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Los Alamos National Laboratory
FY 2021 Site Sustainability Plan

U.S. Department of Energy
Sustainability Performance Office

Los Alamos National Laboratory
FY 2021 Site Sustainability Plan

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Los Alamos National Laboratory
FY 2021 Site Sustainability Plan

Table of Contents

Los Alamos National Laboratory
FY 2021 Site Sustainability Plan

Executive Summary

The FY 2021 Site Sustainability Plan (SSP) presented in this document describes programs and projects planned or underway at Los Alamos National Laboratory (LANL) to facilitate execution of a rapidly changing and growing mission while maintaining the highest standards of environmental and economic sustainability.

Sustainability is a fundamental component of the Laboratory's Comprehensive Master Plan, now under development, which includes infrastructure planned for the near, mid, and long term to support growing and changing missions. The Laboratory's sustainability efforts and goals align well with Executive Order (EO) 13834, Efficient Federal Operations, which requires agencies to prioritize actions that enable more effective accomplishment of their missions, cut costs, reduce waste, and, enhance the resilience of Federal infrastructure and operations.

LANL will enable future missions by replacing aging electrical infrastructures to meet growing demands for electricity. LANL's Sustainability Program plays an integral role in this through adoption of a detailed power procurement strategy to plan for future power growth by balancing costs, risks, known market conditions, and environmental and operational goals. With the SSP presented in this document, LANL focuses on changes supported by deep analysis and new technology.

The SSP describes progress toward achieving a more efficient and resilient Laboratory in all areas with three primary objectives: targeted investments that improve efficiency and resource utilization, transparent tracking of progress through metrics, and engagement of employees and programs at all levels in the organization. Major actions include the replacement of a steam plant built in the1950s, including new controls, new gas supply pipelines, and a more efficient Combustion Gas Turbine Generator (CGTG); development of an on-site 10-megawatt (MW) photovoltaic (PV) system; and implementation of a Smart Labs program to enhance the scientific and technological capabilities of existing facilities while ensuring safe and efficient work spaces.

The Sustainability Program coordinates planning with other organizations responsible for major infrastructure improvements and site upgrades. Sustainability themes are woven throughout the Comprehensive Master Plan. In addition, per the requirements of DOE Order 436.1, Departmental Sustainability, LANL uses an environmental management system (EMS), certified under International Organization for Standardization (ISO) 14001:2004, to establish objectives in order to improve compliance, reduce environmental impacts, increase operational capacities, and meet long-term sustainability goals.

LANL has made significant improvements in energy and water efficiency over the last ten years, including the following achievements:

- HVAC recommissioning efforts in 40 facilities (1.5 million sq. ft.).
- Building Automation System (BAS) replacement and upgrade projects in 15 facilities.
- Implementation of the facility fault detection and data analytics software SkySpark in 60 facilities.

- Energy Savings Performance Contracts (ESPCs) for HVAC and lighting upgrades over a 20-year period ($1.2millionannual savings).
- ESPC for the Power Plant Replacement Project now in the execution phase.
- Analysis and environmental assessment of potential photovoltaic system sites (no significant environmental impacts).
- Implementation of energy efficiency components through Smart Labs.
- Update of the LANL Engineering Standards Manual to incorporate more comprehensive sustainable design criteria and programs such as HPSB and Smart Labs.
- Insulation of LANL steam pits using thermal system insulation infrared technology.
- Addition of LED and motion sensing lighting in parking garages and solar lighting in parking lots.
- Installation of EV charging stations to serve personal and government vehicles.
- Acquisition of a mobile shredding truck to improve the efficiency of paper recycling through lower fuel, labor, and operating costs.

Laboratory energy and water use is forecast to increase because of significant growth in high performance computing (HPC) and the MaRIE (Matter-Radiation Interactions in Extremes) facility, both critically important to key NNSA goals. Over the next 10 years, the Laboratory is likely to experience a doubling of energy use in the HPC facilities along with significant increases in cooling tower water use.

To support this mission growth and maintain efficient operations, major infrastructure and utility investments will be required, while attaining sustainability goals will require innovative solutions, additional resources, and specialized technologies. LANL will focus efficiency measures on key facilities that still have room for mission growth. To enable water efficiency progress, the Laboratory will continue to operate the Sanitary Effluent Reclamation Facility (SERF), implement targeted water reduction projects, and invest in new water treatments that will enable expansion of cooling tower concentration cycles.

Sustainability Program commitments include projects that require a diverse set of funding methods, including indirect, direct, ESPCs, and power purchase agreements (PPAs). The program is managed through the Facilities and Operations Associate Level Directorate. Staffing levels include three full-time employees for executing energy and water conservation projects, analytical reporting, and program management. Other staff members from Engineering Services, Construction Management, Project Management, and Maintenance support project execution.

To meet DOE’s 25% energy intensity reduction goal, LANL estimates that investments on the order of $12.5–15 million/year in existing facilities will be necessary for the next 6 years. This level of funding will be essential to fully implement several large programs that focus on deep energy retrofits and upgrading facilities to create modern, safe, and efficient spaces.

Implementation of sustainable design practices in new construction and major modernization projects will be key to achieving DOE energy intensity reduction goals. While the Sustainability Program within the Utilities & Institutional Facilities (UI) Division focuses mainly

on energy, water, and GHG reductions, collaboration with the Environmental Protection & Compliance Division will be needed for achievement of these and other goals in waste reduction and diversion, pollution prevention, and implementation of the EMS. Table 1 highlights LANL's current and projected performance against the goals in DOE's Strategic Sustainability Performance Plan.

Table 1. Executive Summary – Goals

Prior DOE Goal	Current Performance Status	Planned Actions & Contribution	Overall Risk of Non-Attainment
Energy Management			
30% energy intensity (Btu per gross square foot) reduction in goal-subject buildings by FY 2015 from a FY 2003 baseline and 1.0% YOY thereafter.	LANL achieved an 8.3% reduction from the FY 2015 baseline. Analysis shows this is partially due to COVID-19 and increased teleworking.	LANL will continue to invest in energy reduction initiatives on buildings with higher than average energy intensity than their counterparts. These initiatives include BAS upgrades; HVAC recommissioning in facilities; lighting upgrades; and Smart Labs initiatives.	High
EISA Section 432 continuous (4-year cycle) 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 conservation projects.	Low
Meter all individual buildings for electricity, natural gas, steam, and water, where cost-effective and appropriate.	139 facilities are partially metered and only 2 facilities are fully metered.	LANL Engineering Standards Manuals require new facilities to be fully metered, and the Sustainable Program will continue to require them to be installed to meet GPs and DOE metering guidelines. Life-cycle cost assessments will be done on other existing facilities to determine priority.	Medium
Water Management			
20% potable water intensity (Gal per gross square foot) reduction by FY 2015 from a FY 2007 baseline and 0.5% YOY thereafter.	LANL achieved a 20.3% reduction from the FY 2007 baseline.	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, improve cooling tower operations, and operate a new supercomputing facility with minimal water use.	High

Prior DOE Goal	Current Performance Status	Planned Actions & Contribution	Overall Risk of Non-Attainment
Non-potable freshwater consumption (Gal) reduction of industrial, landscaping, and agricultural (ILA). YOY reduction; no set target.	Currently, all of LANL's water use is potable water and is, therefore, considered part of the water intensity reduction goal.	LANL will not report on ILA goal but will focus efforts in total potable water intensity reduction.	N/A
Waste Management			
Reduce at least 50% of non-hazardous solid waste, excluding construction and demolition debris, sent to treatment and disposal facilities.	LANL diverted 48.4% non-hazardous solid waste.	LANL will continue projects such as the Furniture Reuse, reusable moving bin, composting of woody waste, the Clean-Fill programs, and others to reduce non-hazardous waste sent to landfill.	Low
Reduce construction and demolition materials and debris sent to treatment and disposal facilities. YOY reduction; no set target.	LANL diverted 100% of C&D Waste.	Onsite processing and reuse of concrete, including the recycling of the associated rebar, allows continued reductions in construction and demolition materials going to landfill.	Low
Fleet Management			
20% reduction in annual petroleum consumption by FY 2015 relative to a FY 2005 baseline and 2.0 % YOY thereafter.	FAST Data is not yet available.	LANL will continue to "right-size" its fleet and order more fuel-efficient vehicles.	Low
10% increase in annual alternative fuel consumption by FY 2015 relative to a FY 2005 baseline; maintain 10% increase thereafter.	FAST Data is not yet available.	LANL will continue to lease alternative fuel vehicles as available from GSA, and continue to research alternatives similar to the mobile fueling trucks currently in use.	Medium

Prior DOE Goal	Current Performance Status	Planned Actions & Contribution	Overall Risk of Non-Attainment
75% of light duty vehicle acquisitions must consist of alternative fuel vehicles (AFV).	FAST Data is not yet available.	LANL Fleet Management will continue to acquire low greenhouse gas (LGHG) vehicles as available, and LANL will continue to acquire electric vehicles as needed and supported by LANL's infrastructure. But due to a shortage of charging station infrastructure and the type of light-duty vehicles our customers require, we will be unable to meet the 75% DOE goal at this time. To meet it, an implementation plan will need to be developed and implemented; however we will make every effort to work towards meeting this goal.	High
Clean & Renewable Energy			
"Renewable Electric Energy" requires that renewable electric energy account for not less than 7.5% of a total agency electric consumption by FY 2013 and each year thereafter.	6.1% of LANL's electrical energy is from renewable sources.	LANL is pursuing a 10 MW PV array on-site. The main coal source of power for LANL will shut down and low carbon sources are being planned. LANL will pursue investments in firmed-wind and/or PV PPAs as needed to support mission growth.	Medium
Continue to increase non-electric thermal usage. YOY increase; no set target but an indicator in the OMB scorecard.	LANL remains at 13% with no changes in FY 2020.	New facilities will be asked to make design decisions based on life-cycle cost assessments for solar thermal systems.	Medium
Sustainable Buildings			
At least 15% (by count) of owned existing buildings to be compliant with the *revised* Guiding Principles for Sustainable Buildings by FY 2021, with annual progress thereafter.	9% of LANL's buildings have achieved compliance with the Guiding Principles.	LANL will evaluate life-cycle costs to determine if some GPs might not be applicable and allow for more buildings to be certified. In the meantime, LANL will continue to focus on high-ROI improvements to meet the energy and water saving Guiding Principles. LANL will also push to see new facilities meet the GPs.	Medium

Prior DOE Goal	Current Performance Status	Planned Actions & Contribution	Overall Risk of Non-Attainment
Acquisition & Procurement			
Promote sustainable acquisition and procurement to the maximum extent practicable, ensuring Bio-preferred and bio-based provisions and clauses are included in all applicable contracts.	LANL's P2 Program instituted the SAP Ariba program which will improve data collection regarding these and other sustainable product characteristics.	The Ariba system will have the capability of a dedicated catalog meant only for hand-picked sustainable acquisition products. This will provide LANL staff more opportunity for sustainable choices while ordering.	Medium
Measures, Funding, & Training			
Site set annual targets for sustainability investment with appropriated funds and/or financed contracts for implementation.	Phase 1 of the Steam Plant Acquisition Project will be completed in FY 2022.	LANL is pursuing a 10 MW PV PPA on-site and will pursue investments in firmed-wind and/or PV PPAs as needed to support mission growth.	Medium
Electronic Stewardship			
End of Life: 100% of used electronics are reused or recycled using environmentally sound disposition options each year.	100% of electronics were recycled.	LANL intends to continue disposing of electronics per ITs *Transfer and Sanitizing of Electronic Storage Media* Procedure	Low
Data Center Efficiency: Establish a power usage effectiveness target for new and existing data centers; discuss efforts to meet targets.	The SCC is achieving its PUE goal of 1.3. Goals have not been defined for the LDCC and CCF.	The LDCC will continue transitioning to high density liquid cooled supercomputing in FY 2021. Due to facility age and success of previous investments, no investments in the CCF are planned.	Low
Organizational Resilience			
Discuss overall integration of climate resilience in emergency response, workforce, and operations procedures and protocols.	This integration has not yet been pursued.	Performing a climate change vulnerability assessment will be considered in FY 2021 in which case climate change preparedness would be integrated into operations, policies and procedures.	High

Prior DOE Goal	Current Performance Status	Planned Actions & Contribution	Overall Risk of Non-Attainment
Multiple Categories			
YOY scope 1 & 2 GHG emissions reduction from a FY 2008 baseline.	LANL achieved a 27.7% reduction from the FY 2008 baseline.	LANL has developed a Power Procurement Strategy to plan for low-carbon electricity sources as LANL's main coal powered source will be shutting down. LANL will pursue a PPA for a 10 MW PV installation on site.	Medium
YOY scope 3 GHG emissions reduction from a FY 2008 baseline.	LANL achieved a 51% reduction from the FY 2008 baseline.	LANL is piloting a work-from-home strategy during the COVID-19 pandemic. This is planned to continue post pandemic as well. LANL will continue to install personal vehicle charging stations as demand grows.	Medium

1 Mission Changes

LANL expects major mission growth in HPC and related areas, among others, to support testing of components and assemblies in the variety of configurations necessary for stockpile stewardship and certification processes. The level of growth will require investments in electrical infrastructure, e.g. replacement of aging and obsolete systems, and development of new capabilities to address system gaps, e.g. line upgrades, new switchgear to sustain reliability, and entirely new facilities. Figure 1 shows 10-year projected growth in energy demand at the LANL.

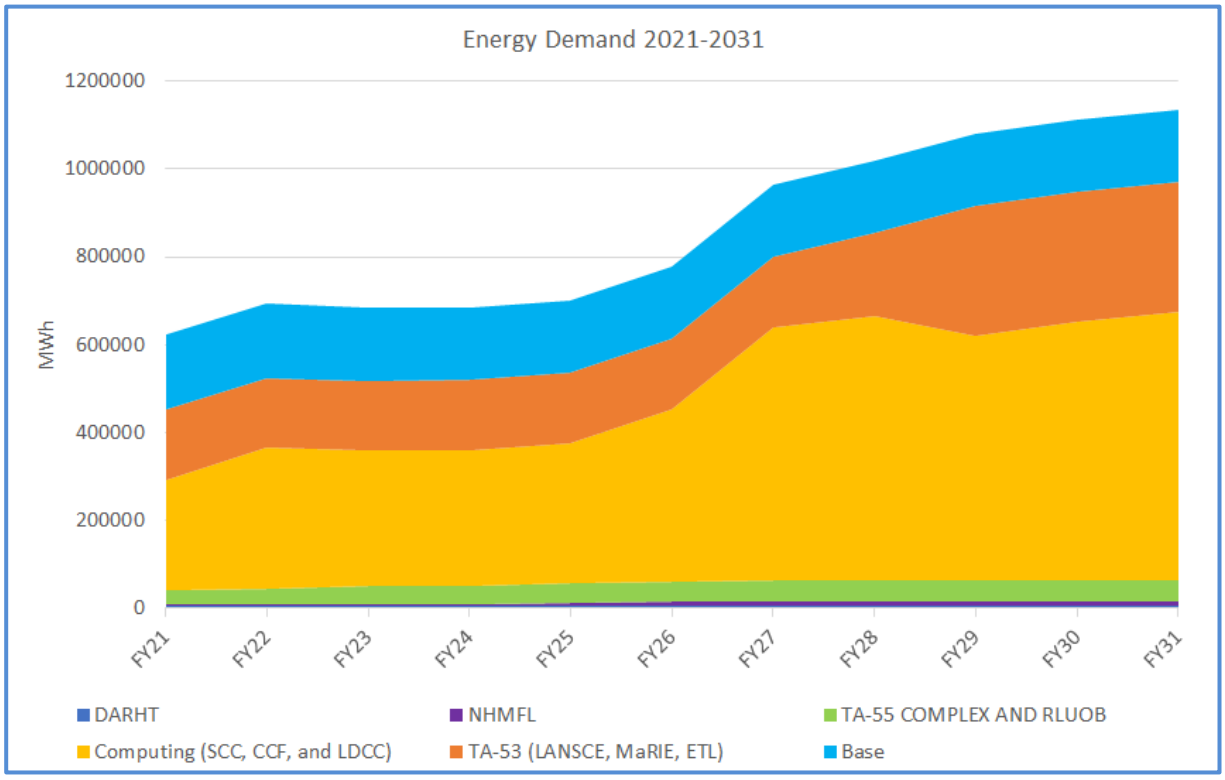


Figure 1. 10-year Energy Demand Forecast.

The LANL Power Master Plan details the path forward to address electrical infrastructure gaps and replacement needs. In support of the plan and growing electricity needs, the Sustainability Program publishes an annual Power Procurement Strategy that analyzes load growth, available energy sources, and costs. The strategy uses a model—i.e. a statistical tool—to examine power generation acquisition strategies and inform the solution detailed in the strategy document. The strategy has four main objectives:

- Informed decisions
- Flexible and adaptable operations
- Economical energy procurement
- Innovative solutions to reduce energy use and carbon emissions

The FY 2020 analysis showed that a diverse mix of resources generated both on and off-site would best meet the goals and improve LANL's electrical system resilience. The graphs pie charts in Figure 2 show the shift to more diverse, flexible, and innovate energy sources.

