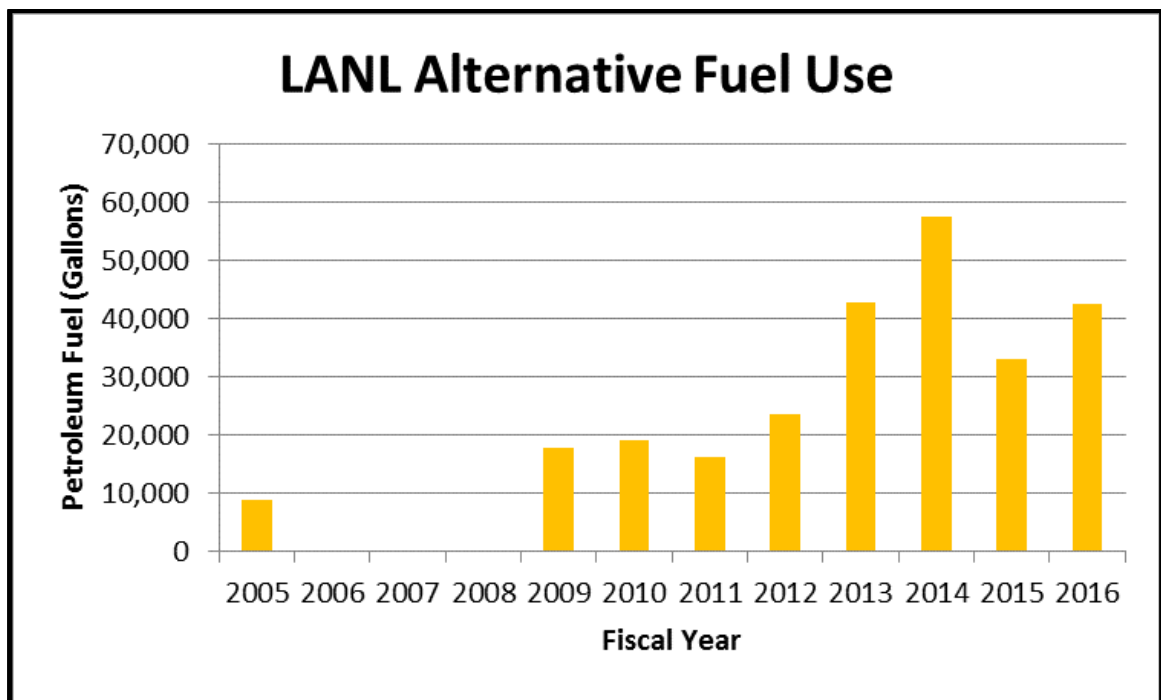


Figure 17. LANL Alternative Fuel Use

Projected Performance:

LANL will continue working toward expanding the use of alternative fuel in the current fleet when available and competitively priced. LANL will continue to use mobile fueling to increase alternative fuel use.

5.3 Fleet-wide per-mile greenhouse gas emissions

Goal: 30% reduction in fleet-wide per-mile greenhouse gas emissions by FY 2025 from a FY 2014 baseline (2016 Target: 3% reduction)

Performance Status:

LANL exceeded the annual target of 3% and achieved a 6% reduction compared to the FY 2014 baseline. When low-GHG emitting vehicles are available on the GSA AFV Leasing guide, LANL is taking every opportunity to order them.

Projected Performance:

LANL will continue to expand the use of alternative fuels in the current fleet when available and competitively priced. In FY 2017 LANL plans to continue to use mobile fueling to maintain alternative fuel use.

5.4 Light Duty Vehicle Acquisitions

Goal: 75% of light duty vehicle acquisitions must consist of alternative fuel vehicles (AFV) by 2015 and each year thereafter

Performance Status:

LANL's total Fleet consists of 1,611 vehicles. 837 or 52% of those are considered Light Duty vehicles (LDVs). Of the 837 Light Duty vehicles, 637 or 76% are alternative fuel vehicles (AFVs). Vehicles, that weigh less than 8,500 lbs gross vehicle weight rating (GVWR) are considered LDVs. EPA 2005 requirements apply to fleets of 20 or more LDVs that are centrally fueled or "capable of being centrally fueled" and are primarily operated in a Metropolitan Statistical Area (MSA)/Consolidated Metropolitan Statistical Area (CMSA). Vehicles heavier than 8,500 lbs GVWR or not located or operated primarily in a covered MSA or CMSA are exempt from the requirements. Since Los Alamos is not located in a MSA, we are exempt from this requirement, however, in support of the requirement, 76% percent of LANL's current Light Duty vehicles are alternative fuel vehicles.

Projected Performance:

LANL will continue working toward expanding the use of alternative fuel in the current fleet and, when available and reasonably priced. LANL will continue to use mobile fueling to increase alternative fuel use and order Low Greenhouse Gas vehicles that are available on the GSA AFV Leasing guide that meet programmatic requirements. Unfortunately, GSA, our first source for vehicles continues to charge an incremental charge for the acquisition of alternative fuel vehicles. Incremental is defined as the price difference between the alternative fuel vehicle and the low price listing of a comparable vehicle.

5.5 Zero emissions or Plug-in hybrid electric vehicles

Goal: 20% of passenger vehicle acquisitions consist of zero emission or plug-in hybrid electric vehicle by 2020, working towards a goal of 50% by 2025

Performance Status:

In FY 2014 LANL acquired two Chevrolet Electric Volts which were assigned to organizations within the Laboratory. These were organizations that had expressed an interest in supporting and promoting alternative vehicle use. The Laboratory currently has two on-site charging stations.



Picture 3. Plug in Electric Vehicles and Charging Station

Projected Performance:

Unfortunately, GSA, our primary source for vehicles, continues to charge an upfront fee for the acquisition of zero emission and plug-in hybrid vehicles. The upfront fee is defined as the price difference between the zero emission and plug-in hybrid vehicles and the low price listing of comparable vehicles availability. Improved affordability of plug-in hybrid vehicles through GSA is required (i.e. convert the upfront fee into a lease payment) before LANL can cost effectively expand the plug-in hybrid fleet. Cost affordability of charging stations on-site is another impediment.

6 SUSTAINABLE ACQUISITION

6.1 Sustainable Acquisition and Procurement

Goal: Promote sustainable acquisition and procurement to the maximum extent practicable, ensuring Bio Preferred and bio based provisions and clauses are included in 95% of applicable contracts

Performance Status:

During FY16, LANS continued to increase the availability of and promote procurement of Environmentally Preferable Products (EPP).

After several months of piloting, LANS implemented the Contract Expert system at the end of FY16. This new tool provides procurement specialists the ability to include clauses and provisions related to

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sustainable acquisition automatically into issued subcontracts and purchase orders. Contract Expert provides a more sophisticated method of managing required clauses and provisions thus allowing management to monitor the use of contractual language related to sustainable acquisition in all subcontract and purchase order actions.

In an effort to increase awareness of sustainable acquisition opportunities, ASM issued Lab-wide communications that described and promoted environmentally preferable purchasing options. For example, ASM issued a communication titled, 'Buy with the Environment in Mind' which provided Laboratory personnel information on what product attributes to look for when selecting an item and listings of energy efficient, paper-based and bio-based products commonly purchased and used by the Lab.