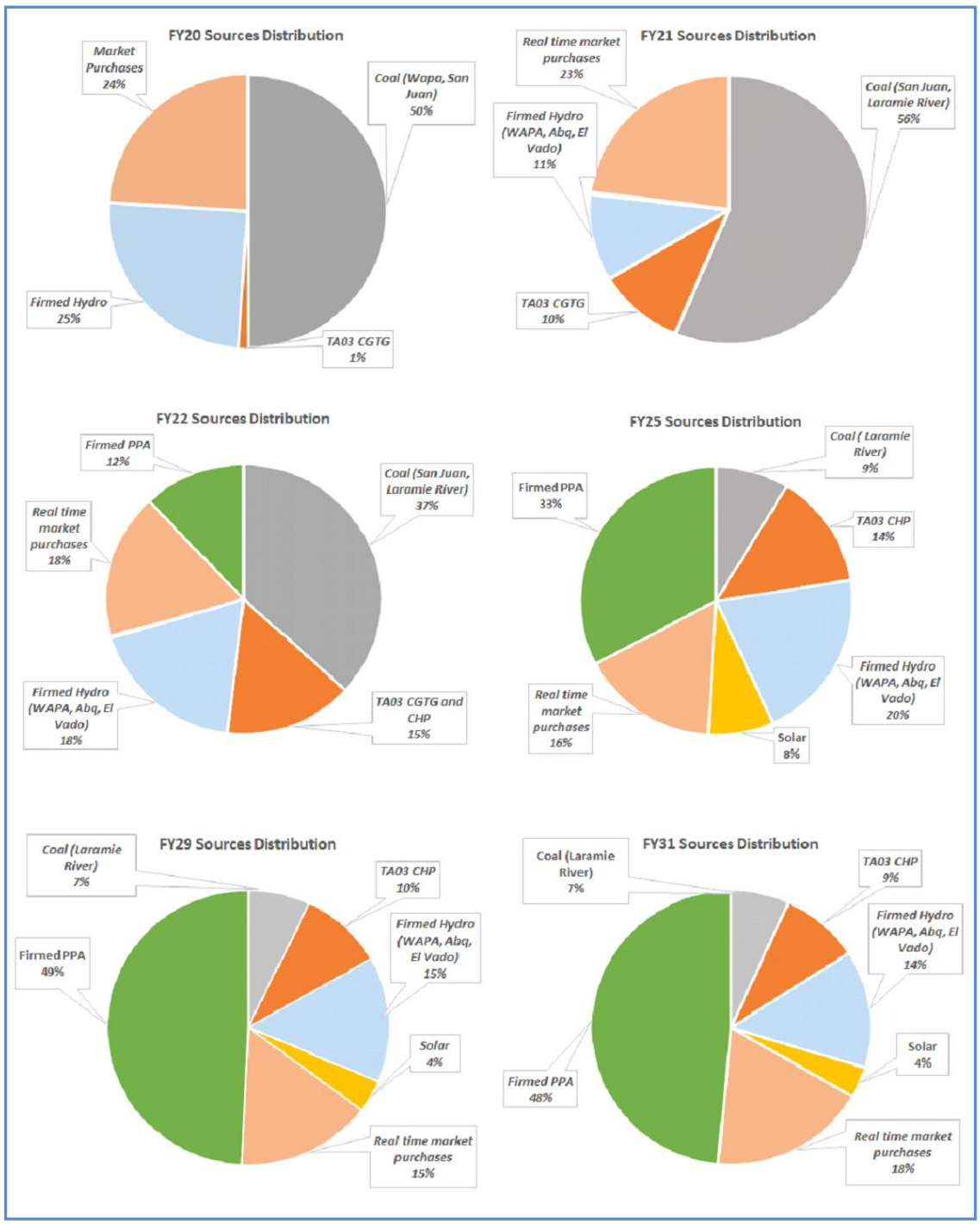


Figure 2. Shift of Energy Sources toward More Diverse, Flexible, Innovative Sources.

2 Energy Management

The Department of Energy National Nuclear Security Administration (DOE/NNSA) and LANL procure and manage the electric generation resources required to support the energy-intense mission work at LANL. DOE/NNSA and LANL and Los Alamos County (LAC) commit their

generation, transmission, and distribution resources to a pool in a long-term contract between the parties called the Electric Coordination Agreement (ECA) or the Los Alamos Power Pool (LAPP)l. The ECA was entered into in 1985 and is set to expire in 2025. The parties are currently working to restructure it.

The ECA pools electrical loads and transmission and generation resources and defines how maintenance and operation resources and expenses are shared. LANL and LAC commit their resources with the understanding that all output will be used by pool members before they make open market purchases and that costs will be apportioned between the parties in proportion to units of energy used. Historically, LANL has used approximately 80% of the energy, but projections show its energy use doubling in the next ten years, a development that is likely to change the percentage.

The LANL CGTG, capable of producing 20–27 MW, serves as an onsite energy resource for the production of electricity from natural gas, a commodity supplied by the New Mexico Gas Company. The CGTG is available to members of the LAPP for peak-load sharing and back-up.

2.1 Energy Use and Intensity

Performance Status

In FY 2020, LANL reduced energy intensity by 8.3% compared to the baseline year of FY 2015. The reduction was partially due to COVID-19 and increased teleworking. During the months of April, May, and June, the Laboratory experienced energy reductions in non-excluded facilities of 11% compared to the same months in FY 2019.

As explained below, since the COVID-19 pandemic started, some buildings have been running 24/7 on at maximum ventilation capacity. This so-called "epidemic mode" can result in higher energy intensity consumption for these buildings. In some buildings, the Epidemic Mode didn’t have much effect on non-excluded energy intensity consumption as there was still an important reduction compared with the FY 2015 baseline and the previous year.

Also in FY 2020, LANL achieved a 5% reduction in Scope 2 GHG emissions compared to the previous year and a 28% reduction compared to the baseline year FY 2015. As the end of FY 2020 approached, LANL had 300 more employees on site than it did in September 2019 and had reduced energy use per person by 4.2%, even though new mission work had started up in certain non-excluded facilities. Instead of using the actual source energy portfolio to calculate GHG emissions, DOE requires the use of the Emissions & Generation Resource Integrated Database (eGRID)—a comprehensive source of data on the environmental characteristics of electric power generated in the region. Using the eGRID factor provides a reasonable estimate of emissions. LANL is also looking for opportunities to construct an on-site 10MW photovoltaic grid which would reduce Scope 2 GHG emissions (goal-excluded and goal-subject) by approximately 12,500 MT CO2. Figure 3 following shows LANL's energy

intensity and emissions performance for goal-subject facilities and the quantities of energy used (goal-excluded and goal-subject) per person.

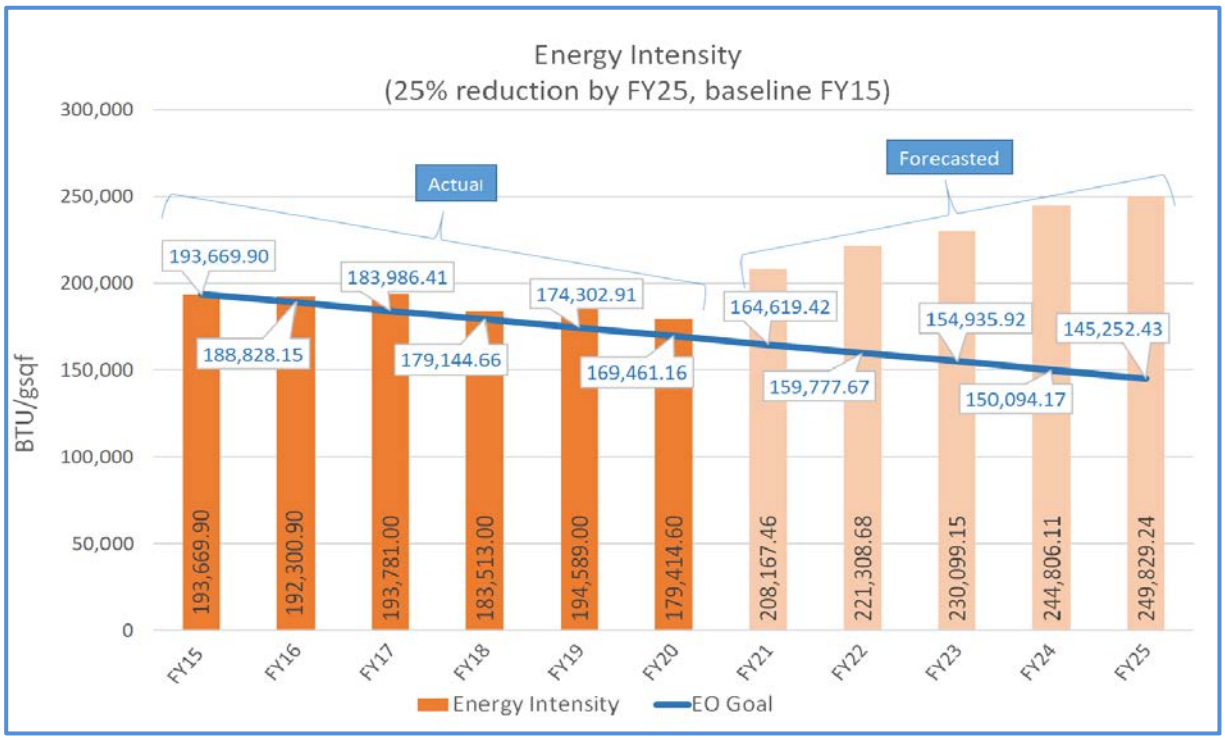


Figure 3. Energy-Intensity Performance.

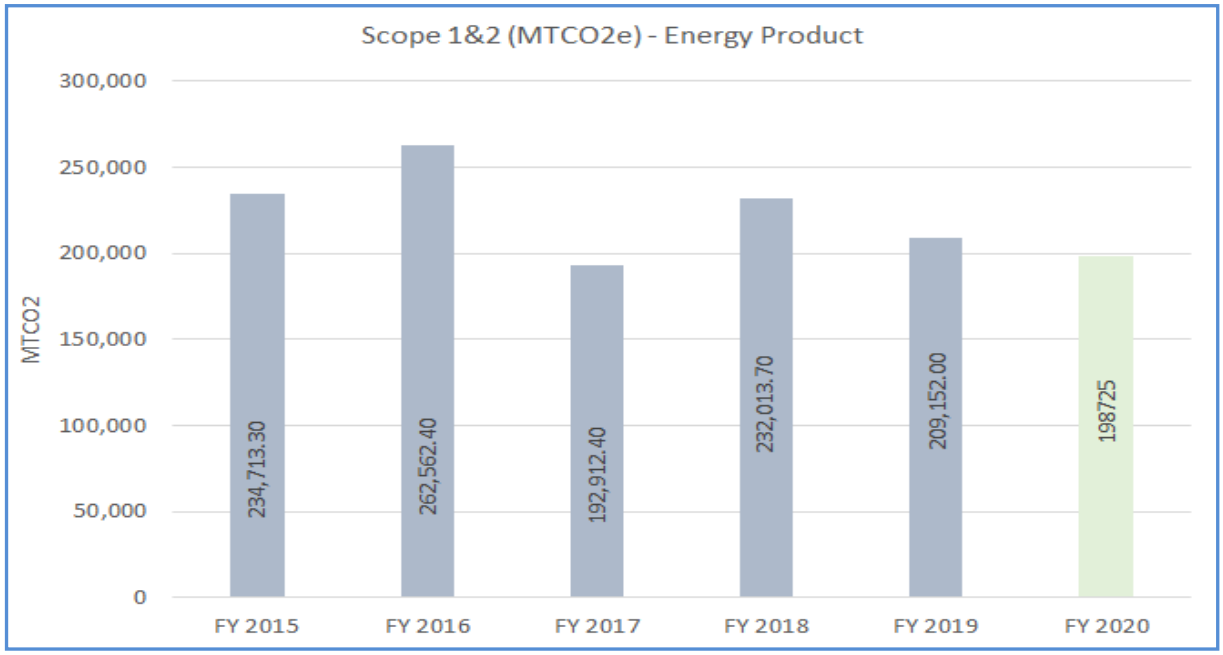


Figure 4. Scope 1 & 2 GHG Emissions.

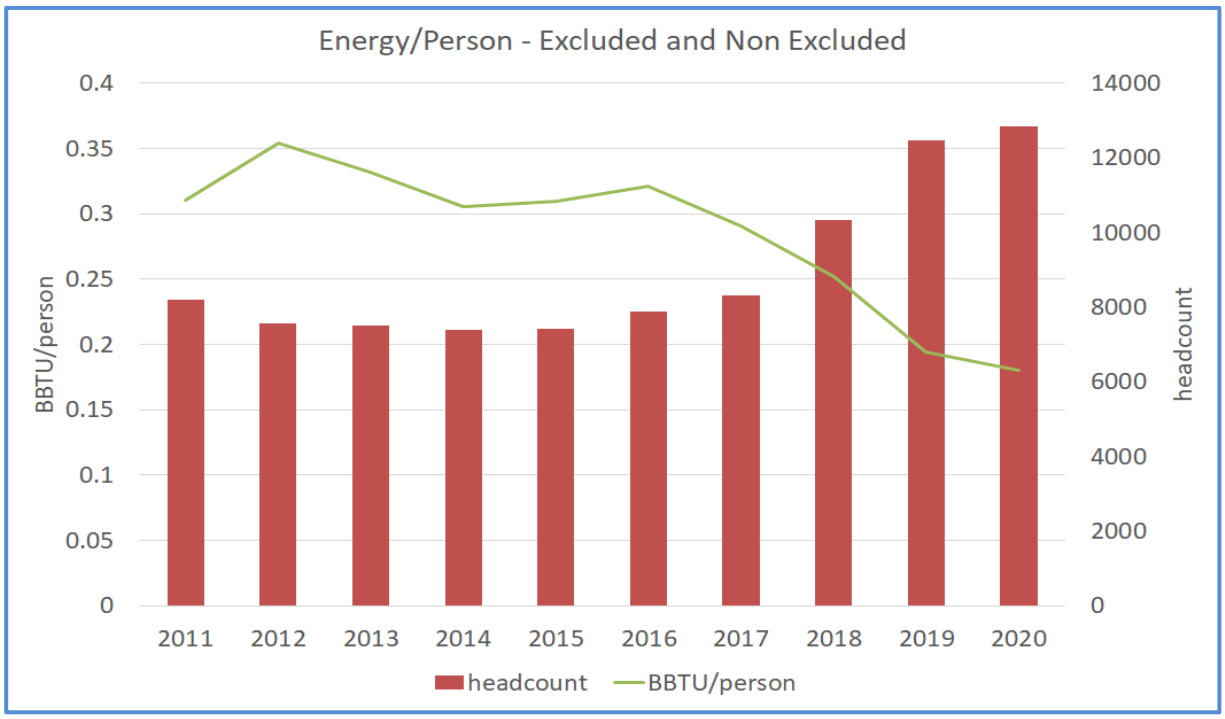


Figure 5. Total Energy/Person.

LANL has analyzed each energy source with respect to Scope 2 greenhouse gas. Its generation resources include coal, hydro, natural gas, and solar. More realistic equivalences have been used to calculate actual and projected Scope 2 GHG emissions from actual energy sources. Calculations like these will help LANL make project investment decisions that maximize the actual potential of reducing energy intensity and GHG emissions.

The main energy source for LANL is coal. Figure 6 shows projected Scope 2 GHG emissions over the next 10 years vs. projected electric energy demand. Because of high equivalency between MtCO2 and MWh, the effect of coal on Scope 2 GHG emissions is clearly visible. This effect will last until summer of FY 2022, when less carbon-intensive energy sources will start playing an important role in LANL's energy portfolio.

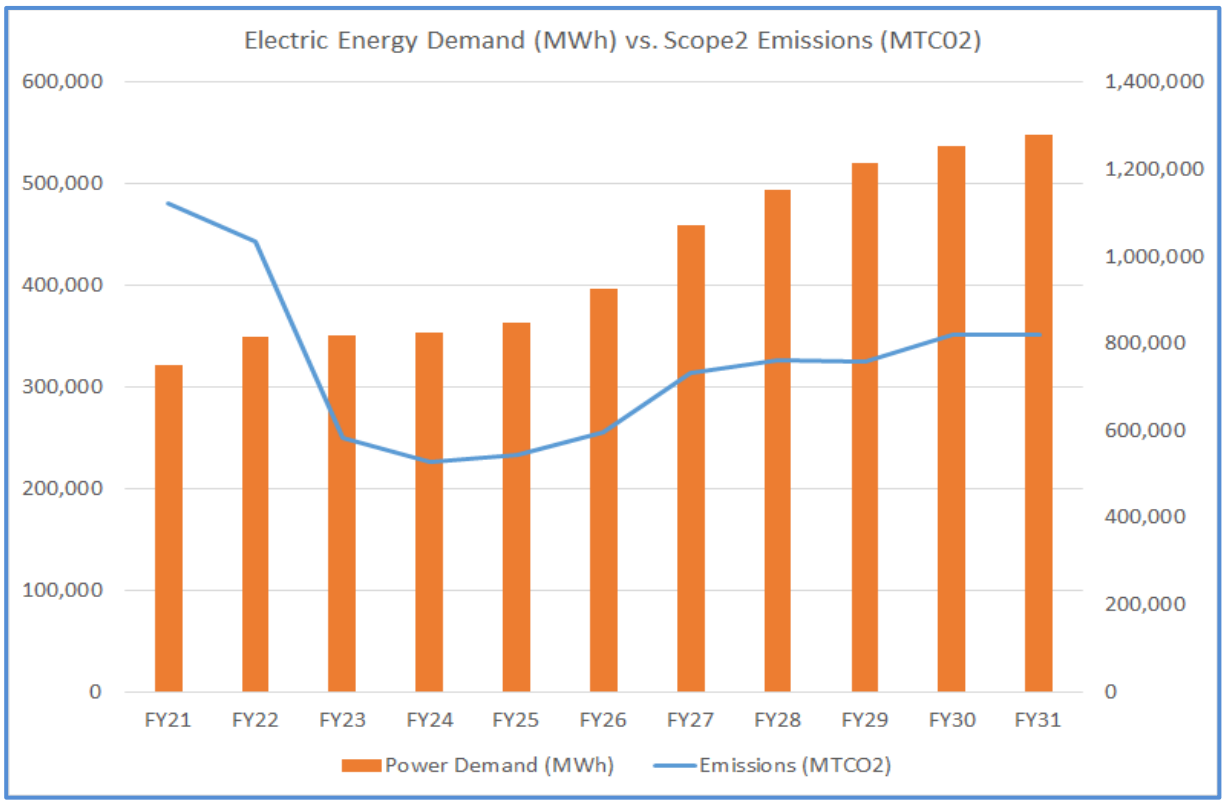


Figure 6. Power Demand vs. Scope 2 GHG Projections.

Figure 7 shows that, in non-excluded facilities over the past year, energy (electric and thermal) intensity (BTU/SQF) has increased because population density in the buildings (staff/SQF) has increased by 20%.

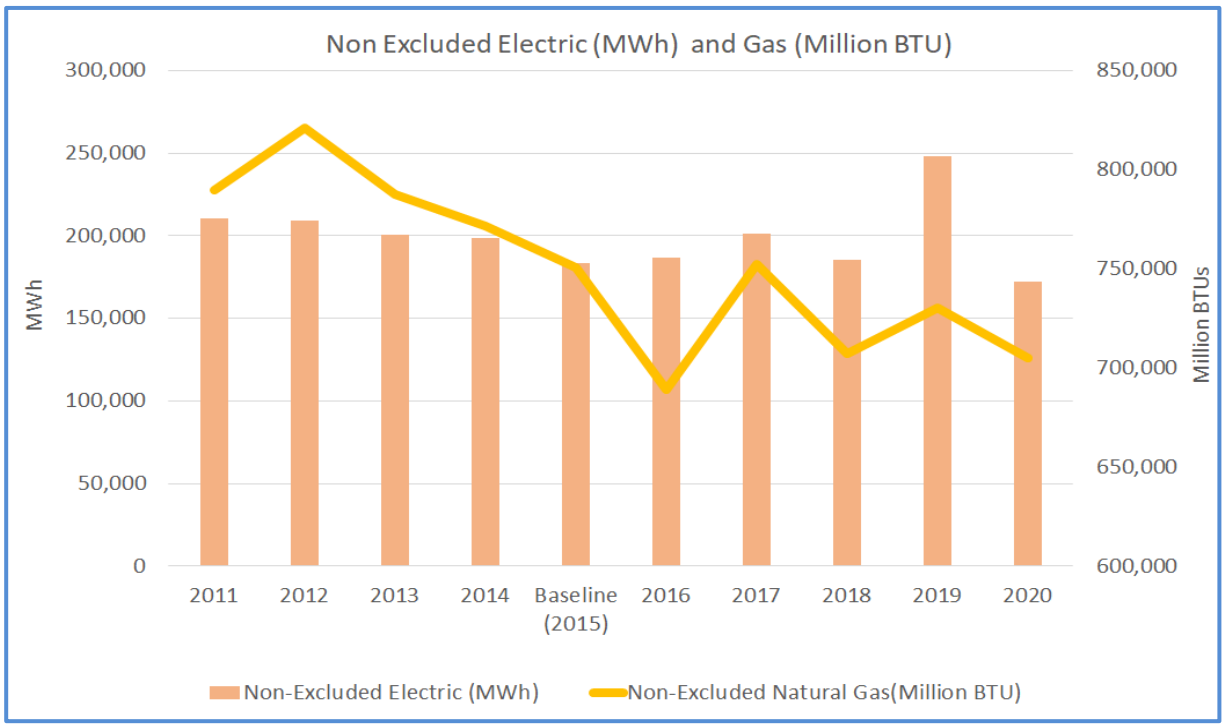


Figure 7. Electric and Gas Use in Non-Mission-Critical Facilities.

Energy use at 100 + buildings can be tracked in SkySpark.

LANL energy use is expected to increase over the next 10 years as HPC and expanded programmatic activities associated with mission growth continue to consume greater quantities of electrical power.

In FY 2020, LANL implemented SkySpark in an additional 8 facilities. The application takes information from the BAS and displays it on a dashboard operated by UI. The dashboard can track energy use at over 100 buildings to help system engineers and facility operation crews reduce energy waste.

Accomplishments under Smart Labs include Demand for Ventilation Assessments and Laboratory Risk Assessments at 03-0032, 03-0034, and 03-0040, as well as training under the title High Performance Smart Labs: A Comprehensive Approach to Airflow Management.

During the COVID-19 pandemic, the ability to use SkySpark and BAS to remotely control the amount of fresh air in various laboratory buildings is of particular importance. Any buildings that were operating at high capacity during COVID-19 were running on maximum ventilation 24/7. This Epidemic Mode programming was based on recommendations from the America Society of Heating, Refrigerating and Air-Cooling Engineers Executive Committee and Epidemic Task Force. Data capture by the BAS team assists leaders and industrial hygienist to make information-driven responses to COVID-19, while the BAS team can program the controllers from their computers.

Figure 8 shows the electrical consumption of one of the buildings running in Epidemic Mode. Ventilation information and electric consumption data are tracked in SkySpark.

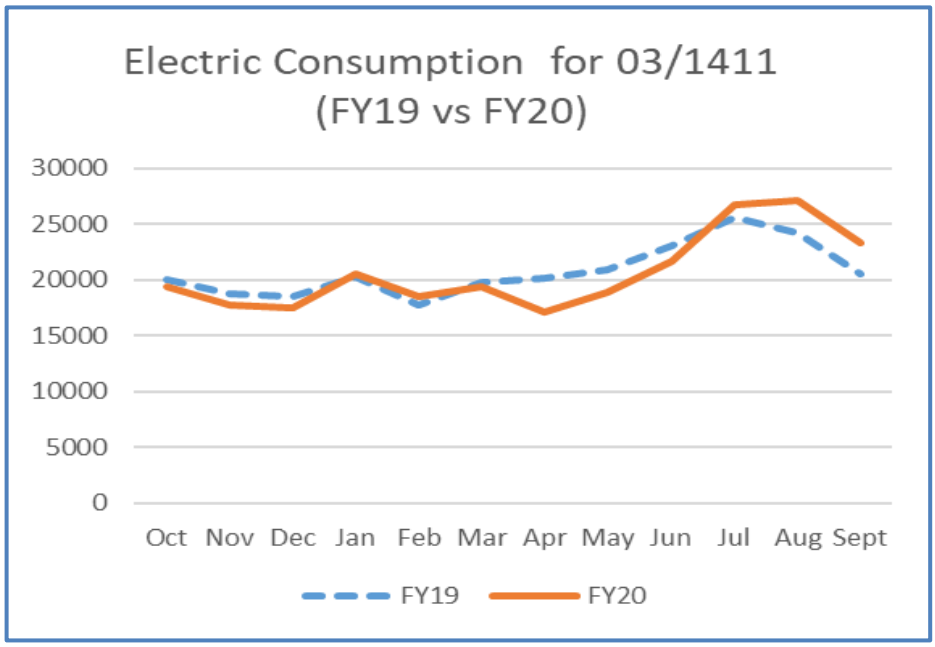


Figure 8. Electric Consumption of Building 03-1411, in Epidemic Mode since April 2020.

The time and effort spent to make these initiatives grow will help the Laboratory meet sustainability goals and better position it to compete for and execute future mission work.

LANL has set energy intensity targets for several building types and completed analysis of facilities with higher energy intensity higher than an established target for the building type. These facilities tend to require investments in in measures to improve tenant comfort and perform deferred maintenance in addition to energy efficiency. LANL may have already committed to investing in these facilities. Figure 9 highlights office facilities that have underperformed energy performance goals or targets in a given month. Graphs like this for laboratory and data centers are analyzed monthly to identify underperforming facilities.

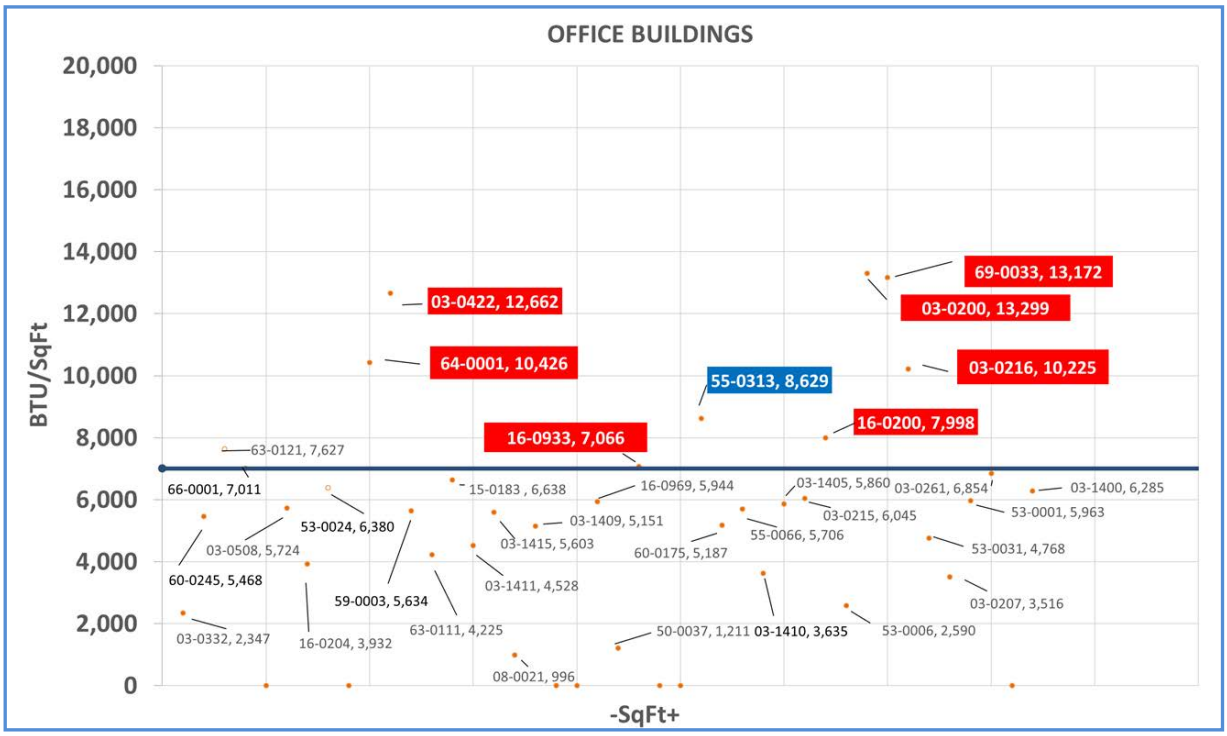


Figure 9. Energy Intensity for Office Buildings with Target Efficiency Goal.

UI sustainability group personnel, working closely with the Laboratory Infrastructure and Site Planning Office, have analyzed the LANL Decommission and Demolish (D&D) list and a list of new construction and have estimated that, by FY 2030, LANL can achieve an energy intensity reduction of 1.8% compared to FY 2020 as old, inefficient facilities are replaced by new, efficient ones. This reduction may occur despite the fact that LANL is projected to double its demand for power as it hires more than 4,000 new employees. This achievement is only possible if the Sustainable Design criteria are applied to all newly constructed facilities.

Plans and Projected Performance

A 2.3% increase in energy intensity is projected for LANL in FY 2021 over FY 2020 for non-excluded facilities. Although the continued teleworking has been considered in this projection, at least until the summer of 2021 due to COVID-19, other factors figure into the increase, including construction of new facilities and programmatic increases in energy use at facilities such as RLUOB and the TA-55 complex.

In FY 2021 LANL plans to initiate a multi-year LED lighting campaign with a scope that covers replacement of all remaining incandescent and fluorescent fixtures with LEDs and installation of smart lighting controls. Initial targets will be buildings and facilities over 2,500 sq. ft. with a goal of covering a total of 100,000 sq. ft or more.

Another significant FY 2021 investment will be insulation of manholes, or steam pits, at TA-03. Many lack insulation and jacketing, contributing to heat loss and the generation of GHG emissions. Anticipated results:

- Reduction in heat loss per pit of 112,000 BTU/hour.

- Savings per pit of $3,400/year.
- Reduction in GHG emissions per pit of 62 MtCO2/year.

The FY 2021 Sustainability Program portfolio includes design and construction of BAS upgrades. Over the past five years, BAS systems have demonstrated energy savings of 40% in heating and ventilation systems. In FY 2021, nine facilities are slated for BAS upgrades.

2.2 EISA Section 432 Benchmarking and Evaluations

Performance Status

LANL has 84 covered facilities that receive energy and water audits to comply with EISA's benchmarking requirements. In FY 2020, 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 the SPO Dashboard Tool.

Plans and Projected Performance

LANL is scheduled to perform energy and water conservation audits in approximately 25% of covered facilities in FY 2021. These audits often coincide with the HPSB assessments, and both can be accomplished simultaneously.

2.3 Facility Metering

Performance Status

Distribution and consumption metering data for physical meters is collected and managed by the LANL Metering Program administrator. Metering data for 118 facilities are entered into Portfolio Manager for benchmarking purposes and used to determine facility energy performance.

In FY 2011, LANL completed electric meter installations and achieved compliance with DOE electric metering goals and now meters more than 90% of electric consumption on individual buildings and process loads. All LANL electricity is distributed through and measured by 130 electric meters at 13.2-kilovolt distribution switchgears.

LANL currently has 372 meters that are read, reported, and monitored on a monthly cycle: 298 electric, 32 natural gas, 3 steam (not including the TA-03 Steam Plant), and 25 water meters. Of these, 114 electric meters and are smart meters.

Natural gas coming into the LANL campus is metered at two main stations: Tech Meters 1 and 4. Usage at 32 gas meters is read and reported. Of the 32 meters, 11 are building level meters, 9 are interchange points between LANL and Los Alamos County, and the remainder meter process loads. The 298 electric meters consist of 130 13.2 kV feeder meters, 32 interchange/billing meters, and 126 structure/facility level meters (some buildings have more than one electric meter). LANL has 23 water meters on either the distribution system or processes, and 2 building level meters. Steam generated at the TA-03 Power Plant is metered as it leaves the facility. Two facilities are metered for their steam use.

In FY 2019, LANL created virtual meters, or BAS remote data collection devices, including currant transducers, flow meters, and resistance temperature detectors linked to the data analytics software SkySpark. Virtual meters calculate usage based on BAS data, equipment nameplate power values, and software programming. Two types of virtual meters are in use in SkySpark and collect the following data points:

- HVAC Power
    - KW fans and pumps
    - KW direct expansion and chiller equipment
- Heat Load
    - KBTU heating delivered to building

Virtual meters offer ease of installation, versatility of data type, and variable reporting opportunities. Combined with the fact that the cost of a virtual meter is only 10% the cost of a hard-wired smart meter, this means LANL plans to install them in existing and new buildings. LANL currently has 57 HVAC power meters and 45 heating load meters. In addition, BAS monitoring/metering data aids with efficiency tuning, temperature/comfort control, and night set-backs. They are installed in 72 facilities.

Other LANL organizations utilize metering data to comply with tracking and reporting requirements such as air quality, environmental impact, and recommissioning.

Plans and Projected Performance

Per DOE metering guidance issued in November 2014, energy and water metering approaches have shifted from percent of the utility consumed by the site to the number of appropriate buildings based on square footage. The LANL Engineering Standards Manual, in the Sustainable Design Criteria chapter, sets minimum requirements for new construction and major renovation in facilities over 5,000 ft^2 following HPSB guiding principles. Installation of energy and water meters is included in Chapter 14 minimum requirements.

Lab plans are to manage, report, and share energy usage information across the site and to develop a database that will collect metering data and create consumption reports for facility managers. The database will be used to analyze and trend energy consumption on a facility-by-facility basis to improve tenant and building management awareness and conservation efforts. In FY 2021, the Sustainability Program plans to work with the BAS team to determine which buildings can best be used to compare the accuracy of the virtual meters with physical meters—with the goal of using such less invasive and less costly alternatives to accurately monitor total energy use in existing buildings and, with DOE approval, as a way to consider buildings for compliance with the GPs.

Another focus for FY 2021 will be to complete life cost analysis on meter installations on previously evaluated buildings. If it is found not to be cost effective to install meters in these buildings, several of them designated "not applicable" may still be certified as meeting the GPs. This, combined with the alternative to use virtual meters, should increase the percentage of compliant buildings and square footage within a 2–3 year time frame.

2.4 Non-Fleet Vehicles and Equipment

Performance Status

As part of its equipment asset management, utilization, and replacement responsibilities, Logistics-Heavy Equipment and Roads & Grounds (LOG-HERG) is implementing a data-driven program to track equipment performance. Data will be used in part as a predictive tool for maintenance and replacement, with the goal of keeping equipment performance at peak and fuel consumption at minimum.

Most heavy equipment is diesel. As units age, they are replaced with units of higher efficiency with TIER 3/TIER 4 engines that reduce fuel consumption and emissions.

Plans and Projected Performance

The tracking metric will compile data by equipment category and type and compare usage hours to fuel consumption.

3 Water Management

After transferring 70% of its water rights and leasing the remaining 30% to Los Alamos County in September 2001, DOE/NNSA entered into a contract to supply the Laboratory with water. LAC owns and operates the main water production system, while LANL owns and maintains an internal distribution system consisting of a series of storage tanks, pipelines, and fire pumps. The system is primarily gravity fed, with pumps available for high demand fire situations at some locations.

There are water meters at selected Laboratory facilities, with supervisory control and data acquisition (SCADA) and equipment surveillance (ESS) systems on the distribution system to monitor water tank levels and water use. LANL continues to maintain the distribution system by replacing those portions of the system in need of repair identified during leak detection surveys.

3.1 Water Use & Management

Performance Status

LANL reduced water use intensity (gallons/sq ft) by 20% In FY 2020 compared to the FY 2007 baseline year. LANL's total consumption in FY 2020 was 256.6 million gallons, compared to 268.4 million gallons in FY 2019, a 7.2% decrease in water use intensity. FY 2020 showed use similar to FY 2019, but water use per person decreased by 7.2%, a decrease that does seem related to COVID-19 or teleworking. See Figure 10.

LANL remains focused on continuation of SERF operations and targeted facility improvements to control water use. It forecasts continued success in maintaining consistent water use levels over the next several of years through persistent monitoring. SERF sent 36 million gallons to the SCC and Trinity compared to 33 million gallons in FY 2019. While this increase may seem minimal, average concentration cycles in the cooling towers have also

increased three-fold on average—even with an increase in the number of cooling towers—promoting future water use reduction and resiliency.