In addition, ASM issues announcement and notices that promote the sustainable products available from the Lab's Catalog vendors. In FY16, ASM issued a Lab-wide communication that highlighted the green janitorial products available from the Lab's janitorial product supplier, including how to find such products in their on-line catalog.

Excluding purchase card and catalog releases, ASM issued 4,221 new subcontracts or purchase orders in FY16. Of these actions approximately 87% included standard language that contractually obligates subcontractors and suppliers to sustainable acquisition requirements. Those subcontracting actions that did not include sustainable acquisition clauses or provisions were not applicable to such requirements i.e. real property leases.

Finally, LANL continues to provide training regarding Sustainable Acquisition for all Designated Procurement Representatives (DPR) in the required "DPR Fundamentals" course. Topics include: affirmative procurement, DPR responsibilities to select and record green products, green product catalog indicators, green catalog location, and catalog fields with green product justifications.

In accordance with LANL's responsibilities to promote sustainable acquisition in its procurement activities to the maximum extent practicable, the Small Business Program partnered with Acquisition Services Management Division and the Environmental Stewardship Group's Pollution Prevention Team to host the first annual Sustainability Fair. The Sustainability Fair was held to educate employees about "greenbuy" options and promote sustainable acquisition practices whenever possible. Eighteen LANL vendors and suppliers attended and showcased their environmentally preferable goods and services, janitorial products, sustainable office supplies, furniture, and other energy-efficient and recycled-content products.

The implementation of DOE Order 436.1 gives procurement representatives more opportunities to choose less hazardous or non-hazardous goods and services with the environment in mind. In FY 2016 a Sustainability Fair was held to educate employees about "greenbuy" options and promote sustainable acquisition practices whenever possible. Eighteen LANL vendors and suppliers attended and showcased their environmentally preferable goods and services, janitorial products, sustainable office supplies, furniture, and other energy-efficient and recycled-content products.

Projected Performance:

LANS and ASM will continue to promote sustainable acquisition whenever possible, ensuring Bio-Preferred and bio-based provisions and clauses are included in 95% of applicable subcontracts and

purchase orders. With the implementation of the Contract Expert tool in FY17, LANS will improve tracking of sustainable acquisition provisions and clauses in new subcontracts and purchase orders.

The ASM Division will also continue to support all sustainability outreach activities coordinated by the Environmental Protection and Compliance organization such as information fairs and similar campaigns. ASM will communicate and promote LANS catalog suppliers and their sustainable product offering through various announcements and bulletins to the Laboratory’s designated procurement representatives (DPRs). As it has in previous years, ASM will support the continued participation by LANS in the Green Buy program.

7 POLLUTION PREVENTION AND WASTE REDUCTION

7.1 Municipal Solid Waste (MSW) and Construction & Demolition (C&D) recycling and waste diversion

Goals: MSW and C&D recycling and waste diversion reduction by 50%

Performance Status:

LANL diverted 50% of solid, non-hazardous waste and 99% of construction and demolition waste in FY 2016. Additionally, LANL construction and demolition activities continued to produce clean fill for reuse on-site. LANL’s progress toward waste diversion goals, and overall recycling is shown in Figure 16.



Figure 18. Progress toward Waste Diversion Goals

The Pollution Prevention (P2) Program is essential to achieve the Grand Challenges of the Long Term Strategy for Environmental Stewardship and Sustainability. The Grand Challenges include:

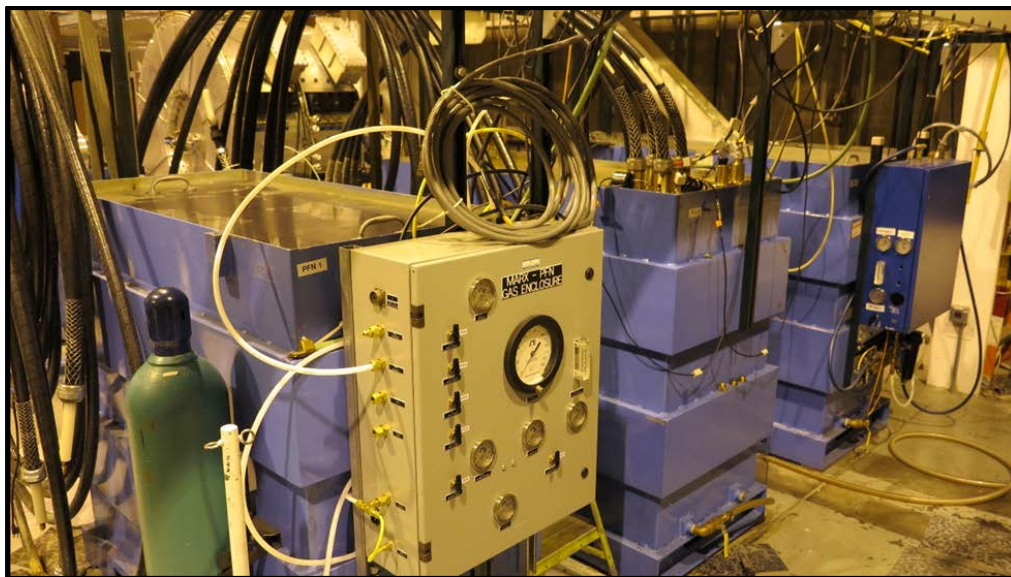
- Collaborate with our stakeholders and tribal governments to ensure LANL’s impact on the environment is as low as reasonably achievable
- Remove or stabilize pollutants from the Manhattan Project and Cold War eras

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- Protect water quality and reduce water use
- Eliminate industrial emissions, discharges and releases to the environment
- Protect human and environmental health by managing and restoring lands
- Produce zero radioactive, hazardous, liquid or solid waste
- Use energy efficiently while creating sustainable energy sources

LANL has a robust P2 program that develops and supports institutional P2 strategies and initiatives that support the Grand Challenges, reduce costs, reduce environmental liabilities and increase operational capacity. Specific areas include Zero Waste, No Exposure Pathway, green chemistry and chemical use reduction, cleaner production projects, SF₆ reduction, green procurement, the Site Wide Clean Up and Workplace Stewardship Program, and green maintenance and infrastructure. The program also meets compliance requirements through compilation of the Hazardous Waste Minimization Report required by the NMED Hazardous Facility Operating Permit, completes DOE Sustainability Goal reporting in the SSP, holds the annual LANL P2 Projects awards competition, and directly funds generators to conduct P2 projects via the P2 Project Fund.

The FY 2016 LANL Annual Pollution Prevention Award Ceremony recognized 41 projects. The projects involved more than 200 individuals from across numerous Laboratory organizations. The project realized an estimated cost avoidance of \$3.4 million. Benefits from these projects include reuse of ~3,000 pounds of computer hardware, recycling of ~1,000,000 pounds of metal and 500 cubic meters of sediment, and avoidance of multiple gallons of solvent purchases for chemical research. The photo below shows some of the electronics that were carefully segregated to minimize the generation of mixed low-level waste.