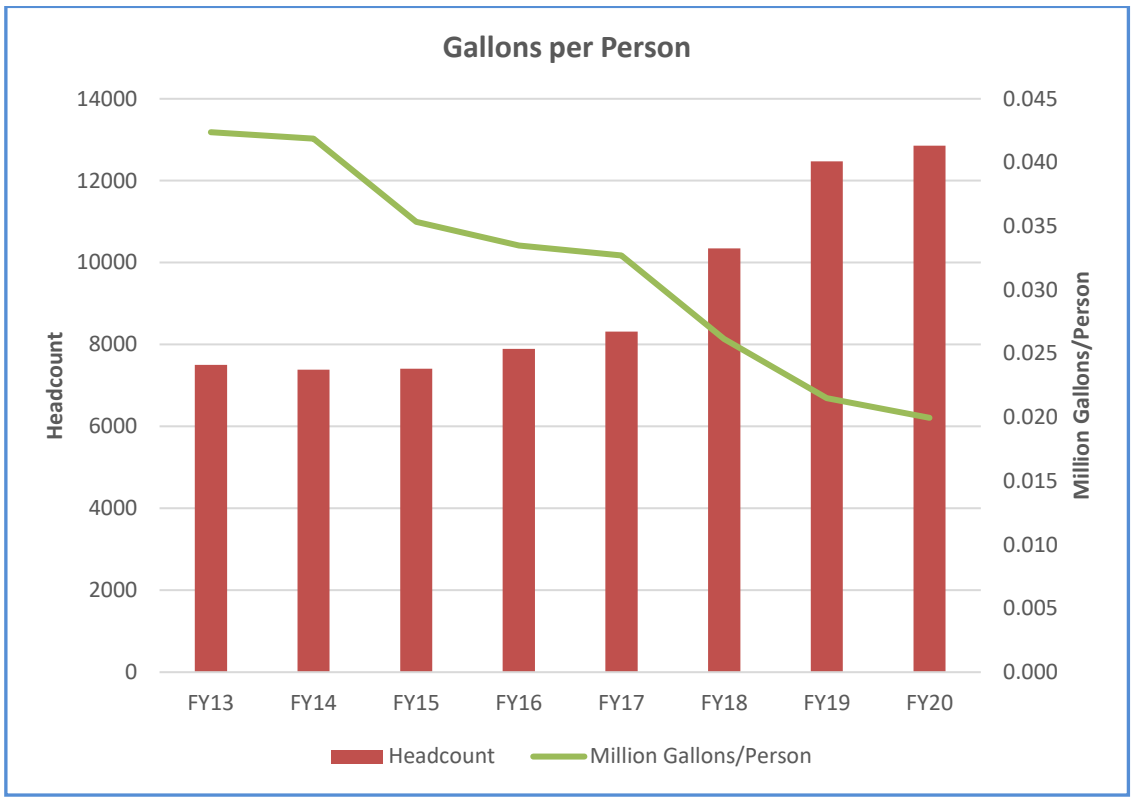


Figure 10. Water Consumption per Person.

LANL's major water consumers are cooling towers (SCC, Trinity, LDCC, LANSCE), steam plants (central and satellite), and buildings. Figure 11 shows LANL's water consumption by major users in FY 2020.

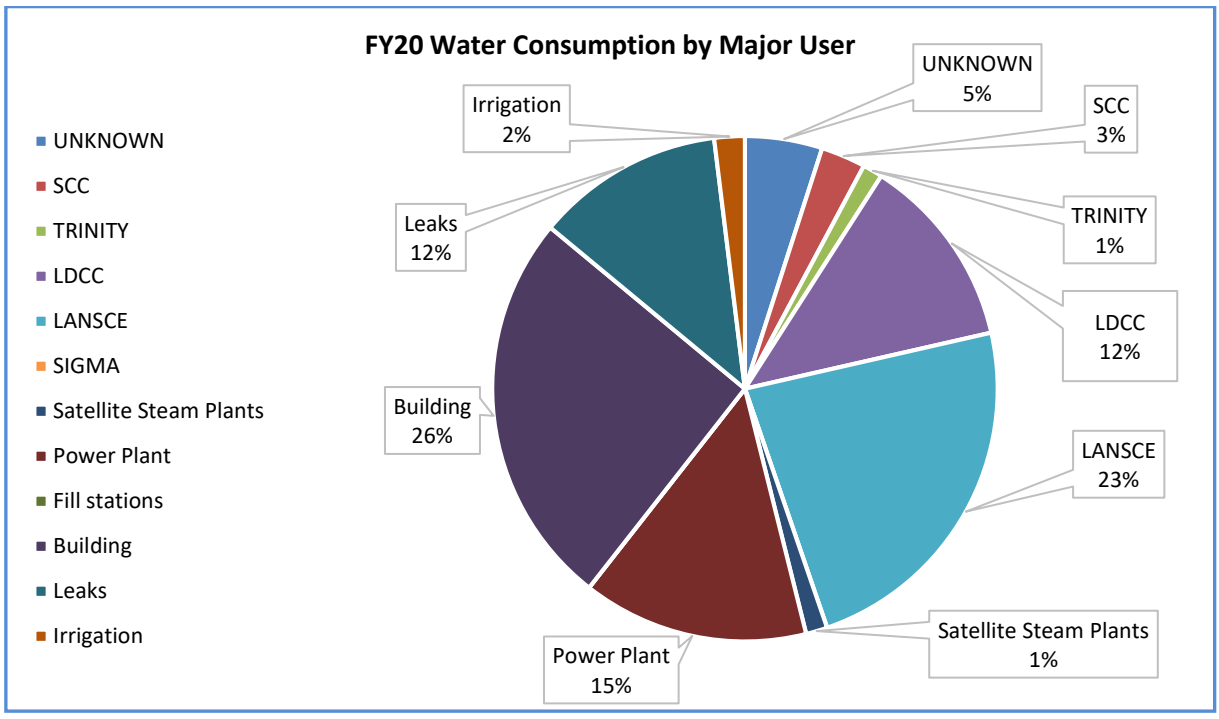


Figure 11. Water Consumption by Major User.

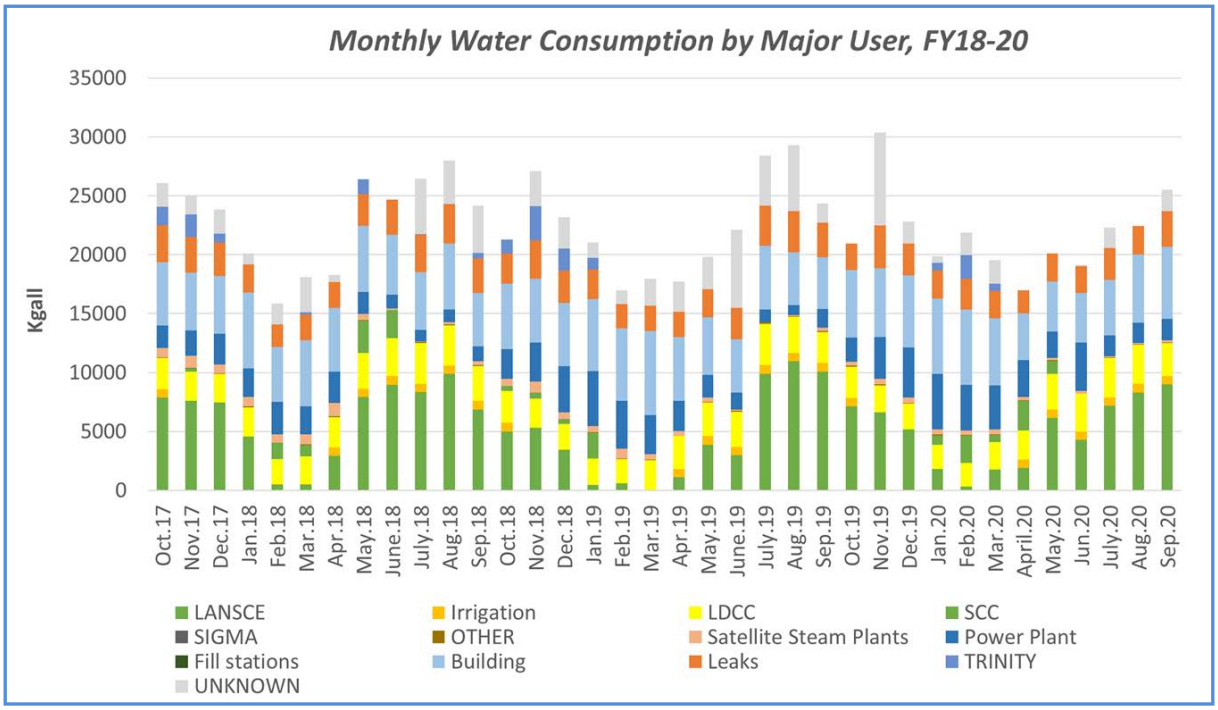


Figure 12. Monthly Water Consumption by Major User.

LANL continues operation of a water consumption model first developed by Pacific Northwest National Laboratory (PNNL) and funded by the DOE Sustainability Performance Office.

Calibration and tuning of this model has brought water usage reasonably close to metered data.

To get a realistic water balance, LANL has refined the PNNL model in several ways. For 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 water use for the buildings, the blow-down from two of LANL's cooling towers discharging to the sanitary system was subtracted from the total amount of water that arrives at the wastewater plant.

According to the FY 2020 water balance, LANL had 5% "unknown" use, which is well below industry standard. In FY 2019, the same category reached 12% of the total water billed. Part of the unknown category may be attributed to a flushing process the fire department performs once a month. Currently, this category is not accounted for in the water balance.

LANL water usage represents approximately one-third of the total water usage from the regional aquifer. The 2008 Site-wide Environmental Impact Statement (SWEIS) measured potential environmental impacts by comparing projections of utility resource requirements against utility system capacities (DOE 2008). LANL's annual water use ceiling, captured in the 2018 SWEIS document, is 542 million gallons. Any water use exceeding this ceiling can be considered an indicator of an environmental impact, and further NEPA 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 productions 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 investments in water reduction beyond those already completed are not anticipated to have a substantive environmental impact.

These projects were implemented to meet Federal stormwater compliance requirements under the Energy Independence and Security Act and NPDES Construction General Permit. Green Infrastructure/Low Impact Development (GI/LID) features are designed to capture stormwater runoff from developed areas and reduce runoff volume, duration, and velocity before it is released to the storm drain system and ultimately to the surrounding canyons. In addition, GI/LID features are used to promote sustainable landscaping by providing supplemental water to native and drought-tolerant plantings.

Plans and Projected Performance

Water efficiency efforts will continue to focus on small, targeted conservation measures that dovetail with site infrastructure upgrades. LANL's EISA 07 facility evaluations generate a list of water conservation measures that will be uploaded in the SPO Dashboard Tool in February. LANL also places emphasis on energy efficiency to reduce LANL's regional impact on water use associated with energy generation. As mentioned in the Facility Metering section, LANL currently has 25 water meters, and smart water meters are required in LANL Engineering Standards Manuals for new facilities that are 5,000 GSF and above.

TA-35 Parking Lot Basin Low-Impact Design (LID) Landscape Project

In FY 2020 the EPC-CP Stormwater Team worked with UI and other project managers to install GI/LID projects at several locations on Laboratory property, including the new modular office building TA-03-2618; Bioresearch Laboratory (BRL) projects at TA-03; shooting range upgrades at TA-72; a new office building complex at TA-15; a warehouse at TA-46; and new parking areas at TA-35.

In addition, LANL plans to work to expand the use of reclaimed waste water in cooling towers and steam plants. For example, one of the FY 2021 projects includes upgrades to the blended water system and the removal of a booster pumping system at SERF. This project, together with other system upgrades, will produce the increases in cooling tower efficiency and resiliency required by new high performance computers.

LANL was able to decrease water intensity by 20.3% compared to the FY 2007 baseline by targeting conservation measures and site-wide reclamation projects. However, current projections show that LANL does not expect to meet the continued goals of 0.5% YOY reduction, because SERF will be able to supply some, but not all, cooling tower water for HPC projects coming on-line over the next five years.

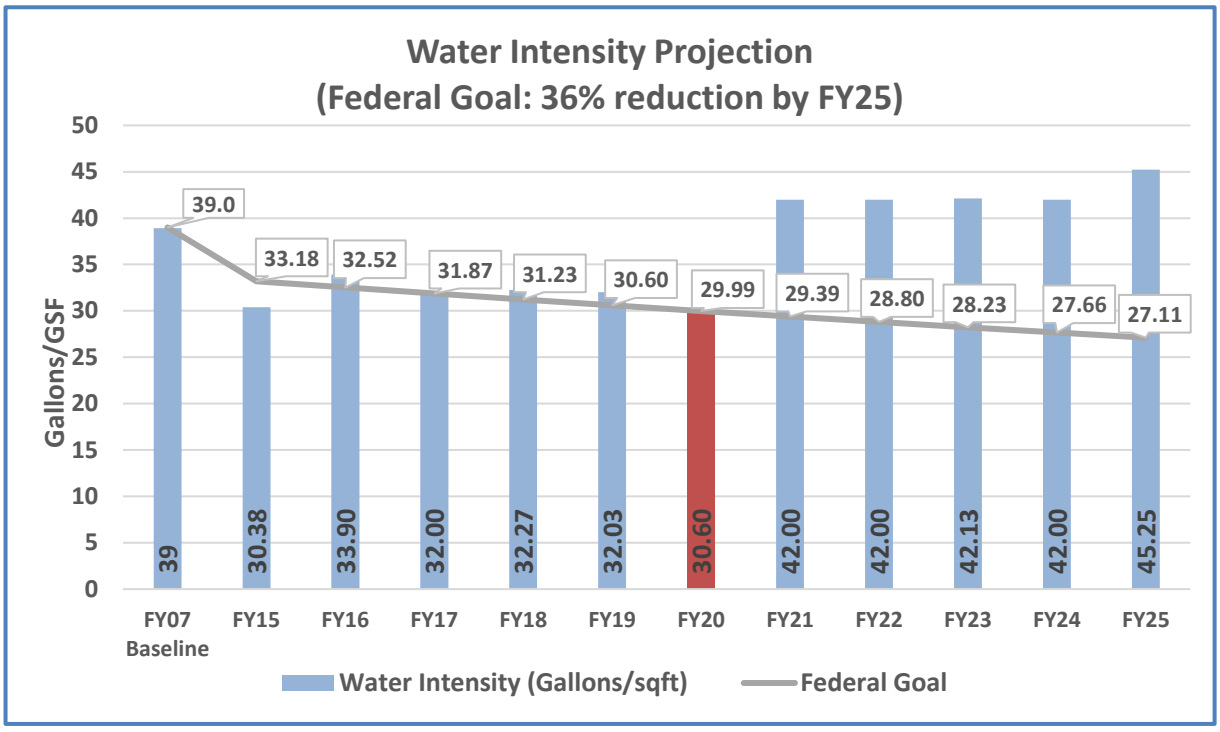


Figure 13. Water Consumption (gallons/GSF) Projection.

4 Waste Management

4.1 Strategies

Performance Status

The Laboratory Pollution Prevention (P2) program focuses on source reduction as the term is defined in the Pollution Prevention Act of 1990. Working with LANL colleagues and contractors, the P2 program identifies source reduction opportunities in need of technical and financial analysis and support. Since project ideas come from different sources with different levels of P2 expertise, the program makes support decisions after a comparative ranking using scoring criteria that emphasize source reduction, return on investment, transferability and support of the LANL mission. Current P2 program focus areas include all types of radioactive waste, green chemistry, cleaner production process improvement projects, and sustainable acquisition. Completed projects are publicized and recognized through internal and external communications and the annual awards competition. The awards include P2 activities and other types of projects and programs (e.g., waste minimization and recycling).

The P2 program also engages in P2 initiatives, which cross cut functional boundaries to investigate large issues embodying environmental risk that may affect the successful completion of the LANL mission. One example is ongoing work to identify and characterize concentrated sources of PCB's on the site that may be complicating wastewater treatment. Another is analyses of water use on the site with the goal of optimal use of water resources.

Structural change, an institutional improvement strategy that uses procedures and standards to reduce subjective decision-making, is a core principal of the P2 Program. P2 program work in chemical management In FY 2020 provides a good example. The P2 program first focused on reduction of the generation of hazardous waste and noticed from available data that a large and recurring component of the hazardous waste stream at LANL was unused/unspent chemicals. For example, in FY 2020, LANL lab packed 1,780 items of unused/unspent chemicals for disposition. As a result, the P2 program devoted significant staff resources to analyze the site-wide chemical management program and overall chemical usage for source reduction opportunities. Three areas of concern were identified: pre-procurement review of chemicals, chemical ordering practices, and chemical inventory management. Based on this analysis, the chemical management program was transferred to the P2 program from Operations and Business Systems (OS-OBS) in order to enable a lifecycle management approach to chemicals, from pre-purchase screening to efficient use and effective inventory practices to disposal. The enhanced program is now staffed with chemical purchasing and inventory specialists who serve as a central source of information and analysis for chemical management at LANL.

The following examples of FY 2019 and FY 2020 P2 projects illustrate the effect of using selection criteria and collaborating with scientists and engineers to achieve source reduction. Both projects, if deemed successful and scaled-up, will substantially reduce inventories of hazardous waste and other material on-site.

FY 2020

- Scientists are experimenting with solid-state chemistry using planetary ball milling to address the hazardous waste generated by traditional concentrated acid wet chemistry for high explosive processes. Research into this method will continue in FY 2021 Scaling it up may lead to reduced disposal and purchase costs associated with the concentrated acids while high explosives workers benefit from exposure to less hazardous chemicals.