Picture 4. Segregated Electronics to minimize the generation of mixed low-level waste

LANL received a DOE pollution prevention award in the sustainable communications category. LANL also received five NNSA awards for pollution prevention projects, including two Best-in-Class awards and three Environmental Stewardship awards. In addition, LANL received a prestigious GreenGov

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Presidential award in 2015 for implementing comprehensive and proactive strategies to mitigate the long- and short-term effects of climate change

In FY 2016, LANL funded 18 pollution prevention projects. The following are some examples:

- **Solventless Powder Reduction and Chemistry**
This team will reduce the amount of hazardous waste generated and new chemicals procured through the installation of a planetary mill. The planetary mill can grind solid materials into tiny particles so that reactions can occur with much smaller quantities of chemicals. The mill deposits energy more efficiently into a reaction than standard solution chemistry, so it reduces the reaction times dramatically, and it eliminates solvent usage altogether from many reactions. Many types of reactions can be facilitated in the planetary mill, and since there is no pressure required, it is safer than the previously used methods. The team expects to avoid the use of several hundred gallons of various solvents annually as well as a few gallons of acutely toxic chemicals. Annual costs avoided from waste disposal and chemical procurement are projected to be in excess of \$10,000, and using thousands of hours more productively has a far greater value.
- **Small Dry-Vacuum Pumps to Replace Centralized Oil-Based Vacuum**
Biological cultures at LANL are grown and manipulated in biosafety cabinets, and in this process biochemists need to aspirate samples and supernatants. This aspiration process was performed by a centrally located oil-based vacuum pump for all high vacuum requirements in the laboratory. This centralized pump ran all the time and required that the oil be changed twice per month. This team used their funding to purchase 45 small oil-free vacuum pumps so that each lab can have its own vacuum source that can be used only as needed. Not only is energy usage reduced and employee time saved, but many gallons of waste oil are no longer generated.
- **Dissolving Post-Detonation Debris with Ammonium Bi-fluoride**
In the field of nuclear forensic study, one of the biggest challenges is dissolving post-detonation debris for analysis. Debris generated after the nuclear detonation is a glassy material that is difficult to dissolve with chemicals. Traditionally, concentrated acids such as nitric acid, hydrofluoric acid, and sulfuric acid are employed during the dissolution. These corrosive acids are not suitable for field sample preparation operations. LANL chemists discovered that a commercially available chemical called ammonium bi-fluoride, found in many retail products, can be potentially used for debris sample preparation. Due to its less hazardous chemical properties, ammonium bi-fluoride has been used as a replacement for hydrofluoric acid, an extremely hazardous chemical, in several industrial applications. This team will study the feasibility of using ammonium bi-fluoride for field analysis of post-detonation debris instead of traditional concentrated acids.

The LANL procedure P412, Environmental Radiation Protection, describes the process and associated requirements for releasing materials from radiological areas. Two projects were funded by P2 to

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continue the progress towards radiological assessment capabilities for items/material directly impacted by the DOE moratorium on releasing suspect material to the public. This includes items/material that could be volumetrically contaminated (activated) and/or exhibit low levels of surface contamination potential. Procedures were developed and approved internally with the intent to demonstrate capabilities in FY 2014. In FY 2015, this process was verified by personnel from DOE Headquarters, the Stanford Linear Accelerator, and Sandia National Laboratory. The NNSA Field Office also performed independent verification for specific shipments. Approximately 605 tons of metal were recycled through this effort, which exceeded expectations. This work was ongoing in FY2016.

LANL continued to implement its Pesticide Discharge Management Plan (PDMP) to comply with changes in EPA's National Pollutant Discharge Elimination System (NPDES) permit requirements. The PDMP describes LANL's actions to minimize pesticide discharges through the use of pest management measures and monitoring/reporting of adverse incidents, including the following:

- Description of Pesticide Management Area and application sites
- Pest problem descriptions and management options
- Chemical/biological pesticides currently in use
- Response and reporting procedures for spills and adverse incidents
- Application, spill, and adverse incident reporting

Projected Performance:

LANL's FY 2017 solid, non-hazardous waste and construction and demolition waste diversion performance is expected to be similar to that of FY 2016 and sustain performance levels at or above the 50% recycling goal. Additionally, LANL will continue to reuse clean fill generated on-site.

In FY 2017, LANL will provide funding to generating organizations to conduct P2 projects. Projects funded in FY 2017 will be integrated with the EMS Objectives & Targets process, as well as the Grand Challenges of the Long-Term Strategy for Environmental Stewardship and Sustainability, ensuring progress is made on attainment of institutional goals. The P2 Program uses six focus areas to identify specific areas for improvement opportunities (e.g., waste minimization/avoidance, emission, discharge or effluent reduction, GHG reduction, resource conservation, process improvement, etc.). These high priority focus areas allowed organizations to identify projects and understand the alignment with institutional goals. In FY 2017, the P2 program will especially pursue opportunities to reduce the generation of TRU and MTRU waste due to the temporary closure at the Waste Isolation Pilot Plant as well as SF₆ reduction.

LANL will continue implementation of an integrated pest management plan that complies with the PDMP at the worker level, including processes and forms for documenting pesticide investigation and application; adverse incident follow-up and response; spill or release reporting; list of approved pesticides; and continuous improvement practices. In addition to the PDMP, other regulatory drivers, DOE plans, and site-specific considerations impact pesticide application and management, including (but not limited to):

- Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)
- Site Sustainability Plan
- Pollution prevention and "green" products

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- Physical security around nuclear and high security facilities
- Safety concerns about silica exposure and terrain-related slips/trips/falls
- Fuel mitigation and vegetation control in explosives areas
- Storm Water run-on/runoff and erosion control

SMEs from these areas will be included in periodic reviews and discussions of pesticide management practices for urban and wildland areas as appropriate to ensure that relevant environmental and safety factors are considered.

8 ENERGY PERFORMANCE CONTRACTS

8.1 Energy Performance Contracts

The ESPC for the replacement of the TA-3 steam plant got underway in earnest in FY '16. The DOE field office requested, and LANL composed, a series of initiating documents early in the year. These documents focused on describing the mission need for the replacement and a preliminary description of the project. This was followed by a DOE-initiated analysis of the business alternatives to an ESPC that concluded that the ESPC was by far the best alternative.

In July, NNSA's Office of Safety, Infrastructure and Operations authorized the Los Alamos Field Office to proceed with an ESPC solicitation.

In FY '17 LANL and Los Alamos Field Office will keep cooperating in the ESPC process.

9 ELECTRONIC STEWARDSHIP

9.1 Purchases

Goal: 95% of eligible acquisitions each year are EPEAT-registered products

Performance Status:

During FY 2015 100% of acquisitions of imaging equipment, computers, and displays available on established blanket agreements, were EPEAT-registered products.

Projected Performance:

The Laboratory will continue to purchase EPEAT-registered products to meet this goal.

9.2 Power Management

Goal: 100% of eligible desktops, notebooks, and monitors have power management enabled.

Performance Status:

LANL did not meet the goal of 100% of eligible PCs, laptops, and monitors with power management implemented, but achieved 92% of power management enabled. Windows computers have built-in power settings to regulate how and when both computers and monitors are powered down to low power states, called "sleep", "standby" or "hibernate". The Windows platform has the most extensive

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power management capabilities of the desktop computing platforms in use at LANL and SCCM has the ability to granularly manage those setting in an automated fashion. While the Macintosh has some limited power settings, there are no tools currently available to centrally manage those settings. The Linux platform does not include power management capabilities. Because of these platform-based limitations, the power management effort of PCs at LANL is limited to Windows. Fortunately, Windows computers make up close to 80% of the desktops in use at LANL.

The following are limitations of the SCCM system:

- In January of 2016, LANL suspended the use of SCCM to manage the power settings on Windows computers. This was due to a conflict between SCCM’s power management and cybersecurity scans to evaluate vulnerabilities on LANL Windows computers. However, nearly all LANL Windows computers still have power settings in place, but only roughly 30% of these systems are set to sleep on a regular schedule.
- LANL does not attempt to manage power settings on Windows server systems for obvious reasons, as most servers are designed to have 24 X 7 availability. Some desktops may also be considered ineligible for power management if they are either incapable of being put into a low power state due to hardware limitations (including virtual computers), or have requirements to be constantly powered on for running experiments, collecting data or other similar operations. To summarize, computers “eligible” for power management at LANL include all Windows desktops and laptops on the unclassified network except:
 - Computers with incapable hardware
 - Virtual computers
 - Computers that are voluntarily excluded due to programmatic needs that preclude power management

Projected Performance:

While LANL has implemented this goal due to the need to suspend SCCM power management because of cybersecurity issues, the projected energy savings using SCCM has not been as high as initially projected. The NIE-CDS SCCM team is currently evaluating third-party products that actually power off and power on Windows systems rather than putting them into sleep mode. The added flexibility of these products may provide a workaround to the cybersecurity scanning issue.

9.3 Automatic Duplexing

Goal: 100% of eligible computers and imaging equipment have automatic duplexing enabled

Performance Status:

This goal is managed through the EMS process and through outreach by the Pollution Prevention Program it is not possible to configure duplex printing in an automated fashion on Windows computers. According to Microsoft. “Microsoft Word Automation clients cannot set the duplex print flag before a print job starts in Microsoft Office Word”.

9.4 End of Life

Goal: 100% of used electronics are reused or recycled using environmentally sound disposition options each year

Performance Status:

The Laboratory disposes of its excess government personal property through its excess/disposition, recycle, trash, or hazardous waste streams as dictated by the type, condition, safety, environmental, and security issues of government personal property. Laboratory workers with supplies or equipment that they no longer need must consult their Property Specialist for proper disposition of any type of government personal property. To be released outside of the Laboratory's stewardship, government personal property must be safe and not pose a security risk. The Laboratory worker must complete the *Excess/Salvage Equipment Request Form*, to initiate the disposal of all barcoded government personal property. Barcoded government personal property that is deemed safe and secure for internal reuse is advertised through the Laboratory's electronic SWAP Shop. All reusable non-barcoded government personal property is made available for internal reuse through a site visit to the excess yard. Laboratory workers are expected to consider the potential for recycling items that are no longer needed.

The Laboratory's IT equipment must be disposed of in accordance with the *Sanitizing Information System Storage Media, Memory Devices, and Other Related Hardware Procedure*, and the Laboratory's Information Systems Destruction and Recycle Plan approved by the NNSA-Los Alamos Field Office.

The Laboratory's reusable safe/secure excess government personal property that is not reused internally is made available to schools, universities, other DOE/NNSA and federal agencies, and state surplus. The Laboratory's excess government personal property that is safe/secure and is in salvage condition or is not transferred to an internal or external organization is released for public sale.

Projected Performance:

LANL plans to continue the programs and processes described above in the Performance Status section.

10 CLIMATE CHANGE RESILIENCE

Northern New Mexico has experienced drought conditions since the mid-1990s. These drought conditions have contributed to the occurrence of large wildland fires impacting the Laboratory and adjacent lands. The damage to the forests and soils at and surrounding LANL dramatically decreased the landscape's ability to retain precipitation. Thus monsoon season thunderstorms have produced dramatic flooding events, primarily occurring in LANL canyons (LANL 2014a). These flood events have produced road and infrastructure damage, and high amounts of soil erosion. Thus, LANL has experienced and has planned for the impacts of climate change, predicted for the southwestern United States in the national Climate Assessment (Melillo et al. 2014). These climate change impacts include increasing temperatures, increasing frequency of wildland fires, the potential for extended droughts, and the potential for increasing frequency of heavy rainfall events. This section summarizes the adaptations the Laboratory has and will make in the future as our climate continues to evolve.

10.1 Policies

Goal: Update policies to ensure planning for, and addressing the impacts of, climate change

Objective 1: Determining Risk

The Laboratory has identified wildland fires, caused in part by drought and rising temperatures, to be the primary climate change risk that will affect Laboratory mission, operations, and personnel. This assessment is based on fact the Laboratory has endured two significant wildfire events already this century as well as on the predictions cited above. LANL assesses both the likelihood and the severity of this risk as high.

The risk identified as next highest in significance is flooding resulting from heavy precipitation events. As with wildfire, this assessment is based both on recent history and published predictive analysis. LANL views the likelihood of flooding to be high but the impact to be only moderate, largely due to the topology of the site and the location of real estate assets.

The final significant risk is seen in increased temperatures that could potentially overtax building cooling systems and limit outdoor activities. Recent history has not presented this problem but the predictive work shows it to be of concern. LANL views the likelihood of this risk to be high but the impact to be moderate.

In an effort to undertake a more comprehensive evaluation of risks and vulnerabilities to climate change, LANL developed a conceptual model of climate change impacts during 2015 to identify the climate stressor, the impacts of the stressor on LANL, the likelihood of the stressor, and the severity of the stressor (Dewart 2016). LANL followed the framework provided in the U.S. Climate Resilience Toolkit. This model is presented and will be updated in LANL's annual Long Term Strategy for Environmental Stewardship and Sustainability work plans published by the Environmental Protection and Compliance Division.

Objective 2: Current Activities

Los Alamos has a wide-ranging program to prepare for and to respond to climate change and the impacts to operations, mission, and personnel. The primary work for preparation and adaption is decentralized among LANL organizations:

- **Wildland Fire Management Program:** The Laboratory began forest thinning in response to wildland fires that occurred in the 1970s and mid-1990s. The formal Wildland Fire Management Program was established in 2008 in response to drought, rising temperatures, and wildfires. This program is operated under the Security and Emergency Operations Division and the program is very mature (LANL 2015b). Annually, site vegetation data are updated using Landsat satellite technology. A risk assessment is performed, assuming fires could be ignited at any LANL location. The assessment identifies which areas are most likely to threaten life, operations, and infrastructure. The annual work plan for forest thinning activities is developed from the assessment. In addition, LANL works cooperatively with the US Forest Service, National Park Service, local cities and counties, and neighboring Pueblos to prepare and train for wildland fire response.