FY 2019

- This project reduced the use of acids in post-detonation debris solubilization. Debris generated after nuclear detonation is a glassy material that is difficult to dissolve with chemicals. Traditionally, corrosive acids such as nitric acid, hydrofluoric acid, and sulfuric acid in their most concentrated forms are employed. Scientists in Actinide Analytical Chemistry tested the chemical ammonium bifluoride (ABF, NH4HF2) for potential application to debris sample preparation. Because of less hazardous chemical properties, ABF has been used by industry as a replacement for hydrofluoric acid, one of those extremely hazardous chemicals. Using P2 funding, LANL scientists demonstrated that glass materials can be digested when mixed with ABF solid powder and heated at 125 degrees C, allowing identification and quantification of actinide isotopes and trace metals providing valuable nuclear forensic signatures in the post-detonation debris. In FY 2019, with continuing P2 program support, analytical actinide chemists tested ABF glass material dissolution in synthetic post-detonation debris studied widely in the nuclear forensic world. Results indicate ABF is indeed capable of synthetic post-detonation debris dissolution. Next steps would be to test the ABF process on live nuclear forensic samples.

Waste reduction and waste minimization are integrated with decision-making and practice at most levels of LANL. Institutional GET training now includes waste generation awareness. Every year, dozens of LANL staff submit applications for environmental awards, many for waste reduction and waste minimization. In FY 2020, many LANL waste management professionals planned to attend McCoy RCRA training, but these events were canceled because of COVID-19. One important waste minimization activities during the Green Is Clean program, which returned to full operations in FY 2018 in a repurposed facility with increased capacity. Green Is Clean uses gamma ray spectroscopy to scan bags of combustible material that have been designated low-level (radioactive) waste (LLW) to re-characterize waste that does not meet LLW criteria. That waste can then be appropriately categorized as municipal solid waste, leading to considerable cost savings and reducing volumes disposed in LLW facilities. utilization of this program increased In FY 2019 and FY 2020.

In FY 2020, despite COVID-19 interruptions to on-site work, LANL still made several high-level radioactive waste (TRU) shipments to the Waste isolation Pilot Plant (WIPP) in Carlsbad. Legacy waste and new generation radioactive waste must be shipped off-site to support the LANL's plutonium pit mission. Because of the high cost of processing and storing high-level radioactive waste (TRU) at WIPP, TRU waste minimization efforts have become a priority for LANL management, and operators at plutonium facilities implemented a SAVY container reuse project in which waste management professionals place an inner slip container inside radioactive waste SAVYs. Since the radioactive waste is in contact with only the slip lids, the outer SAVY containers may be recovered.

From November 2019 through May 2020, the recovery process diverted 121 drums that would have been sent to WIPP, saving $218,491 and avoiding the additional costs of sending TRU waste off site. Although COVID-19 safety protocols have interrupted radioactive waste minimization efforts at plutonium facilities, plans are in place for the next fiscal year. These include limitations on material inputs into facilities and implementation of purchasing and inventory controls on tools, materials, and chemicals used in radioactive areas. Other strategies include purchasing longer life span materials and avoiding disposal of serviceable instruments such as balances and ovens.

The LANL recycling program, which consists of the Materials Recycling Facility (MRF), waste management coordinators, subcontractors, and the Los Alamos Eco Station, manages waste with potential for recycling:

- Plastic containers
- Aluminum containers
- Office paper
- Cardboard
- Electronics, and
- Alkaline batteries and non-office waste
- Ferrous and non-ferrous metals from production and construction
- Concrete construction debris
- Lead-acid batteries

- Fluorescent bulbs
- (Punctured) aerosol cans
- Clean pallets and dimensional lumber waste

Non-office waste is either scanned for radioactivity or reviewed using Acceptable Knowledge to assure suitability for transport and handling off-site. LANL must subsidize all recycling activity because of its relatively remote location; only non-office metals provide any financial return.

The P2 program has initiated an analysis of recycling program assumptions, including the types of materials collected, collection methods and the adequacy of certifications provided by processing facilities. The P2 program is also applying source reduction principles to reduce the generation of recyclable materials – one area of focus being plastic bottles. The P2 program requested the installation of 10 water bottle filling stations based on interest in them from Earth Week Activities. The installations are continuing into FY 2021 as not all installations were completed in FY 2020. The P2 program is analyzing battery disposal pathways at the Laboratory to optimize battery waste management. By better understanding battery waste, the P2 Program hopes to identify and then educate battery users to look for source reduction opportunities. This initiative will be expanded in FY 2021.

LANL's Furniture Reuse program coordinates on-site reuse of many types of office equipment and the off-site donation of used excess office equipment to schools on a rotating basis. Other waste items, such as lead-acid batteries, can be declared "excess/salvage" and serviced by Operational Support/Warehouse and Salvage Operations. These programs divert goods from disposal in municipal solid waste landfills and reduce purchases of new office equipment, especially chairs, tables, desks and shelving.

Stacked Moving Bins on Special Dolly.

Project changes and reorganizations find Laboratory workers frequently moving offices to new locations. These moves have created several challenges for the Laboratory, including the generation of extra cardboard waste and the risk of injury when personnel move items on their own.

Todd Berkebile and Brett Chandler from the Infrastructure Planning Office came up with the idea of addressing the safety issue and reducing the waste by providing staff with reusable and stackable plastic moving bins and specially designed dollies. The idea was pitched to senior management, who allocated $33,000 for a pilot phase. Because of high demand, the program then received an additional $50,000 in funding. It reduces the number of cardboard boxes sent to landfills in a year by approximately 3,500.

Composting of woody waste at LANL is managed through the Los Alamos County solid waste management system, which shreds and mixes it for processing with other wood waste collected by the county. If the material is considered high enough in quality, it can be declared salvageable and managed by Warehouses & Salvage Operations. A flow-through composter, located at the SWWP and commissioned In FY 2017, processes sludge generated by the SWWP. The plan is to use all the compost generated by this facility on LANL property and thereby eliminate the need for off-site disposal. Pending implementation of this plan, the material is being stored at the SWWP.

Composting food waste in this composter, while technically feasible, is currently considered financially impractical unless handling and storage costs are subsidized by the LANL food service contractor.

The LANL Clean-Fill Program diverts soil to on-site use that would otherwise be landfilled.. In FY 2020, for instance, a major waterline replacement project at the Lab used approximately 2,500 cubic yards of this material. To ensure the material is clean and reusable, the Clean-Fill Program manager applies acceptable knowledge criteria.

Other non-hazardous waste materials, beyond soil and construction and demolition debris, are diverted from landfill disposal through recycling and re-use programs, described above, conducted by LANL and the LAC Eco Station.

In FY 2018, LANL's Site-Wide Clean-Up & Workplace Stewardship Program (the Site Clean-up Program) expanded to include on-site processing and reuse of large amounts of concrete, mostly from removal of concrete sidewalks, with the steel rebar removed and separated for recycling. Most of the material is used by LAC. Concrete waste generated during LANL construction and demolition projects is considered the responsibility of subcontractors, so the material, unlike other construction and demolition debris, has not yet been included in the Site Clean-up Program and none it has been diverted from landfilling.

The Site Clean-up Program also worked with radiation and environmental professionals at the LANL linear accelerator to reduce creation of low-level radioactive waste (LLW) through careful analysis of metals awaiting disposal. Metals determined to be non-radioactive may be handled as recyclables instead of LLW. 1.5 million pounds were recycled in FY 2019.

Operational delays from the COVID-19 pandemic have reduced this to a projected 20,000 pounds for 2020. But as the COVID-19 pandemic diminishes, waste generation rates per capita are expected to return to levels previously projected as the result of Laboratory mission expansion, clean-up of legacy radioactive waste, and the ongoing demolition of legacy facilities. But the amounts of increase in FY 2020 and FY 2021 will depend on when and how fast this happens.

Other measures to reduce waste generation per capita include accelerating progress in the adoption of sustainable acquisition policies, reduced generation of mixed radioactive and hazardous waste, and reduced generation of unused and spent chemicals requiring categorization and disposal as hazardous waste.

LANL has no waste-to-energy systems.

After careful analysis of waste management operations, it has become increasingly clear that staff support has been inadequate. To address this issue and drive positive change, the Environmental & Waste Programs (EWP) Leadership Team has been actively working, in collaboration with Associate Laboratory Director for Environment, Safety, Health, Quality,

Safeguards, and Security (ALDESHQSS) and the Deputy LANL Director for Operations, to develop and implement actions that will improve the effectiveness and efficiency of waste management operations.

Using information from both internal and external assessments, compliance nonconformities, lessons learned, shipping metrics, and staffing comparisons, waste management has undergone significant improvements in a short period of time. The staffing levels achieved this year have allowed LANL to backfill Waste Management Coordinator positions lost due to attrition with qualified individuals no gaps in coverage. This “boots to the ground” support allows LANL to be proactive in ensuring compliance and process efficiency. The new hires improve project management and support site-wide Laboratory packing operations, site cleanouts, and process improvement initiatives. Although the goal of 50 full-time waste management employees has yet to be reached, LANL is committed to moving forward as resources are made available.

LANL continued making improvements in chemical management in FY 2020. An enhanced Chemical Management Program, staffed by specialists in chemical purchasing and inventory, is being developed to serve as a central source of for chemical management information and analysis .The first phase of the program will institute structural changes in order to reduce quantities of unused and unspent chemicals requiring management as hazardous waste, accelerate adoption of safer alternatives, and improve worker health and safety. The second phase will work with teams of LANL researchers to develop alternatives that not only benefit programs and workers but reduce environmental impacts and will apply elsewhere in the DOE complex and beyond.

These changes to the Chemical Management Program in FY 2020 are in addition to others that LANL will initiate in FY 2021. The Pollution Prevention (P2) program has completed a site-wide analysis of chemical and material toxicity across 15 parameters, indexed them to volume and cost, and created a matrix of chemicals and materials to target for intensive research into alternatives.

Consumption of the dielectric gas sulfur hexafluoride ($SF_{6,}$) was greatly reduced in FY 2018, when staff at the Dual Axis Radiographic Hydrodynamic Test Facility (DAHRT) fixed leaks in facility manifolds, while the P2 program worked with plasma physics researchers to redesign a switch to use air in place of SF_6. DAHRT SF_6 consumption levels have shown no increases in FY 2019 and FY 2020, evidence that these measures continue to be successful. Use of refrigerants at DAHRT is strictly managed .

Pesticides have traditionally been used at LANL to control target pests (e.g., noxious weeds, etc.) as part of landscape management, including meeting safety, security, and wildland fire management goals. All such applications (herbicides, insecticides, etc.) are covered by the Laboratory's National Pollutant Discharge Elimination System (NPDES) Pesticide General Permit (PGP), which requires evaluation of identified pests and management options to minimize pesticide use, prohibition of application to water, and submission if an annual pesticide application report to the Environmental Protection Agency. Alternative methods of pest control include mechanical processes such as mowing, hand-pulling, seeding with preferred species, fertilizing to encourage native and other preferred vegetation, and mulching to suppress growth of vegetation that isn't preferred.

5 Fleet Management

5.1 Strategies

Fleet Composition

At the end of FY 2020, LANL had 1,721 vehicles, including Los Alamos Fire Department (LAFD) equipment. Of the 1,721 vehicles, 116 were DOE owned and 1,605 were leased from the General Services Administration (GSA). The fleet included 885 or 74% light duty vehicles (LDVs) of which 571 or 66% were alternative fuel vehicles (AFVs). LDVs include vehicles that weigh less than a 8,500 lb. gross vehicle weight rating (GVWR). The LANL vehicle total increased in FY 2020 as it added eight mission-essential vehicles and two plug-in electric vehicles to the fleet.

To right-size its fleet and reduce costs, during the FY 2020 GSA leased-vehicle replacement cycle, LANL transitioned 31 vehicles to low-greenhouse gas (LGHG) and downsized 28 passenger-hauling vehicles to smaller, more efficient versions. LANL plans to continue the process into FY 2021.

Fuel Consumption

Figure 14 shows that LANL used 487,447 gallons of fuel in FY 2020, a decrease from the 562,174 it used in FY 2019. The decrease was caused largely by the COVID-19 pandemic. As employees transitioned to teleworking in March, we saw a sharp decrease in vehicle use, and this had a direct impact on fuel consumption.

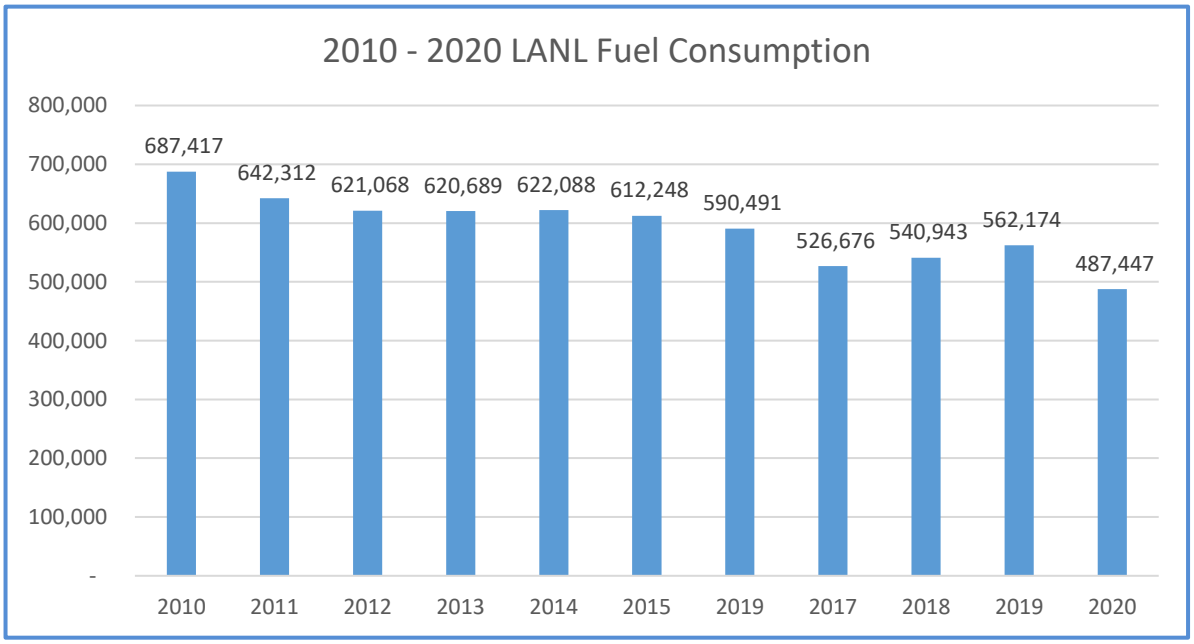


Figure 14. Total Fuel Consumption.

Alternative Fuels

In FY 2020, LANL used a combined total of 29,773 gallons of E85 and B20. E85 is primarily used in flex-fuel vehicles operated by LANL institutional facilities and security organizations. B20 is primarily used by a few vehicles assigned to other organizations.

Because of LANL's remote location, E85 and B20 are not available at local private fueling stations. LANL therefore subcontracts with a pueblo-owned business to use mobile fueling trucks to haul E85 from a bulk fuel plant a 40-mile round-trip from LANL and dispense fuel directly into vehicles, while LANL vehicles operating on B20 drive to the bulk plant to fill up.

LANL plans to continue leasing alternative fuel vehicles as available from GSA while evaluating alternatives to the mobile fueling trucks.

LANL reduced use of B20 fuel about 10 years ago because of reliability issues that appeared during cold winter months, when the fuel tended to thicken up, plug filters, and prevent vehicles from starting. Moreover, high concentrations of water were found in fuel transport trucks used to haul B20 fuel. The Laboratory therefore has no current plans to increase use of B20 but is focusing sustainability efforts on increasing the use of E85 .

EPAct 2005 requirements apply to fleets of 20 or more LDVs that are centrally fueled or "capable of being centrally fueled" and operate 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 MSA or CMSA area are exempt from the requirements. Since LANL is not located in a MSA area, we are exempt from this requirement, but in support of the requirement, 66% percent of LANL's current LDVs are alternative fuel vehicles.

EPAct 2005 requires GSA fleets to spread the incremental cost of alternative fuel vehicles (AFVs) across the entire leased fleet. Surcharges are assessed by GSA fleets at the agency level, depending on the agency-specific needs. This policy funds the incremental cost of AFVs purchased for customer agencies throughout a fiscal year by adding a surcharge to all vehicles in inventory each month.

Electric Vehicles

LANL added two leased electric vehicles (EVs) in FY 2020, bringing the total to eight, with plans to order more in FY 2021. EV charging station locations are especially expensive to install at LANL because of its aging infrastructure, and so charging stations are built only as funding and usage demands increase. In FY 2020 LANL installed one new charging station with two charging ports at TA-63. At the end of FY 2020, LANL had 8 on-site charging stations reserved for government vehicles, with 3 more available for personal vehicles. EV charging stations equivalent to 2% of the total number of parking spots are planned for two new parking garages under construction.

LANL has the goal of increasing the number of electric vehicles in its fleet. But GSA, the primary source of Laboratory vehicles, continues to charge substantial upfront fees for leasing zero emissions and plug-in hybrid vehicles. For LANL to lease additional electric vehicles, these front-end fees must either be adjusted downward or subsidized by DOE HQ and/or GSA.

5.2 Success Stories/Lessons Learned

GPS Program

LANL completed a GPS project for vehicles in FY 2020 which began in September 2019 to improve monitoring of driving habits and vehicle use. The goal of the project was to take a previously launched GPS pilot program to full implementation. During FY 2020, LANL installed approximately 1,100 new GPS units over the approximately 300 installed during the pilot, with the result that at the end of FY 2020, 1,407 vehicles were GPS equipped. In FY 2021, 30 more GPS installations are planned. LANL's Centerra security vehicles and LAFD equipment are not GPS equipped now and will not be GPS equipped in the future.

Fleet Communication

LANL's fleet management website was replaced by a new version In FY 2020 in order to improve customer understanding of and communication on vehicle policies and requirements. There were two focuses: ensure that information was regularly updated to reflect changes in policies, procedures, and customer needs; and make navigation easier. When the COVID-19 pandemic hit, LANL was able to use the new site to provide new and updated information in a timely manner.