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- Long Term Site Planning: The Laboratory has a number of organizations which participate in long term site planning, including adaptation for climate change, and these programs are very mature.
- Comprehensive Site Plan (LANL 2015c) is developed by the Operations Infrastructure Office and it establishes the 10 year direction for site development. The 2008 Site-Wide Environmental Impact Statement codified the Comprehensive Site Plan's recommendation to move facilities out of canyon bottoms, reducing the risk of flooding to site infrastructure.
- Long-Term Strategy for Environmental Stewardship and Sustainability (LTSESS): The Department of Energy directed the Environmental Protection and Compliance Division to establish the LTSESS to integrate Laboratory wide environmental stewardship with operations. The Strategy provides guidance on establishing site programs to meet the Environmental Grand Challenges (LANL 2015a). The LTSESS includes the requirement to annually review the conceptual model of climate change impacts at LANL, and update as needed. This effort began in FY 2012 and has a moderate level of maturity.
- Permit Requirements Identification System (PRID): PRID is operated by the Engineering Services Division and is a very mature system. This system allows new projects to be reviewed, prior to commencement, to assure that environmental, and other, requirements are met. The Environmental Protection and Compliance Division reviews new projects to identify issues that could occur due to climate change. For example, using the PRID system, expansion of high explosives testing activities is being moved to an alternate LANL site, due to the threat of wildland fires at the original site. LANL has allocated between \$150M and \$300M to move the high explosives testing to the alternate site.
- Environmental Remediation: The Laboratory has operated a long term program of monitoring surface and groundwater quality under the Associate Directorate for Environmental Programs. The water monitoring programs are very mature. Groundwater monitoring wells located in canyons were hardened and protection was added to sampling ports following the Cerro Grande Fire in 2000. These actions were taken in anticipation of flooding, following the fire. These actions will protect groundwater monitoring infrastructure as future climate change may increase intense rainfall and local flooding.
- Operational Environmental and Ecosystem Monitoring and Compliance Support: LANL has a number of environmental protection programs that routinely address climate change impacts. These are mature programs.
 - Environmental Sampling Board – This Board reviews sampling plans to assure that monitoring strategies adjust as climate change impacts the site.
 - Forest Management Plan – This plan provides guidance to making decisions on site vegetation to maintain the healthiest forest possible, as the atmosphere warms and potentially dries. FY 2016 work is focused on a pilot project to model soil erosion risk across LANL using GIS. This will allow prioritization of sites at highest risk of damage from soil erosion, which may be enhanced as the climate changes. As sites are prioritized, vegetation protection measures can be implemented. In addition, forest ecology Subject Matter Experts (SMEs) review new projects in the PRID system, for considerations of impacts to forest health (LANL 2014)

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- Habitat Management Plan – This plan directs the monitoring of birds and T&E species as they move due to climate change and requires native plants to be incorporated into reseeded areas (LANL 2014).
- Cultural Resources Management Plan – This plan directs the monitoring of archeological sites and historic buildings and directs erosion control work as needed for the protection of these sites. Erosion may be increased as the climate changes, due to heavy rainfall events, and this plan will govern the adaptation of work to protect archeological sites (LANL 2006).

Objective 3: Future Activities

Expanding on the conceptual model of climate change impacts, the National Renewable Energy Laboratory (NREL) will work with LANL to conduct a climate vulnerabilities assessment and resilience strategy for LANL. The plan is to integrate climate change adaptation into planning efforts in LANL engineering design and infrastructure planning. The Climate Assessment of the Southwest (CLIMAS) will identify climate stressors and their potential vulnerabilities

The Wildland Fire Management Plan will continue to be implemented in the effort to address the impacts of increasing temperatures, reduced precipitation, wildland fire risk and future flash flooding resulting from wildland fire. This program is operated under the Security and Emergency Operations Division.

The Forest Management Plan will continue to be implemented, to address the impacts of increasing temperatures, decreasing rainfall, and more frequent wildland fires and heavy rainfall events. The Plan's goals are to minimize soil erosion, maintain a mixed conifer woodland in a health condition for as long as possible, and support wildfire fuel mitigation efforts. The Environmental Protection and Compliance Division is responsible for these efforts.

LANL anticipates that the EPA will issue an MS4 Permit to the Laboratory and Los Alamos County in the FY 2016-FY 2017 timeframe. The goal of the permit is to decrease non-point source pollution into canyons and arroyos that discharge to the Rio Grande. The permit requires a broader implementation of storm water controls around LANL's urbanized areas, such as parking lots and buildings, than had previously been required. These controls will reduce the off-site migration of contaminants, in particular if climate change leads to more frequent, intense rain storms. In addition, it will require that discharges of industrial storm water be moderated by eliminating the exposure of industrial materials to precipitation.

Final environmental cleanup remedies for Material Disposal Areas will be developed over the next decade; climate change adaptation to heavy rains, wildfire, and possible increases in erosion for final remedies will be considered in the future. The Environmental Programs Associate Directorate is responsible for this effort.

Objective 4: Real Property and Supply Chain Resilience

Damage to real property as a result of wildland fire, flooding or landslides is seen as a medium to high vulnerability. LANL has evaluated and continues to maintain the site to create sufficient wildland fire-

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defensible space around all buildings. As mentioned earlier, a major goal of LANL's site planning efforts is to eliminate the risk of flooding and landslide to real property.

The two fundamental supply chain vulnerabilities are energy (electric and gas) and water supply. These are all viewed as medium risk vulnerabilities. The resiliency actions taken are:

- For electricity, LANL has developed an electrical curtailment contingency plan. LANL maintains on-site electrical generation assets and fuel oil reserves to provide backup capabilities.
- For natural gas there is no direct action that LANL can take. LANL has developed a gas curtailment contingency plan.
- For water, LANL has developed a water curtailment contingency plan.

Objective 5: Regional and Local Coordination

Regional and local partnerships have been established with other federal agencies, municipalities, and local organizations in the effort to improve our understanding of climate change science, share best practices and data, and establish regional coordination in planning and policy. These are:

- The Laboratory's Wildland Fire Management Program Office is co-located with elements of the US Forest Service, the National Park Service, and the Valles Caldera National Preserve. Coordination and communication with other agencies is supported through an Interagency Wildfire Management Team, interagency agreements, and the New Mexico Joint Powers Agreement. The Santa Fe Zone Board (SFZB) includes the LANL Wildland Fire Management Program as voting members, participates in cross-agency training, cooperates on fuels projects, and manages resources for the region. The SFZB is responsible for the Northern New Mexico Type 3 Incident Management Team.
- The East Jemez Resources Council is an interagency group of natural and cultural resources management professionals that meets two-four times a year to discuss current and future management issues, including climate change impacts. Meetings are regularly attended by individuals from DOE, LANL, the USFS, the US National Park Service, The Valles Caldera National Preserve, the Nature Conservancy, NMED, the New Mexico State Forestry Department, Accord Pueblos, and Los Alamos County.
- LANS is a member of the Energy Federal Contractors Group (EFCOG), which provides a forum for sharing information, issues, and best practices on climate adaptation across the DOE Complex through EFCOG's subgroup for Sustainability and Environment. This subgroup helps sites in meeting the Executive Order on Federal Leadership in Environmental, Energy, and Economic Performance.
- The LANL Institute of Geophysics, Planetary Physics, and Signatures has sponsored climate research at LANL since 1984. General focus areas include studies that extend our understanding of the causes of temporal variations of ocean and atmospheric basin-scale oscillations, rapid climate change on both global and regional scales, and the physics and chemistry governing storms, hydrology, geomorphic processes, and land use in regions experiencing climate change.

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Current funded projects include detection of climate signals from millennial length ice cores, real-time methane observation, attributing sources from Arctic and gas fields, and canopy carbon dynamics in a hotter, drier climate.

- Scientists in LANL's Earth and Environmental Sciences Division conduct national and international multi-lab initiatives to use the most advanced observational and experimental capabilities available to address critical problems facing our world. The Computational Earth Science Group uses high performance computing to examine microscale, mesoscale, and global-scale atmospheric phenomena, and to model wildland and urban fire phenomena. The Earth Systems Observation Group has major projects in carbon capture utilization and storage and tree mortality related to drought and temperature. Teams from this group operate stationary and mobile climate research facilities worldwide, study the impacts of fire emissions and aerosol-cloud-precipitation interactions on global climate, and contribute to the DOE-Biological and Environmental Research Next Generation Ecosystem Experiment that examines the climate change impacts in the Arctic.
- The DOE Office of Science funds the Climate, Ocean, and Sea Ice Modeling project in the Theoretical and Computer, Computational, and Statistical Sciences Divisions at LANL. For more than 20 years, the project has been developing high performance component models of the ocean, sea ice, and land ice. The team members apply models to sea level rise, rapid changes in the Arctic, global circulation of the ocean, and biogeochemical ecosystem interactions such as methane release.

Objective 6: Removing and Reforming Barriers

The Laboratory faces a significant challenge over the next 25 years in balancing near-term needs while transforming the infrastructure to ensure long-term viability (LANL 2015c). The Laboratory has an aggressive Ten-Year Site Plan (LANL 2015c) where long term challenges are identified and addressed. As information and knowledge are gained on site-specific climate adaptation challenges, the Ten-Year Site Plan will be used to identify tactics and strategies for adaptation.

10.2 Emergency Response Procedures

Goal: Update emergency response procedures and protocols to account for projected climate change, including extreme weather events.

The LANL Security and Emergency Operations Division maintains emergency response procedures to protect the LANL workforce in the event of inclement weather, including severe weather, such as flooding, that may increase as climate change impacts the southwestern United States. These procedures also include communications with employees and neighboring communities as well as coordination with nearby local governments and school districts. These procedures are reviewed every 2 years and updated as required. No revisions were made in FY16.

10.3 Health and Safety Protocols

Goal: Ensure workforce protocols and policies reflect projected human health and safety impacts of climate change

The LANL Smoke Air Quality Guidance is reviewed every 2 years. This guide advises management on smoke air quality levels from nearby fires that may require the modification of outdoor work activities. The guide was reviewed in 2015 and no technical changes were made.

10.4 Management Commitment

Goal: Ensure site/lab management demonstrates commitment to adaptation efforts through internal communications and policies

LANL has adopted the FY 2016 Institutional Objectives and Targets as part of the site Environmental Management System (EMS). As part of the Objective to create a sustainable future, the following target was established: Plan for adaptation to climate change and implement identified controls (e.g. reducing greenhouse gas emissions, etc.). These objectives and targets were communicated to every Directorate and Division EMS point of contact with the intention that they organization-specific goals and objectives.

Laboratory management has an active communications effort to routinely notify employees of wildland fire danger and required work restrictions throughout the year. LANL management along with the Wildland Fire Managers, in partnership with the LANL Communications Office, posts daily fire danger ratings and work restriction guidance on the LANL home web page. Smoke air quality measurements and work restriction guidance (as needed) are posted as Alert messages on the LANL home web page. Specific LANL-all emails are disseminated in the event of wildland fires or significant smoke events, to notify employees of possible evacuations and work restrictions.

10.5 Updating Adaptation and Resilience policies

Goal: Ensure that site/lab climate adaptation and resilience policies and programs reflect best available current climate change science, update as necessary.

The LANL Wildland Fire Management Plan is updated annually with the most current data describing the forests and fuel load on-site. These up-to-date data are implemented in the annual site risk assessment, to identify the specific areas of highest risk on-site. Annual work-plans for forest management are developed based on the risk assessment.

The LANL Forest Management Plan FY 2016 includes the completion of the site land cover map. The land cover map is based on August 2014 Landsat satellite imagery. The satellite data are verified on the ground by SMEs, to identify the specific distribution of vegetation by type. This data will be used to support the evaluation of soil erosion risk across the site. As the opportunities arise, forest management staff will support watershed-level planning for storm water and erosion controls, including forest health thinning.

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ATTACHMENTS

Attachment 1: Excluded Buildings Self-Certification Process

Attachment 2: DOE Sustainability Dashboard-Comprehensive Scorecard

Attachment 1: Excluded Buildings Self-Certification Process

DOE BUILDING EXCLUSION
SELF-CERTIFICATION FORM
FY 2015

FROM: Los Alamos National Laboratory
Program Office Landlord
TO: Sustainability Performance Office
DATE: MM DD, YYYY

SUBJECT: SELF-CERTIFICATION FORM FOR THE ENERGY INTENSITY GOAL OF EISA 2007

Each buildings or group of buildings excluded under the criteria for a Part G or Part H exclusion is/are metered for energy consumption and their consumption is reported annually.

If any building has been excluded under the criteria for Part H for impracticability then all practicable energy and water conservation measures with a payback of less than 10 years have been installed. A justification statement that explains why process-dedicated energy in the facility may impact the ability to meet the goal has been provided in the FIMS Report 063.

I certify that the buildings listed on the Excluded Buildings List produced by FIMS as Report 063 dated 10 November 2015 for Los Alamos National Laboratory of DOE Site on pages XX through XX meet the exclusion criteria in *Guidelines Establishing Criteria for Excluding Buildings* published by FEMP on January 27, 2006.