COVID-19 Impacts

In March 2020, in response to the COVID-19 pandemic, 70% of LANL's workforce transitioned to telework. This had a direct and immediate impact on mission support vehicle utilization, which dropped by 24%. It also impacted fuel consumption, which (as noted above) fell from 562,174 gallons in FY 2019 to 487,447 gallons in FY 2020. The pandemic also created a challenge to vehicle maintenance and repair and responses to safety recalls. Through collaboration and focused effort, vehicle maintenance, repairs, and recalls are back on track, ensuring vehicles are safe and in compliance with GSA regulations.

Specialty Vehicles

LANL placed orders for and purchased several specialty vehicles directly in FY 2020 when the GSA was unable to provide them through normal channels because the ordering process for specialty vehicles had undergone changes. As a result, the LANL Fleet Management team needed to document the process of requesting approval from GSA and develop all pertinent information required for such purchases. Once all the information needed for these requests was gathered and processed, the FY 2020 deadlines were still tight, so it was necessary to begin the process for FY 2021. Meeting these challenges has given the Fleet Management team the experience needed to support customer needs in FY 2021.

Site-car Pilot Program

To increase utilization of GSA-leased vehicles in FY 2020, LANL initiated a pilot program for vehicle sharing. In areas where LANL was unable to obtain enough additional vehicles to support organization needs, all organizations with vehicles in the region, area, or building were queried and invited to pool vehicle resources to facilitate sharing. Under this ongoing effort, owning organizations continue to pay for and support their vehicles but encourage

others to them as needed and available. This gives organizations access to vehicles they would otherwise lack and helps owning organizations meet vehicle utilization standards. LANL had great success with this programming FY 2020 in TA-03-0787, where five vehicles were shared between four groups, In FY 2021, LANL plans to transition this from a pilot to a lab-wide program, posting information on the program on the Fleet Management website.

6 Renewable Energy

6.1 Strategies

For some years LANL has generated a portion of the energy it uses from on-site renewable sources like photovoltaics (PVs) and hydroelectric installations. Figure 15 puts the percentage generated in this way in FY 2020 at 4%. To increase the percentage while addressing baseload needs, LANL is planning use of PPAs and other strategies as follows:

1. PPA financing for construction an on-site 10 MW PV plant.
2. PPA financing for acquisition of battery storage systems. The initial solicitation is anticipated to be on the order of 20 MW.
3. Use of renewable energy credits in large new projects as needed to obtain the required LEED certification.
4. Managing computational loads to meet objectives such as minimizing expensive hour-ahead market purchases and increasing loads as market conditions warrant.

Initiative 1 has been the subject of study for some years now and there is a mature conceptual design. The project recently received support from Triad upper management. Approval by the Los Alamos Site Office is expected early in FY 2021.

Initiative 2 will begin this year. LAC, LANL's partner in power procurement, recently entered into a PPA in which PV sources were found to be least expensive.

Initiative 3 is part of efforts by the Sustainability Program to Incorporate LEED and HPSB into new projects. Included would be solar domestic hot water heating.

Initiative 4 began in the second half FY 2020 and is now in conceptual plan development. One recent development: roll-out of a dashboard showing real time PUE at our major computing center. Development of the system behind the dashboard will be an important prerequisite.

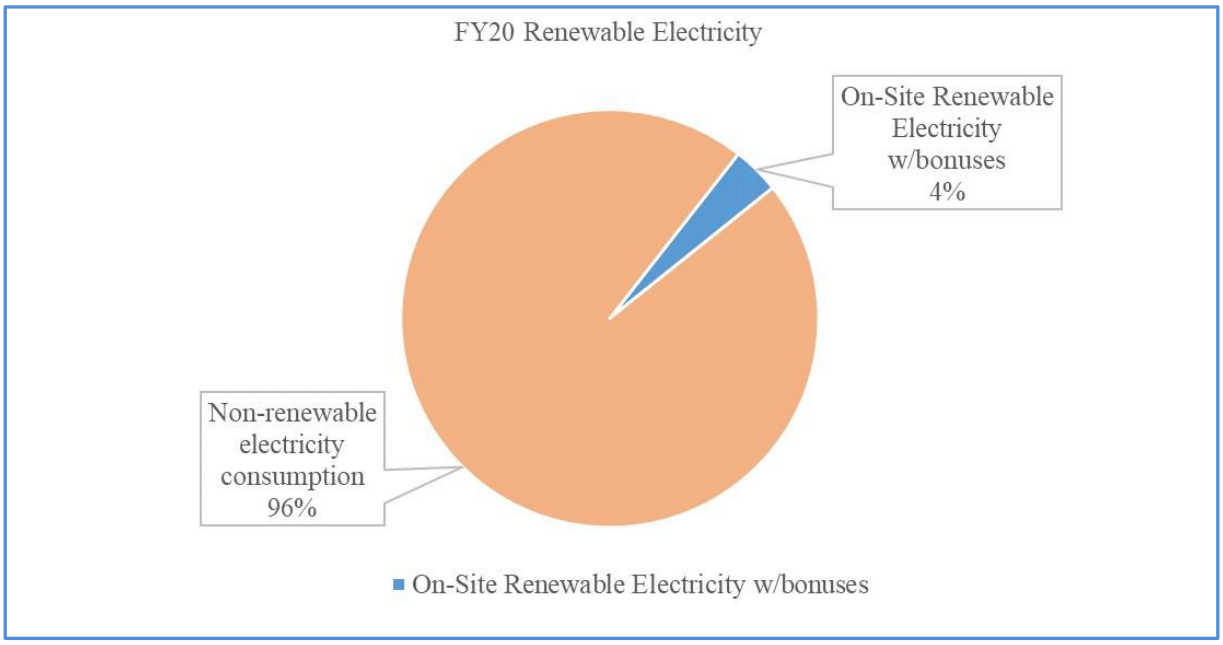


Figure 15. FY 2020 Renewable Compared to Non-Renewable Energy.

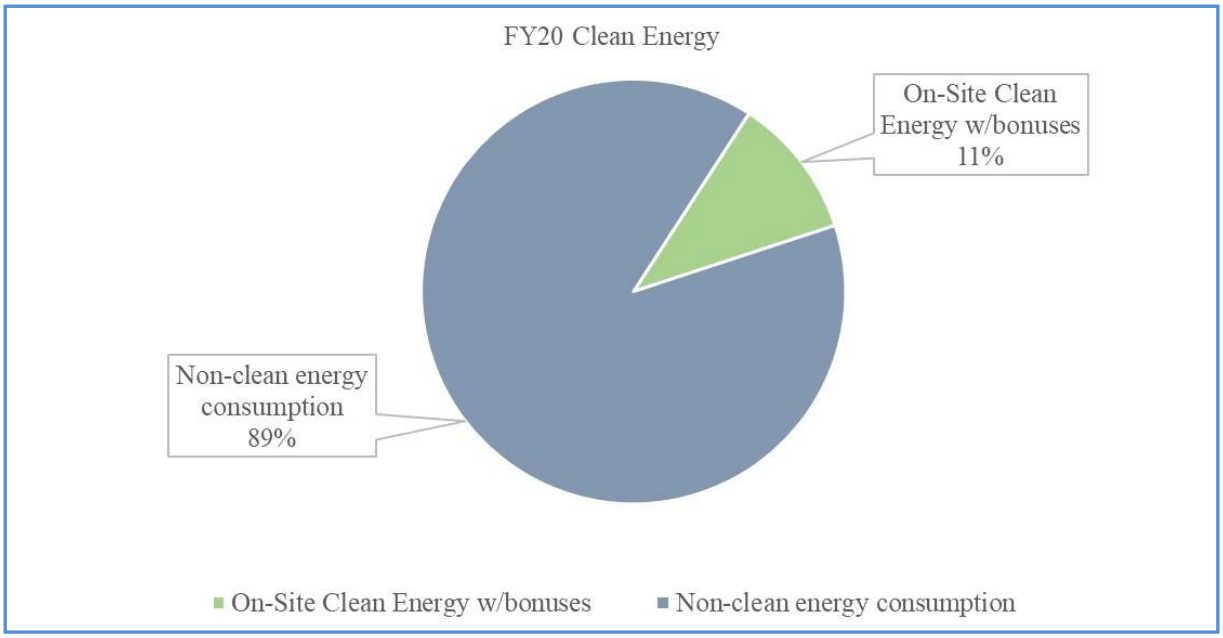


Figure 16. FY 2018 Clean Compared to Non-Clean Energy.

7 Sustainable Buildings

7.1 Guiding Principles

Performance Status

Prior to the issuance of the 2016 Guiding Principles, LANL selected and assessed 34 HPSB-candidate buildings that constituted 15% of existing buildings greater than 5,000 GSF. At that time, the buildings were on average 90% compliant with HPSB 2008 guiding principles (GPs), with 8 buildings fully compliant. Four other buildings were subsequently completed, with three of them achieving LEED Gold, bringing the current number of GP-compliant buildings to 11. The Tactical Training Facility at 16-1550 would also have been deemed 100% compliant had it been certified as LEED Gold. But it was never evaluated against the 2008 or 2016 GPs and a compliance percentage cannot be specified.

One building was completed in FY 2020:

- MOB (Modular Office Building), a secure office building: This new permanent modular building is expected to comply with guiding principles requirements and, at the writing of this report, is in the process of collecting and providing the necessary compliance documentation as well as completing network connections for smart meters.

Table 2 shows assessed existing facilities and new facilities and the compliance status of each. Green indicates 100% compliance with the 2008 guiding principles, white indicates lower GP compliance, and blue indicates 50% compliance with the 2016 GPs.

Table 2. High Performance Sustainable Buildings Guiding Principle Implementation Status

Property Name	Guiding Principles % Compliance	Property Name	Guiding Principles % Compliance
03-2011 Adv Computer Lab	100	03-1410 Los Alamos Site Office	100
03-1411 Occupational Med Facility	100	03-1415 Office Building	100
16-0933 Office Building	100	63-0111 Office Building	100
69-0033 Emergency Ops Building	100	52-0033 Weapons Support	100
63-0144 Laboratory/Office Building	100 (LEED Gold)	55-0400 RLUOB	100 (LEED Gold)
16-1550 Tactical Training Facility	LEED Certified	55-0440 Mechanical Building	100 (LEED Gold)
59-0003 Office Building	96	03-0508 Compu Physics Office	96
03-1409 Office Building	92	60-0175 Comm Ops Building	96
03-0207 Oppenheimer Study	92	46-0535 Chem Tech Support Building	92
03-1405 Office Building	89	22-0120 HDF Hydrotest Des Facility	89

Property Name	Guiding Principles % Compliance	Property Name	Guiding Principles % Compliance
16-0824 Office Building	88	03-1400 Nat'l Security Sciences Bldg	88
60-0245 Radio Shop	88	16-0969 Weapons Pit Support	88
53-0006 Accelerator Tech	88	03-0502 Space Science Lab	88
55-0066 FITS Office Building	88	53-0031 NPB Technical Support	88
53-0024 Laboratory/Office Building	88	55-0313 Office Building	88
35-0213 Target Fabrication Bldg	81	03-0261 Otowi	85
03-0216 Weapons Test Support	81	53-0001 Laboratory/Office Building	81
09-0021 Laboratory/Office Building	81	03-1498 Data Communication	81
03-2618 Modular Office Building	50	03-0422 Office Building	62

LANL currently has 137 DOE owned and operated buildings over 5,000 sq. ft. which have not been designated excess and have been designated sustainable building subjects. The total square footage of those buildings is 5.83 million. LANL has evaluated 1.63 million sq. ft. for compliance with the GPs, which equates to approximately 28% of both the subject square footage and the buildings, with 9% of the subject square footage achieving compliance.

Two common barriers to achieving the energy efficiency goals of the GPs are (a) the age of the building stock and (b) Laboratory functions that require high ventilation rates. Because of this, in lieu of targeting existing buildings for 100% compliance of the GPs, LANL focused on high ROI energy reduction projects in FY 2020, while applying sustainable design criteria to the design of new facilities. Recommissioning on average save 20% in electricity and heating energy use per building while improving tenant comfort and productivity.

Plans and Projected Performance

The 2016 guiding principles require installation of advance building-level meters for all the utilities (electric, thermal and water). However, because of the expense, lack of resources, and possible disruption of service involved in installing physical meters, LANL's Building Automation System (BAS) Team has developed what has become known as virtual meters. These BAS data collection points, along with equipment information and programming, can produce calculated thermal energy and power use estimates. This is discussed in more detail in the metering section and in a white paper written by LANL BAS staff. In FY 2021, the Sustainability Program will work with the BAS team to determine which buildings could be used to compare the accuracy of virtual meters with physical meters, to see if using these less invasive and less costly alternatives can accurately monitor total energy use in existing buildings, and with the approval of the DOE, serve as a way to consider buildings for compliance with the GPs.

Another focus for FY 2021 will be completion of life cost analysis on meter installations on previously evaluated buildings. If it's found not cost effective to install meters in these buildings, several denoted not applicable may still be certified as meeting the GPs. This, combined with the alternative of using virtual meters, should increase the percentage of compliant buildings and square footage within a 2-3 year time frame.

To continue the efforts to focus on high ROI energy reduction projects on existing buildings, in FY 2021, LANL plans to:

- Complete design of BAS for 9 facilities.
- Execute BAS design and implement SkySpark in 8 of those 9 facilities.
- Complete design of recommissioning efforts in 4 facilities.
- Perform the 4-year follow-up of the facilities previously recommissioned to ensure continued energy efficiency.
- Conduct EISA audits in 21 facilities.
- Complete the collection of thermal energy meter data to develop baseline year data. for verifying the 20% energy savings.

7.2 New Building Design

LANL has had mixed success in meeting the Federal building efficiency standards. The standards for LEED and DOE High Performance Sustainable Building compliance (Guiding Principles) have been included in the requirements for new construction, but they have been met inconsistently. While subcontract constructors and designers are gaining familiarity and expertise with LEED certification, there is less industry awareness of the DOE Guiding Principles. But with the DOE requirement for LEED-Gold compliance moving to $50 million, more emphasis is being placed on DOE guiding principles requirements.

Examples of buildings with issues that impacted guiding principles compliance are noted below:

- The CEFC (Commercially Engineered Facility Construction. This laboratory office building neared completion during FY 2020. It is expected to meet LEED-Gold certification but did not meet DOE Guiding Principles. While projected to improve energy efficiency compared to ASHRAE 90.1-2013, the high air-volume design requirements of the laboratories were not mitigated and it did not meet the 30% improvement threshold. This is permanent modular construction.
- Three TA-55 warehouses managed by the Army Corp of Engineers. The project management team has been granted a LANL variance from the LANL Engineering Standards. Compliance with the Guiding Principles for these projects is unclear.
- Temporary Structures. While not technically considered “new construction,” these structures present other issues. Several office trailer complexes have been built or are in design/planning to address critical office shortfalls. These structures are designated “temporary” and so do not fall under normal LANL engineering requirements for permanent buildings. They tend to be configured with electric heat pumps for heating and cooling.

Plans and Projected Performance

Over the past 5-years, LANL has avoided the use of leasing to address space needs while maintaining a significant portfolio of leases in Los Alamos. Because of regional demographics, the Los Alamos lease market can accurately be described as a limited market, with logistical constraints on competition. With LANL as the primary employer, the market is essentially an oligopoly in which LANL dominates the leasing market. Notwithstanding this, several property owners who lease to LANL have pursued energy improvement projects and promoted sustainable practices. Replacement windows, LED lighting, and efficient mechanical equipment have been installed in conjunction with recycling and water conservation. Under U.S. Office of Management and Budget Circular Guidelines, any new lease proposals are to be scored with high consideration given to energy efficiency and sustainability.

LANL has completed a small number of new construction projects since FY 2007, but four buildings are expected to have beneficial occupancy in FY 2021, followed by one in FY 2024 and one more in FY 2027:

- CMRR Warehouse. Expected to comply with LEED Gold and DOE guiding principles. No documentation provided to date.
- CEFC (as mentioned above). Not expected to meet DOE guiding principles . Some compliance documentation provided showing better than 80% compliance.
- MUOB (Modular Office Building). Permanent modular construction now under construction. Planned to go online in FY 2021. Sustainability Program working on compliance levels with project managers. Expected to meet DOE guiding principles. .
- TA-35 Modular Office Building. Expected to comply with DOE guiding principles.
- TA-22 Laboratory/Office Building. Beneficial occupancy planned for FY 2024. Expected to comply with DOE guiding principles.
- EMC (Energetic Materials Characterization) Facility. Working with project team now in pre-conceptual design phase. Should be LEED-Gold and DOE guiding principles compliant. Beneficial occupancy expected in FY 2027.

The Sustainability Program is actively influencing the design of eight other new facilities, including three fire stations. Projects will benefit from a new edition of Guide to LANL HPSB, offering additional information about guiding principles, including strategies for compliance, requirements for documenting compliance, life-cycle cost analyses, and how analyses may be used to document compliance. In addition to the new edition of the Guide, the Sustainability Program is undertaking a chapter by chapter review of Engineering Standards Manuals and standard specifications to ensure that DOE guiding principles for each discipline are better defined.