DOE Site Office Official – printed name

DOE Site Office Official – signature

Date

Contact Information:

First, Last Name

Title

Phone: (000) 000 - 0000

email: abc@de.fgh

Attachment 2: DOE Sustainability Dashboard. Comprehensive Scorecard



Comprehensive Scorecard

All Dept / Under Secretaries
All Program Offices
Los Alamos National Laboratory
FY 2016 (tentative)

Greenhouse Gas Inventory

Scope 1 & 2 Greenhouse Gas Emissions

Goal: Reduce direct GHG emissions by 50 percent by FY 2025 relative to FY 2008 baseline

Interim Target (FY 2016): -22.0 %

Current Performance: -32%



	FY 2008	FY 2016	% Change
Facility Energy	297,539.0	262,562.5	-11.8%
Non-Fleet V&E Fuel	1,788.7	0.0	-100.0%
Fleet Fuel	5,207.1	4,494.6	-13.7%
Fugitive Emissions	41,386.6	44,523.9	7.6%
On-site Landfills	0.0	0.00	N/A
On-site WWT	20.5	8.6	-58.0%
Renewables	0.0	0.00	N/A
RECs	0.0	-77,533.9	-Infinity%
Total (MtCO2e)	345,941.9	234,055.6	-32.3%

Scope 3 Greenhouse Gas Emissions

Goal: Reduce indirect GHG emissions by 25 percent by FY 2025 relative to FY 2008 baseline

Interim Target (FY 2016): -7.0 %

Current Performance: -22%



	FY 2008	FY 2016	% Change
T&D Losses*	15,817.2	10,794.4	-31.8%
Air Travel	6,768.1	12,438.5	83.8%
Ground Travel	2,041.6	355.9	-82.6%
Commute	48,655.8	32,508.4	-33.2%
Off-site MSW	1,531.7	2,503.7	63.5%
Off-Site WWT	0.0	1.0	N/A
Total (MtCO2e)	74,814.3	58,601.9	-21.7%

* Includes T&D losses for purchased renewable electricity and T&D credits from RECs

Facilities

Waste

Municipal Solid Waste Diversion

Goal: Divert at least 50 percent of non-hazardous solid waste (excluding construction and demolition debris)

Interim Target (FY 2016): 50.0 %

Current Performance: 50%



Energy Intensity

Goal: The latest energy intensity reduction goal, requires a reduction in energy intensity for goal subject facilities by 25 percent by FY 2025 relative to FY 2015 baseline. The prior goal, required a 30 percent reduction by FY 2015 relative to FY 2003 baseline.

Interim Target (FY 2016): -2.5 %

Current Performance: -1%



	FY 2015	FY 2016	% Change
Purchased Utilities (MMBtu)	1,379,563.5	1,367,002.9	-0.9%
Purchased Renewables (MMBtu)	0.0	0.0	N/A
Goal-subject GSF	7,123,272.0	7,108,666.0	-0.2%

Energy Intensity (Btu/GSF)

193,669.9

192,300.9

-0.7%

Renewable Electricity

Goal: By FY 2025, use 30 percent renewable energy as a percentage of overall facility electricity use

Interim Target (FY 2016): 10 %

Current Performance: 24%



	FY 2016 Electricity Consumption	FY 2016 Renewable Electricity w/ Bonuses	% of Total
Grid Electricity	459,650	0.00	N/A
On-Site Renewable Energy	1,146	2,293	0.5%
Purchased Green Electricity	0	0.00	NaN%
Renewable Energy Certificates	N/A	107,125	23.2%
Total (MWh)	460,797	109,418	23.7%

Clean Energy

Goal: By FY 2025, use 25 percent renewable energy as a percentage of overall facility electric and thermal energy use

Interim Target (FY 2016): 10.0 %

Current Performance: 15%



	FY 2016 Energy Consumption	FY 2016 Clean Energy w/ Bonuses	% of Total
Grid Electricity	1,568,327	0.00	N/A
Non-renewable Thermal Energy	937,470	0.00	N/A
On-Site Renewable Energy	3,911	7,822	200.0%
Purchased Green Electricity	0	0.00	NaN%
Renewable Energy Certificates	N/A	365,511	NaN%
Total (MMBtu)	2,509,708	373,333	14.9%

Potable Water Intensity

Goal: Reduce potable water intensity by 36 percent by FY 2025 relative to FY 2007 baseline

Interim Target (FY 2016): -18.0 %

Current Performance: -9%



	FY 2007	FY 2016	% Change
Water Consumption (million gal)	336.5	287.9	-14.4%
Aquifer Recharge (million gal)	0.0	0.0	N/A
Total GSF	9,036,290.0	8,484,994.0	-6.1%
Water Intensity (Gal/GSF)	37.2	33.9	-8.9%

Industrial, Landscaping, Agricultural Water

Goal: Reduce industrial, landscaping and agricultural water use by 30 percent by FY 2025 relative to FY 2010 baseline

Interim Target (FY 2016): -12.0 %

Current Performance: 0.0%



	FY 2010	FY 2016	% Change
Industrial	0.0	0.0	N/A
Landscaping	0.0	0.0	N/A
Agricultural	0.0	0.0	N/A
Total ILA Water (million gal)	0.0	0.0	N/A

High Performance Sustainable Buildings

Goal: Ensure 17 percent by building count comply with the Guiding Principles for sustainable buildings by FY 2025.

Interim Target (FY 2016): 15.0 %

Current Performance: 5.1%



	Building Count	GSF
Guiding Principles Certified	10	465,054
Total Applicable*	198	6,825,841
Performance (%)	5.05%	6.81%

* Applicable means buildings and trailers that are DOE owned or DOE leased where the gross/rentable SqFt is greater than 5,000.

EISA SCORECARD INFO WILL GO HERE

Fleet

Fleet Greenhouse Gas Emissions/Mile

Goal: Reduce per-mile greenhouse gas emissions by 30 percent by FY 2025 relative to FY 2014 baseline

Interim Target (FY 2016): -3.0 %

Current Performance: -6%



	FY 2014	FY 2016	% Change
Fleet Fuel GHG (MtCO2e)	4,483.0	4,494.6	0.3%
Fleet Miles (x1000)	5,477.7	5,841.7	6.6%
Greenhouse Gas Emissions / Mile (gCO2e/Mile)	818.0	769.0	-6.0%

Fleet Petroleum

Goal: Reduce fleet petroleum use by 20 percent by FY 2015 and thereafter relative to FY 2005 baseline

Interim Target (FY 2016): -20.0 %

Current Performance: -25%



	FY 2005	FY 2016	% Change
Gasoline	551,860	361,144	-34.6%
Diesel	109,941	135,078	22.9%
Biodiesel*	0	23	N/A
Total Petroleum (GGE)	661,801	496,245	-25.0%

* Includes only the diesel content of B20

Fleet Alternative Fuel

Goal: Increase fleet alternative fuel use by 10 percent by FY 2015 and thereafter relative to FY 2005 baseline

Interim Target (FY 2016): 10.0 %

Current Performance: 378%



	FY 2005	FY 2016	% Change
E-85	9	42,441	471466.7%
Biodiesel*	181	6	-96.7%
CNG	8,697	0	-100.0%
Other*	0	0	N/A
Total Alternative (GGE)	8,887	42,447	377.6%

* Biodiesel contains B100 plus the biodiesel content from B20. Other contains LNG, LPG, and electric

	FY 2016	%
Off-Site Landfills	1,480.0	50.1%
On-Site Landfills	N/A	N/A
Waste to Energy*	0.0	0.0%
Non-diverted Waste	1,480.0	50.1%
Diverted Waste	1,318.1	44.7%
On-site composted	0.0	0.0%
Off-site composted	153.5	5.2%
Total Diverted Waste	1,471.6	49.9%
Total Waste (metric tons)	2,951.6	100.0%

* For E.O. 13693, waste to energy does not count as diverted waste

Construction & Demolition Diversion

Goal: Divert at least 50 percent of construction and demolition materials and debris

Interim Target (FY 2016): 50.0 %

Current Performance: 100%



	FY 2016	%
Landfilled C&D Waste	7.6	0.4%
Diverted C&D Waste	2,088.6	99.6%
Total C&D Waste (metric tons)	2,096.2	100.0%

Electronics Acquisition

Goal: 100 percent of eligible electronics procurements must be environmentally sustainable (e.g. EPEAT)

Interim Target (FY 2016): 95.0 %

Current Performance: 100%



	EPEAT Acquired	Total Acquired	%
Monitors	0	0	N/A
Computers	5,975	5,975	100.0%
Imaging Equipment	423	436	97.0%
Televisions	0	0	N/A
Total Acquired	6,398	6,411	99.8%

Electronics Recycling

Goal: Dispose of 100 percent of electronics through government programs and certified recyclers

Interim Target (FY 2016): 100.0 %

Current Performance: 100%



	Amount	%
Transferred or Donated	28,848.390	33.7%
Recycled by Certified Recycler	56,831.760	66.3%
Recycled by non-Certified Recycler	0.000	0.0%
Amount disposed (e.g. landfill)	0.000	0.0%
Total Electronics Waste (metric tons)	85,680.150	100.0%

Power Management

Goal: Implement and actively use power management features on 100 percent of eligible computers (PCs & laptops) and monitors

Interim Target (FY 2016): 100.0 %

Current Performance: 92%



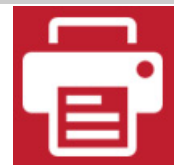
	Total Owned	PM Enabled	Exempt	%
Monitors	33,400	30,060	0	90.0%
Computers	10,626	6,867	3,759	100.0%
Total Items	44,026	36,927	3,759	91.7%

Duplex Printing

Goal: Implement and actively use duplex printing features of 100 percent of eligible printers

Interim Target (FY 2016): 100.0 %

Current Performance: 0%



	Total Owned	Duplex Enabled	Incapable	%
Total Printers	0	0	0	0.0%

Acquisition

Sustainable Acquisition

Goal: Ensure 95 percent of new contract actions for products and services meet sustainable acquisition requirements

Interim Target (FY 2016): 95.0 %

Current Performance: 100%



	Contracts Reviewed	Contracts Without Opportunity	Contracts Meeting All Requirements	%
Number of Contracts	3,910	0	3,910	100.0%

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ABBREVIATIONS AND ACCRONYMS

°F	Degrees Fahrenheit
AFV	Alternative Fuel Vehicle
ASHRAE	American Society of Heating, Refrigeration, and Air-Conditioning Engineers
BAS	Building Automation System
BTU	British Thermal Units
C&D	Construction & Demolition
CCF	Central Computing Facility
CD	Critical Decision
CEDR	Consolidated Energy Data Report
CEQ	Council on Environmental Quality
CINT	Center for Integrated Nanotechnology
CMRR	Chemistry and Metallurgy Research Replacement Facility
CMSA	Consolidated Metropolitan Statistical Area
DARHT	Dual Axis Radiographic Hydrodynamic Test facility
DM	Deferred Maintenance
DOE	Department of Energy
EAP	Environmental Action Plan
ECM	Energy Conservation Measure
EFCOG	Energy Federal Contractors Group
EI	Enterprise Infrastructure
EISA	Energy Independence and Security Act of 2007
EMS	Environmental Management System
EOC	Emergency Operations Center
EPA	Environmental Protection Agency
EPP	Environmentally Preferable Purchasing
ESPC	Energy Savings Performance Contract
ESS	Equipment Surveillance System
FIMS	Facilities Information Management System
FIRP	Facility and Infrastructure Recapitalization Project
FOD	Facility Operations Director
FTE	Full-Time Equivalent
FY	Fiscal Year
GHG	Greenhouse Gas
GP	Guiding Principles
GPP	General Plants Project

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GSF	Gross Square Feet
GVWR	Gross Vehicle Weight Rating
HPC	High Performance Computing
HPSB	High Performance Sustainable Buildings
HVAC	Heating, Ventilation, and Air Conditioning
ILA	Industrial, Landscape, and Agricultural
IOD	Infrastructure On Demand
ISO	International Organization for Standardization
IT	Information Technology
kW	Kilowatt
kWh	Kilowatt-Hour
LANL	Los Alamos National Laboratory
LANS	Los Alamos National Security, LLC
LANSCE	Los Alamos Neutron Science Center
LDCC	Laboratory Data Communications Center
LDV	Light Duty Vehicle
LEED	Leadership in Energy and Environmental Design
LFT	Low Flow Turbine
LRDP	Long-Range Development Plan
LTSESS	Long-Term Strategy for Environmental Stewardship & Sustainability
M4	Making, Measuring, and Modeling Materials Laboratory/Office
MaRIE	Matter-Radiation Interactions in Extremes
MBTU	Million British Thermal Units
MLLW	Mixed Low-Level Waste
MRRL	Methanol Recirculation and Recovery Loop
MSA	Metropolitan Statistical Area
NAABB	National Alliance for Advanced Biofuels and Bioproducts
NECPA	National Energy Conservation Policy Act
NF	Nuclear Facility
NISC	Nonproliferation and International Security Complex
NMED	New Mexico Environment Department
NMRR	New Requirements and Major Maintenance
NMSSUP	Nuclear Materials Safeguards and Security Upgrade Project
NNSA	National Nuclear Security Administration
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRDA	Natural Resources Damage Assessment
NRMM	New Requirements of Major Maintenance
NSSB	National Security Sciences Building

2017 Site Sustainability Plan

OCIO	Office of the Chief Information Officer
OMB	Office of Management and Budget
P2	Pollution Prevention
PADOPS	Principal Associate Director for Operations and Business
PDMP	Pesticide Discharge Management Plan
PF	Plutonium Facility
PNNL	Pacific Northwest National Laboratory
PUE	Power Use/Utilization Effectiveness
RAMP	Roof Asset Management Program
RECs	Renewable Energy Certificates
RLUOB	Radiological Laboratory, Utilities, and Office Building
RLWTF	Radioactive Liquid Waste Treatment Facility
ROI	Return on Investment
SAP	Sustainable Acquisition Plan
SCC	Strategic Computing Complex (also known as Metropolis Center)
SCCM	Microsoft Systems Management Server 2007
SERF	Sanitary Effluent Reclamation Facility
SERF-E	Sanitary Effluent Reclamation Facility-Expansion
SloD	Secure Infrastructure on Demand
SJGS	San Juan Generating Station
SME	Subject Matter Expert
SOC	LANL Protective Force
SSP	Site Sustainability Plan
SSPP	Strategic Sustainability Performance Plan
SWEIS	Site-Wide Environmental Impact Statement
TA	Technical Area
TRP	Technical Area 55 Reinvestment Project
TRU	Transuranic
TTF	Tactical Training Facility
TYSP	Ten-Year Site Plan
UI	Utilities and Institutional Facilities
USFS	US Forest Service
USGBC	United States Green Building Council
WMC	Waste Management Coordinator