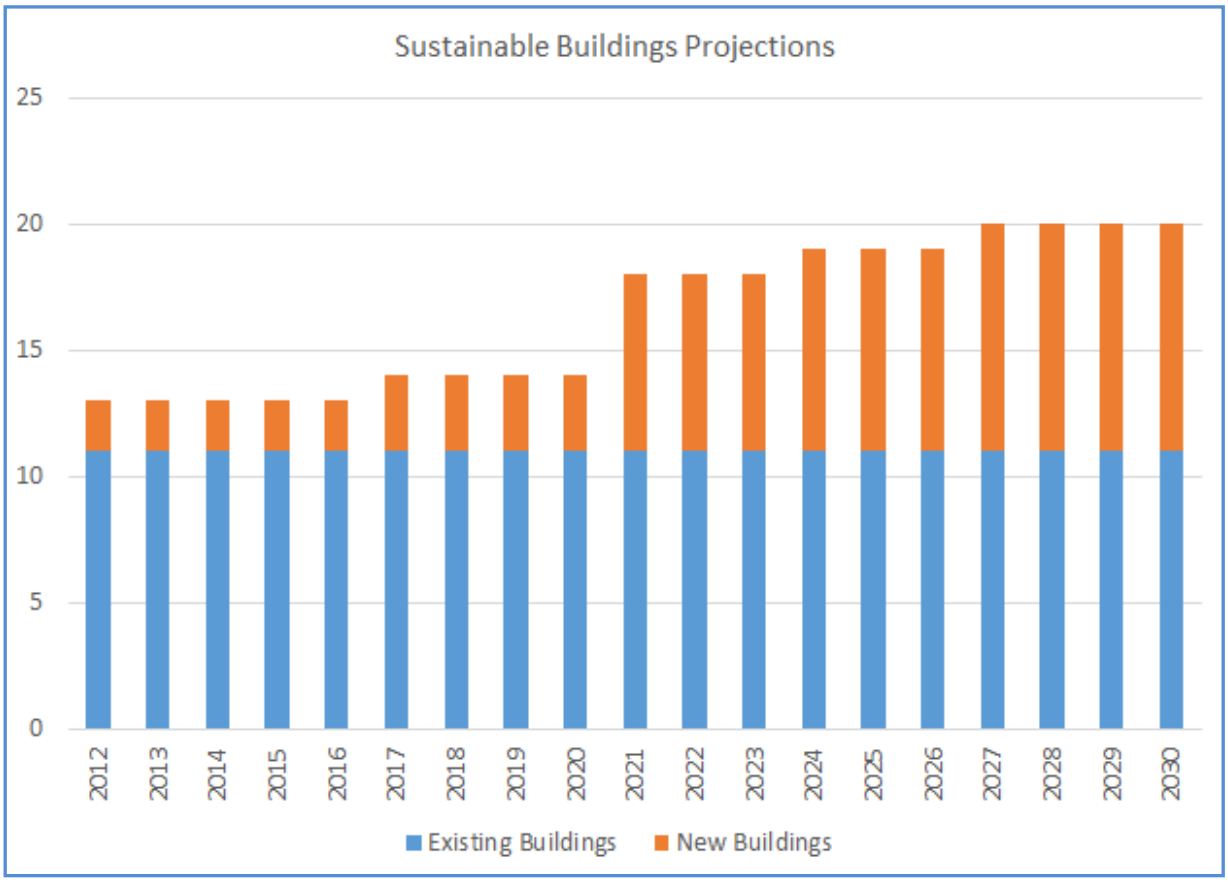


Figure 17. Sustainable Buildings Projections.

With new construction planned over the next 10–30 years, LANL is positioned to increase the number of High Performance Sustainable Buildings. The Sustainability Program estimates that by FY 2030, LANL will have reduced its energy intensity by 1.8% because of new construction, compliance with the DOE guiding principles, and the demolition of older energy inefficient facilities compared to FY 2020 even though an estimated 4,000 new employees will be hired and power demand will double.

8 Acquisition & Procurement

8.1 Sustainable Acquisition Strategies

FY 2020 was an encouraging year for sustainable acquisition at LANL. Progress in sustainable acquisition in past years has been limited and small in scope due to structural barriers. While resources were needed elsewhere, and so change was not as extensive as we would have liked, progress was still made. The associated acquisition and procurement details are discussed in this section.

In FY 2020, 4,029 eligible contract actions and 3,868 contract actions contained sustainable acquisition clauses. The contract actions that did not contain sustainable acquisition clauses had a foreign places of performance.

Progress was made in the effort to maximize acquisition of designated products. In FY 2020, as mentioned in the FY 2019 narrative, the Pollution Prevention (P2) program worked closely with the Acquisition Services Management division on implementation of a new procurement system based on commercial software known as SAP Ariba (henceforth referred to as Ariba). P2 has worked on identifiers needed to flag (and later produce data for) designated products. When Ariba is implemented, vendors will be required to note whether or not a product is Energy Star-qualified; contains minimum amounts of post-consumer recycled content;, is Electronic Product Environmental Assessment Tool (EPEAT) compliant; or possesses other sustainable properties such as bio-based.

While this list isn't completely comprehensive, it is an excellent step in “getting the plumbing in place” for future expansion and immediately improved data collection. In the past, none of these product characteristics were noted by vendors, who had to be contacted individually to obtain sustainable acquisition data. The Ariba system will also offer a dedicated catalog containing hand-picked sustainable products. All this is designed to facilitate making sustainable choices when ordering.

Due to COVID-19, LANL's FY 2020 Sustainability Fair, normally held during Earth Week, was cancelled. But the 50th anniversary celebration of Earth Week was still considered a success with a completely online venue. Attendees could visit the Earth Week webpage and participate in each day’s theme, including a daily tip, a daily sustainably sourced (and healthful) recipe, and easy to use information that could be downloaded and printed at home. These tips touched sustainable acquisition, personally and professionally, through recommendations such as “Avoid Fast Fashion” and “Start with Your Office” shown here.

The LANL P2 program hosted its second annual Elkay water bottle filling station competition in which organizations could enter for a chance to win a filling installation in their office space. The original intent was to select three winners. But there was so much interest that the P2 program chose 10 winning organizations. Because not all installations could be completed in FY 2020, partially due to site restrictions due to the COVID-19, installations will continue into FY 2021.

To do its part in implementing EPA recommendations for specifications, labels, and standards designating environmentally preferable products and services, LANL updated and revised its own sustainable acquisition engineering standards in FY 2019. The updates were based on the Green Procurement Compilation, which consolidates guidance from multiple agencies, including the EPA. This will provide LANL staff with up-to-date sustainable acquisition requirements. LANL continues to train all of its designated procurement representatives on sustainable acquisition responsibilities. This training will be updated in FY 2021 because of the change in the LANL procurement system from Oracle to Ariba.

Biobased Products and Biobased Provisions

Biobased clauses and product specifications are not included in LANL's eligible contract clauses or actions, nor does the institution have a system in place to track biobased data. But the change to Ariba will include a mechanism to track biobased products.

To meet the biobased reporting requirement for the previous reporting year of FY 2019, manual queries were issued to individual Triad vendors and to areas with high use of biobased products (e.g. Triad machine shops and custodial support services).

For FY 202 , products such as COOLUBE 2210 and COOLUBE 2210EP were queried in the institution’s chemical inventory system, known as ChemDB. Once a product was shown as activated in the database during the FY 2020 period, owners of the chemical were contacted to verify purchase in FY 2020. This data was then reported into SAM.gov. As with FY 2019, this method is incomplete. Improved data collection via Ariba should increase data quality in future reporting years.

9 Measures, Funding & Training

9.1 Efficiency and Conservation Measures

Performance Status

The SSP builds on FY 2020 accomplishments while planning investments in FY 2021 to facilitate further progress.

FY 2020 accomplishments:

- Continued implementation of the Smart Labs program to increase the energy efficiency of Laboratory facilities.
- Performed assessments of 10 facilities for HPSB and Smart Labs, including data collection, records retrieval, and ventilation assessment field support.
- Prepared recommissioning reports for three facilities and performed assessments of 21 facilities with 1,570,635 sq. ft. of space in relation to EISA requirements.
- Completed installation of the energy analytics and fault detection software SkySpark in 60 buildings and completed arrangements to collect electric meter data in another 75.
- Completed BAS upgrades from pneumatic to digital control in two facilities.

- Provided 36 million gallons of reclaimed wastewater from SERF to the SCC for reuse in cooling towers.
- Achieved cost avoidance of $1.2 million through P2 projects.
- Achieved cost avoidance of $25 million and potentially more through the TRU waste avoidance program (recognized by a Patricia E. Gallagher Environmental Award).
- Continued execution work on the TA-03 Power Plant replacement project comprising a new control system, new gas supply piping network, and a more efficient CGTG to provide heat to TA-03 facilities.

FY 2021 investments:

- $1.1 million indirect program funding for the P2 Program.
- $637,000 indirect program funding (via P2) for the improvement of LANL's chemical management program. This is critical for the proper management of chemicals and eventual reduction of hazardous waste.
- $3.9 million indirect program funding for the Sustainability Program.
- $3 million indirect funding to operate the Sanitary Effluent Reclamation Facility (SERF) to maintain water reduction.

Solar Workstations Outside Otowi.

The Sustainability Program installed three new solar-powered outdoor workstations at TA-03 in FY 2020. Each provides employees with a convenient outdoor venue for getting out of the office to perform work, hold meetings, take breaks, eat lunch, or just hang out with friends in a relaxed, healthful setting.

Two of the workstations are located near the flag poles outside Otowi. The third was installed outside the Wellness Center.

Each is equipped with four 120-VAC power sources and eight USB ports capable of charging laptops and smart phones. Depending on the amount of available sunlight and the types of devices connected, each workstation has the capacity to charge between 75 and 150 devices per day.

Plans and Projected Performance

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 improve efficiency in 3 facilities each year. Through investments in building automation systems, lighting, and other efficiency projects, LANL plans to achieve the following goals in FY 2021:

- Improve energy efficiency to meet LANL efficiency standards in 3 facilities.
- Maintain water use at or below FY 2020 levels.

The Sustainability Program is also working through the EMS program to implement energy and water efficiency projects across the Laboratory.

In FY 2021, LANL will leverage direct funding from the Recapitalization Program and from the NA-50 Asset Management Program (AMP) to optimize energy efficiency opportunities. Recapitalization plans include $63.828 million (including new authority and carryover) for a variety of projects with the potential to reduce energy use. Priorities for AMP include projects to replace common building systems (such as roofing, heating and cooling) with modern, high-efficiency systems. It is anticipated that the AMP program will expand to cover other systems with sustainability impacts 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.

10 Travel and Commute

10.1 Business Travel Strategies

Because international and domestic travel restrictions to attempt to reduce the spread of the COVID-19, air travel emissions from LANL employees declined even more than commuter emissions. Comparing FY 2020 and FY 2019 air travel data, GHG emissions from this category decreased by 55 percent.]

10.2 Commute Strategies

In FY 2020, commuting and travel by LANL staff was business-as-usual until interrupted by COVID-19 and the implementation, on April 1, of health and measures requiring non-mission-essential staff to telework and mission-essential staff to telework whenever possible. LANL data shows that on the last day in March, before lockdown,10,864 employees worked on site. After the April 1 lockdown, only 1,285 staff members worked on site. At the end of FY 2020, 43% of the workforce worked on site while the other 57% teleworked.

The new reality of COVID-19 decreased GHG emissions from LANL commuting and travel . Commuter contributions came to 36,425 metric tons of CO2 compared with the FY 2019 contribution of 54,398 metric tons of CO2, for a 33% decline. Employee commuter data is

calculated for the current fiscal year using the 2019 LANL commuter survey and population numbers for the Laboratory on-site workforce. The P2 program conducted the FY 2019 LANL commuter survey working with Workforce Data Analysis. It was sent through email to 928 staff; 551 of them responded, for a 59.4% response rate. The P2 program delivered hardcopy to 221 Laboratory maintenance and logistics workers (craft workers) since they do not regularly use email; 116 filled it out, for a 52.5% response rate. The P2 program did not conduct a FY 2020 commuter survey because of staffing constraints and work interruptions from COVID-19.

Although COVID-19 safety measures forced LANL staff to telework, management has emphasized the importance of teleworking to support the plutonium pit mission. To achieve the mission's targets, LANL management is planning to increase the LANL workforce. LANL does not have sufficient space to bring on all these new hires, nor have federal funds been earmarked for enough new facilities. The telework strategy thus appears the approach going forward. Shifting a significant number of staff to work off-site will open up office space. In FY 2020, LANL conducted a telework pilot project with 1,336 staff to gage telework feasibility. For FY 2021, telework will be utilized in a combined strategy to reduce COVID-19 spread at LANL and to increase the workforce.

LANL maintains and allows public access to a central transit station facility on NNSA property within the main campus at TA-03. This central station allows four transit systems to converge: the Laboratory taxi and bus system, LAC Atomic City Transit, the New Mexico Department of Transportation Park and Ride, and North Central Regional Transit District buses. Atomic City Transit provides transportation to and from the White Rock town-site, and to and from the Los Alamos town-site. Other systems such as Park and Ride provide public transit services to the surrounding communities of Espanola and Santa Fe. The New Mexico Rail Runner Express train provides employees from the Albuquerque area the option of riding a train to Santa Fe and connecting from there to Los Alamos.

LANL provides taxi services for employee travel between sites during the day so that fewer people require their personal vehicles. These services have been affected by COVID-19 with reduced ridership and/or minimal scheduling.

In FY 2020, the LANL Bicycle Safety Committee succeeded in getting bike racks and lockers installed throughout the Laboratory (including the lockers at Otowi shown here) to encourage bike ridership.

Prior to FY 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 to reduce the total commuter days per year. Additionally, LANL employees find carpool or vanpool groups through the Commuter's Corner blog to assist with reducing the parking load of single occupancy vehicles; just under 20% of Laboratory workers living outside Los Alamos County use a carpool/vanpool for their work commute, with a majority coming from Albuquerque. Four electric vehicle charging stations charging spots with two ports each have been installed across the Laboratory for personal vehicles. Use of the

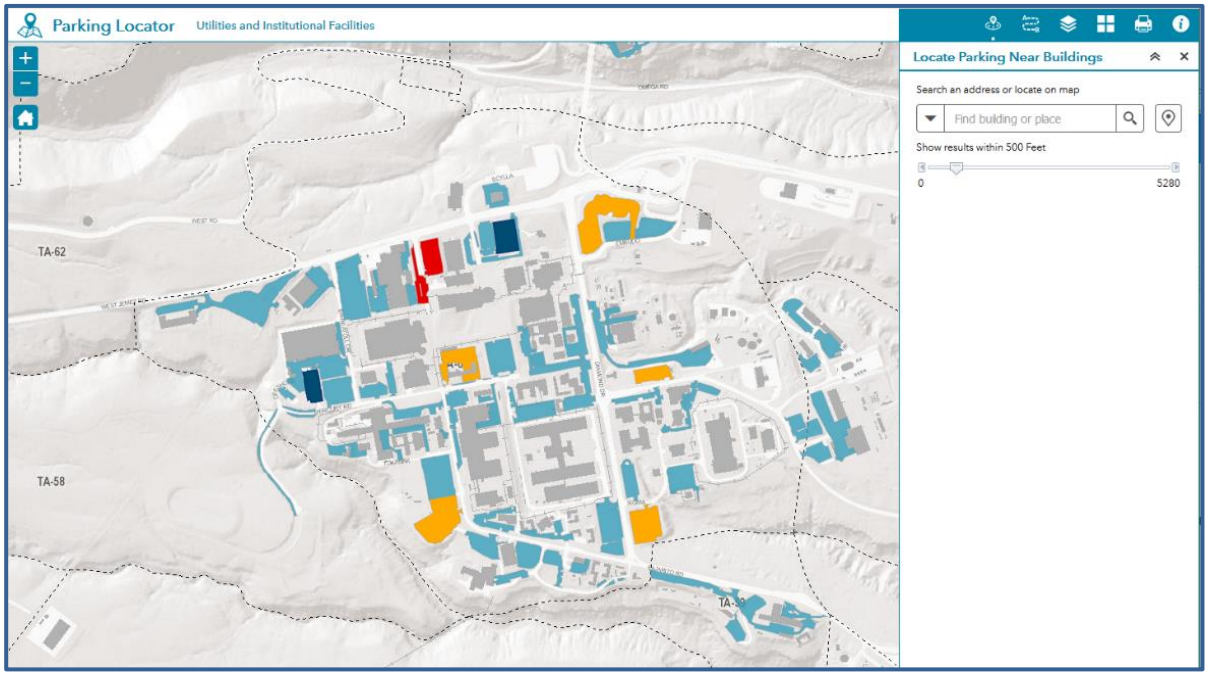
charging stations is monitored to determine if and when more will be needed. Private users pay LANL $0.50 per hour to cover the cost of electricity.

Telecommunication Services (NIE-TS) provides telecommunication technologies and services enabling science, programs, and operations at LANL. This group provides the entire Laboratory with voice, wireless, data, and video communication services. With this infrastructure in place, there is a reduced need to travel by air and ground for work related activities. More important, the establishment of this technology enabled easy transition to telework as a means to minimize COVID-19 spread within the LANL workforce.

LANL works hard to recognize commuter success stories on alternative means of transportation such as the Park and Ride system. Efforts to change behavior, such as commuting to work or consideration of purchasing an alternative energy vehicle, are promoted by events such as LANL Earth Day.

In FY 2020, a call to action was created asking Earth Week participants to consider alternatives to solo commutes. These alternatives include the Park and Ride, Rail Runner Express, carpooling, bike riding, the LANL Taxi Service, and Atomic City Transit mentioned above. An infographic was created for Earth Week participants interested in purchasing a new car to understand the pros and cons of an electric vehicle versus a conventional one.

The LANL campus is located in an isolated area of New Mexico and is staffed by employees from various locations around the state. Housing opportunities within the nearby towns of Los Alamos and White Rock are limited requiring staff to drive from locations such as Espanola, Santa Fe, and Albuquerque on a daily basis. According to the FY 2019 Commuter Survey, 72.6% of staff drive a single occupancy vehicle for a normal commute day while 12.3% use carpool and 5.8% use public transportation. However, this issue is being mitigated with LANL's telework strategy since fewer staff members are driving to work. Furthermore, based on survey data, a large percentage of Laboratory employees seem to not be well informed in regards to electric vehicles and hybrid and plug in hybrid vehicles. When asked if they would consider these types for their next commuter vehicle in the survey, 20.7% stated "I do not know" for electric or plug in hybrid vehicles and 33% stated "I do not know" for hybrid vehicles. This indicates lack of knowledge - a strategy for FY 2021 would be to continue to educate LANL workers in regards to the advantages and disadvantages of electric vehicles and hybrid and plug in hybrid vehicles, and it may generate enthusiasm to switch to these alternatives for future commuter vehicle purchases. Furthermore, if demand for electric vehicles or plug in hybrid vehicles increases, this would incentivize the Laboratory to install more charging stations.



GIS parking locator app helps employees find parking places.

A key issue caused by the high rate of single occupancy vehicles used for commuting is space for parking, which is critical to efficient conduct of business. Areas of concern include the TA-03 core and the Pajarito corridor which contains TA-55, TA-35, TA-50, TA-63, and TA-48. The guiding document to address the Laboratory's parking issue is the 2019 Parking Study (UI-RPT-039-R0). Short-term strategies to address the issue include redesign of parking area striping patterns to provide space for more vehicles, construction of new parking lots, technology advancement, and development pf LANL shuttle routes to move workers more efficiently around the Laboratory. Long term strategies include construction of additional parking garages/structures, development of biking infrastructure around the Laboratory, upgrading the transit center, improving reliability and frequency of Atomic City Transit buses, and increasing the number of workers using alternative commuting methods such as public transportation and carpool/vanpool; opportunities to increase alternative commuting include strengthening the service provided by Park and Ride through cheaper fares or no fares, a more frequent schedule to and from the Laboratory, and more drop off points for the Park and Ride busses. In FY 2020, using the 2019 Parking Study as guidance, LANL carried out some of these strategies; it developed a GIS Parking locator app to help LANL employees find underutilized sparking spots in difficult to see areas.

The LANL taxi service added two new routes to the central transit station from facilities down the Pajarito Corridor IN FY 2020 to reduce afternoon/early evening traffic congestion. Before the pandemic, total ridership was over 300 people per day for these new routes. Also in FY 2020, LANL began construction on a new parking garage, centrally located, with plans for 450 parking spots, electric vehicle charging stations, motorcycle parking, high occupancy vehicle parking, and bicycle racks. Notwithstanding these strategies, the best approach to reduce LANL's parking bottleneck is to increase the number of employees that work off-site full-time or part-time.

11 Fugitives & Refrigerants

11.1 Control Strategies

Fugitive emissions from LANL increased slightly during FY 2020 compared with FY 2019. While overall it is believed that previous reduction efforts remain effective, there was a slight increase in sulfur hexafluoride (SF6) purchases compared to the previous year. The majority of SF6 purchases are for mission critical operations, so reduction opportunities are limited. Refrigerants usage decreased from the previous fiscal year and other fugitives varied only slightly from the previous year.

Fugitive emissions are carefully monitored at LANL and reduced wherever practical. For FY 2021, however, LANL does not expect increases. Overall, fugitives and refrigerants should look about the same in the next reporting cycle since the P2 program is not aware of any large changes in activities which would impact emissions.

For SF6, this gas is managed as a chemical and a compressed gas on the site. Purchasing and the later refilling of a cylinder is managed by the centralized LANL Gas Facility. Each full cylinder that arrives at the LANL Gas Facility is assigned a barcode. This barcode number is tracked in ChemDB, the LANL chemical inventory database. Once a cylinder is deployed to an organization from the Gas Facility, this information (location, user, organization, etc.) is updated through ChemDB. When a cylinder is deployed, it is recorded using the Gas Facility order tracking system which is what is presently being used to track SF6 emissions, for the Sustainability Dashboard. A cylinder is considered 100% emitted during the fiscal year that it is deployed to the end user, even if the user doesn't completely spend the cylinder in that time-frame. When a cylinder is recognized as consumed, or no longer needed, by the user, it is returned to the Gas Facility to be shipped to Air Gas for refilling. LANL has a finite number of SF6 cylinders that are always in rotation between use and refilling.

As mentioned in the waste management section, the current system of chemical management at LANL makes it difficult to maintain an accurate real-time tally of consumption and purpose of the gas without double-checking gas facility purchase data or performing a walk-down of all SF6 uses, a very time intensive process. Expected improvements in chemical management slated for FY 2021 and beyond will benefit SF6 tracking and management in future years by facilitating improved inventory management and process tracking. The P2 program is looking at ways to measure the actual amount of gas emitted, Methods will rely on innovative chemical tracking techniques.

In FY 2018, LANL had two key wins that have demonstrated benefits in FY 2019 and FY 2020 in SF6 reduction, technology innovation, and leak reduction. This came in the form of two projects:

- LANL made significant progress in FY 2018 on SF6 emissions. As reported in past years, the Dual-Axis Radiographic Hydrodynamic Test facility (DARHT) has been the top user of SF6 on the site. SF6 is used in the facility as a dielectric insulator for its high voltage switches. During a wall-to-wall walk-down of SF6 use on the site in the calendar year of 2016, it was identified that the DARHT facility's closed loop system needed further evaluation with regard to leaks due to their high amount of cylinder purchases. A closed loop system should not be losing SF6, and one section of elevated, and hard to reach, manifold was identified as a potential leak location. Multiple mechanical joints in piping for SF6 were also identified as more prone to

leaks than welded joints. During the course of FY 2018, the staff of the facility took the initiative to identify leaks and complete repairs. Close to the end of FY 2018, SF6 purchased cylinders was tallied and totaled nine cylinders compared to the previous year which totaled 22 SF6 cylinders. This was including maintenance activities which result in SF6 losses. The total reduction was a 59% decrease in SF6 cylinder purchases. When the savings is calculated, assuming that every cylinder contains 115 pounds of SF6 and is fully consumed, 1,495 pounds of SF6 emissions were avoided. This can be calculated as 15,461 metric tons of carbon dioxide. In FY 2019, overall SF6 emissions decreased from FY 2018 demonstrating further success of these efforts. Additionally, FY 2020 increases do not appear to be attributed to this facility.

- A successfully implemented SF6 gas reduction project resulted from a multi-year effort in LANL's Plasma Physics group (P-24) in collaboration with Virginia Tech University. Pure SF6 is used as an insulating gas to prevent electrical arcs from forming in high-voltage equipment that produces short pulses of power for experiments that support research in both nuclear fusion and astrophysics. Additionally, a mixture of 15% SF6 and 85% argon is used to insulate rail gap switches in the same laboratory. A P2-funded project enabled P-24 to begin development of switches that can use compressed air or oil instead of the SF6/argon mixture. Phase 1 in FY 2017 showed that the new design is effective, and in FY 2018 the P2 program further supported performance testing, which was successful. The benefits include increased productivity, set-up flexibility, reduced labor time and elimination of SF6. P-24 has confirmed applicability of the new switches to similar equipment in the DOE complex and elsewhere. This is the quintessential P2 project, an achievement that eliminates waste through source reduction and increases efficiency, decreases safety risks, and is transferable. In FY 2019, further validation of this work was seen as no new mixtures of 15% SF6 and 85% argon were purchased at LANL and this continued into FY 2020.

At this time, the P2 program is unaware of SF6 alternatives that would benefit LANL-specific uses, nor is it aware of possible program changes that could increase SF6 consumption on the site.

12 Electronic Stewardship

12.1 Acquisition Strategies

Performance Status

LANL participated in the procurement of FY 2020 Electronics Acquisition of EPEAT-registered and ENERGY STAR certified electronic office products with the purchase of the following electronics categories: computers, monitors, imaging equipment, televisions, mobile phones, and severs. LANL purchased a total of 14,878 EPEAT - registered and ENERGY STAR certified products in FY 2020.

LANL has no policy or procedure that requires and ensures acquisitions of EPEAT - registered and ENERGY STAR certified electronic office products. But LANL strongly encourages subcontractors to purchase these products and this is detailed within LANL-issued subcontracts General Conditions, e.g. the following:

GC-77 Green/Sustainable Products (Feb 2015)

Whenever possible, SUBCONTRACTOR shall offer green/sustainable products and/or repair/spare parts, which meet the (1) minimum content levels for sustainable products or (2) Environmental Program certification or (3) product attributes, listed at the Sustainable Facilities Tool website found at http://www.sftool.gov/greenprocurement. Minimum content levels, environmental program certifications and product attributes, if any, are listed under the column titled "Procurement Info" for each product.

When green/sustainable products and/or repair/spare parts are purchased under this subcontract, when requested by CONTRACTOR SUBCONTRACTOR shall provide quarterly reports to CONTRACTOR describing green/sustainable products procured by CONTRACTOR in the preceding quarter. Reports shall (at a minimum) include the following information:

1. *Total dollar value of CONTRACTOR purchases for the preceding quarter, separated into each product category shown at the Sustainable Facilities Tool website.*

Total dollar value of CONTRACTOR green/sustainable product purchases for the preceding quarter, separated into each product category shown at the Sustainable Facilities Tool website.

Plans and Projected Performance

LANL will keep purchasing EPEAT - registered and ENERGY STAR certified electronic office products and working closely with its Subcontractors.

12.2 Remote Operations – Strategies

Performance Status

Since FY 2013, to reduce energy usage and costs in computers, monitors, and laptops, LANL has worked toward the goal of using Microsoft Systems Center Configuration Manager (SCCM) and similar software applicable to Macintosh equipment to remotely assess and control power settings in 100% of eligible work stations on the unclassified yellow network. In FY 2018, the Laboratory extended application of centralized power management to all Windows-based computer systems, not just work stations, and made the automatic eleven-minute sleep cycle the Laboratory standard.

The number of computer systems subject to network-based power management continues to increase—from approximately 20,000 in FY 2019 to more than 27,000 in FY 2020, a number that includes an estimated 6,700 Macintosh systems.

Limitations

In January of 2016, LANL decided to temporarily suspended use of SCCM on Windows computers because of a conflict between SCCM power management and cybersecurity scans to check for compliance and vulnerabilities. After instituting measures to ensure that equipment can undergo cybersecurity scans in sleep mode, the Laboratory reinstated use of SCCM. Today, however, while nearly all Windows computers use SCCM to control basic power settings, the number of systems are set to sleep on a regular schedule is only two percent. Windows-based equipment deemed "eligible" includes most desktops, servers, and laptops on the unclassified network except for so-called virtual computers, computers with special incompatible hardware, and computers excluded for programmatic reasons.

Most network printers are excluded from centralized power management, but 40% of the printers directly connected to a Windows system are not excluded. To save paper, duplex printing is a default Laboratory setting applicable to approximately 1,100 printers.

COVID-19 Impacts

As noted, the advent of the COVID-19 pandemic suddenly led to a requirement that most LANL workers switch to teleworking, i.e. performing their jobs over the Internet and local network using Laboratory laptops. Not all power management settings are applicable to laptops used remotely, but the automatic eleven-minute sleep cycle is .

12.3 Electronic Stewardship/End of Life

Performance Status

LANL employees dispose of excess government property through the excess/disposition process, by recycling, as trash, or inclusion in hazardous waste streams.as dictated by the property type and condition, safety, and environmental or security issues. Property specialists are available for guidance. For disposition or disposal outside Laboratory stewardship, property must be safe and not pose a security risk. Laboratory workers are required to complete Form 2893, Excess/Salvage Equipment Request, for disposal of barcoded property.

Laboratory workers are expected to consider the potential for recycling an item no longer needed. Barcoded property deemed safe and secure for internal reuse may be advertised through the LANL electronic SWAP shop. LANL IT equipment must be disposed of in accordance with the *Transfer and Sanitizing of Electronic Storage Media* Procedure (P211), and the Laboratory's Information Systems Destruction and Recycle Plan. Non-barcoded property may be made available for internal reuse at the excess property yard.

Safe and secure property not reused internally is offered to schools, universities, other DOE/NNSA and federal agencies, and New Mexico surplus property agencies. If not accepted, it may be released for public sale.

COVID-19 Impacts

COVID-19 has slowed disposal of electronics because of delays in scheduling pick-up, by social distance protocols, and the added complication of telework.

Plans and Projected Performance

LANL plans include continuing the programs and processes described above.

12.4 Data Centers – Strategies

Performance Status

LANL operates three HPC data centers supporting a mix of institutional, special purpose, and Laboratory missions: the Strategic Computing Complex (SCC), the Laboratory Data Communications Complex (LDCC), and the Central Computing Facility (CCF).

Over the past several years the CCF has increased efficiency by consolidating operations and reducing the amount of special purpose computing, leaving special purpose and mission computing to the LDCC and SCC. LDCC plans for efficiency improvements include a shift from low density air cooled computers to high density, liquid cooled computer. Certain types of special purpose and mission computing will migrate to the SCC.

Current power usage effectiveness (PUE) data includes the following:

- SCC: 1.20 (per existing metering)
- LCCC 1.33 (measured on entry level and biannually at room level)
- CCF: 1.51 (per utilities usage and other, manually collected data)

In FY 2020, considerable investments were made to increase data center efficiencies through completion of the SCC Exascale Class Computing Cooling Equipment (ECCCE) Project; continuation of the SCC Bus Duct Replacement Project; start of the SCC CTS-2 Chilled Water Loop Project;, and start of the LDCC Bravo Cooling Loop Project.

ECCCE provided an increase in existing warm water-cooling capability at the SCC, including installation of the major new mechanical and electrical infrastructure using a heat-exchange medium three orders of magnitude more efficient than air as well as the previously installed Trinity computer cooled by warm water circulating at a temperature of approximately 75 degrees. This has opened the door to use of energy-efficient evaporative cooling towers, eliminating the need for less efficient mechanical chillers, and will enable supercomputers like Crossroads to employ warm-water cooling as well.

The SCC Bus-Duct Replacement Project will continue in FY 2021 with electrical distribution system upgrades to increase the power available to supercomputers compared over mechanical cooling.

The SCC CTS-2 Chilled Water Loop Project began in FY 2020. Existing CTS-1 supercomputers at the SCC are air-cooled. The chilled water loop will allow higher efficiency liquid cooling by CTS-2 systems.

The LDCC Bravo Cooling Loop Project will expand liquid cooling systems for to meet the needs of the institutional computing supercomputers planned for the facility.

Plans and Projected Performance

Continuing improvements are planned for FY 2021 to increase HPC data center efficiency, including a new touch-screen dashboard at the SCC with an automated power forecasting pilot using HPC software that will be able to show users how much energy each part of the SCC facility is using at any given time. Power Usage Effectiveness (PUE) calculations will be shown on the display in the SCC lobby to show how LANL is saving energy.

The pilot to automate HPC power forecasting is ambitious. It is expected to produce a power forecast using resource management software commonly called a job scheduler. There are many challenges to overcome but, if successful, would identify new energy efficiency potentials.

The SCC is close to achieving a PUE goal of 1.3, and the new dashboard is expected to show this in FY 2021, while the LDCC is expected to continue the transition to high density

liquid cooled supercomputing. Because of the facility's age and the success of previous investments, no investments in the CCF are planned.

13 Resilience

13.1 Resilience Strategies

LANL's ongoing response to the COVID-19 pandemic demonstrates tried and true ability to adapt quickly and flexibly to novel situations, as previously demonstrated during the Cerro Grande and Las Conchas fires. The key difference with COVID-19 is that the Laboratory has remained open and operating, never closing while constantly pivoting quickly as needed, especially during the early days of the pandemic, When the first cases of COVID-19 in New Mexico were identified on March 11 and New Mexico schools were ordered closed, LANL immediately began encouraging workers to begin teleworking to the extent possible. By April 1, employee data showed that the number of employees working on site had fallen to 1,285 from the 10,864 who had been there three weeks earlier. Meanwhile, within a matter of days, network and telework infrastructure had undergone upgrades—or was in the process of being upgraded—and new computer resources were acquired and distributed to support the demand.

Over the weeks and months that have followed, more resources were allocated to support teleworking. By the end of FY 2020, telework had become established and was fully supported by LANL (including appropriate charging practices) as the default method of performing all LANL work to the extent possible. Even when COVID-19 pressures appeared to be relaxing, a good portion of the LANL workforce continued teleworking.

These successes—from the point of view of work performance, more efficient use of site resources, and reduced demand for energy—have made telework a prime candidate for permanent and widespread use in the conduct of business at LANL after the COVID-19 pandemic ends. It is likely to be especially valuable in freeing up space for new personnel critical to mission expansion in the short and long terms. These factors have led to launch of a telework pilot program in FY 2021 to formally evaluate its feasibility.

The LANL Emergency Operations Support Center (EOSC) has supported the pandemic response by operating a COVID-19 information hotline answered by medical staff; has added COVID-19 testing and analysis capabilities to the drug testing program it operates on site; and has developed and provided training in the use of personal protective equipment (PPE) for Laboratory employees (who are required to complete a COVID-19 questionnaire before entering facilities after return from telework or quarantine.

More broadly, LANL has performed pandemic modeling and provided other COVID-19 expertise to the State of New Mexico, the United States, and the international scientific community.

13.2 Preliminary Findings, Interim Work, Next Steps

To increase resilience to outside forces and events, LANL has made several efforts, including a major modeling study , to better understand how infiltration, run-off, and ground water resources may be affected by climate change impacts on temperature, precipitation, vegetation, and Pajarito Plateau wildfires.

The FY 2020 modeling study was broad with four primary focus areas:

- ParFlow surface/subsurface modeling.
- INFIL modeling.
- Groundwater modeling (had gone dormant).
- Characterization of soil properties for improved modeling accuracy.

A new edition of the Guide to LANL HPSB was published in FY 2020, adding design principles for climate change resiliency to provide guidance and encouragement during design phases through resiliency assessments and related tools. At the facility level, several projects in the design phase in FY 2021 are slated to analyze stormwater runoff and heat-island effects from the point of view of resiliency .

Other groundwater modeling work is planned for FY 2021. With many mission-critical facilities relying on a plentiful supply of water on the Pajarito Plateau, the modeling is designed to develop information vital to decision makers as well as help LANL fulfill its role as a good neighbor to surrounding communities.

Aa climate change vulnerability assessment ;planned for FY 2021 may provide an additional opportunity to integrate climate change preparedness into policies and procedures and day-to-day operations.

With shutdown of San Juan Generating Station planned in FY 2022, LANL may lose one of its largest power generating resources. One response may be to seek alternative financing for the previously mentioned 10 MW photovoltaic system slated for development on 50 acres of Laboratory property, for which preliminary plans have been made and an environmental assessment completed.

14 Appendices

Uploaded Documents

1. Energy Management

   Metering Upload Template_LANL_FY 2020 complete.xlsx

2. Acquisition & Procurement

   Dashboard Workbook _Sustainable Acquisitions Contracts_LANL.xlsxs