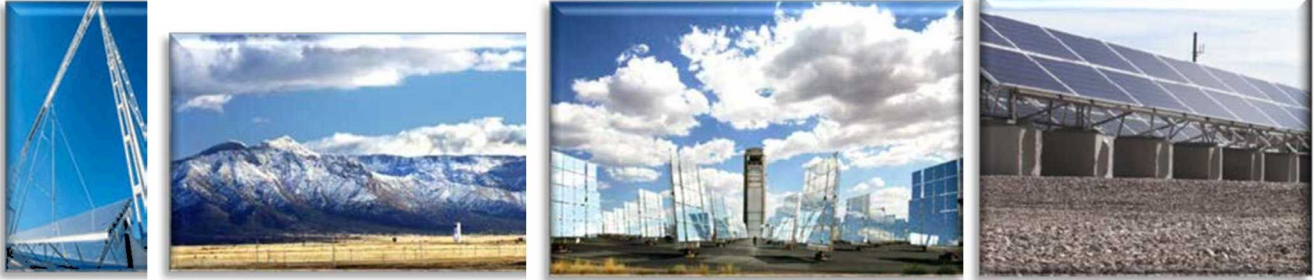


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Fiscal Year 2020 Site Sustainability Plan



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Acronyms and Abbreviations

Acronym	Definition
AFV	alternative fuel vehicle
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
B20	biodiesel (20 percent biobased, 80 percent petroleum)
BAS	building automation system
CFR	Code of Federal Regulations
CO ₂ e	carbon dioxide equivalent
CUB	central utility building
CY	calendar year
DOE	United States Department of Energy
E85	ethanol-based fuel (85 percent ethanol, 15 percent unleaded)
EISA	Energy Independence and Security Act
EMS	Environmental Management System
EO	Executive Order
EPA	United States Environmental Protection Agency
EPEAT	Electronic Product Environmental Assessment Tool
EPP	environmentally preferable purchasing
ES&H	Environment, Safety and Health
ESPC	Energy Savings Performance Contract
FY	fiscal year
GHG	greenhouse gas
GPP	general plant project
HEMSF	High-Energy Mission Support Facility
HERMES	High-Energy Radiation Megavolt Electron Source
HPC	high-performance computing
HPSB	High Performance Sustainable Building
IGPP	institutional general plant project
ISO	International Organization for Standardization
KAFB	Kirtland Air Force Base
KTF	Kauai Test Facility
LED	light-emitting diode
LEED	Leadership in Energy and Environmental Design
LLNL	Lawrence Livermore National Laboratory
MESA	Microsystems and Engineering Sciences Application Complex
M&O	management and operating
NNSA	National Nuclear Security Administration

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Acronym	Definition
NTESS	National Technology & Engineering Solutions of Sandia, LLC
PV	photovoltaic
R&D	research and development
REC	renewable energy credit
Sandia	Sandia National Laboratories
SF6	sulfur hexafluoride
SFO	Sandia Field Office
SME	subject matter expert
SNL	Sandia National Laboratories
SNL/CA	Sandia National Laboratories, California
SNL/KTF	Sandia National Laboratories, Kauai Test Facility
SNL/NM	Sandia National Laboratories, New Mexico
SNL/TTR	Sandia National Laboratories, Tonopah Test Range
SPHINX	Short Pulse Nano Second X-radiator
SSP	Site Sustainability Plan
SSPP	Strategic Sustainability Performance Plan
STAB	Stabilization Facility
TBD	to be determined
TTR	Tonopah Test Range
U.S.	United States
USC	United States Code
YOY	year over year

Units of Measure

Acronym	Definition
%	percent
24/7	twenty-four hours, seven days a week
Btu	British thermal unit
GGE	gasoline gallon equivalent
GSF	gross square feet
K	thousand
kVA	kilo-volt-ampere
kW	kilowatt
M	million
MMBtu	millions of British thermal units
mt	metric ton
mtCO ₂ e	metric tons of CO ₂ equivalent
MW	megawatt
Mwh	megawatt hour
sq ft	square foot
V	volt
W	watt
yr	year

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Executive Summary

Introduction

United States Department of Energy (DOE) O 436.1, *Departmental Sustainability*, requires each DOE site to develop and commit to implementing an annual Site Sustainability Plan (SSP) that identifies that site's contributions toward meeting DOE sustainability goals. These sustainability goals are reinforced by Executive Order (EO) 13834, *Efficient Federal Operations*.

The DOE *Strategic Sustainability Performance Plan* (SSPP) embodies a commitment to increasing sustainability and establishes the foundation for meeting the objectives of EO 13834. The Sandia National Laboratories (hereinafter referred to as Sandia) SSP is prepared annually to support the DOE SSPP and the National Nuclear Security Administration (NNSA) sustainability goals and broader sustainability program. Accordingly, this SSP and its associated DOE Sustainability Dashboard data entries encompass Sandia contributions toward meeting the DOE sustainability goals. This SSP fulfills the contractual requirement for National Technology & Engineering Solutions of Sandia, LLC (NTESS), the management and operating (M&O) contractor for Sandia, to deliver an annual sustainability plan to the DOE/NNSA Sandia Field Office (SFO).

This SSP also serves as the deliverable to address the following DOE reporting requirements:

- DOE Annual Energy Report, as required by the National Energy Conservation Policy Act, Energy Policy Act of 2005, and the Energy Independence and Security Act (EISA) of 2007
- Section 432 of EISA 2007, which requires reporting of energy and water conservation measures that are identified in site audits

Site Information, Description, and Operations

Sandia personnel conduct mission activities at four primary locations: Sandia National Laboratories/New Mexico (SNL/NM); SNL/California (SNL/CA), SNL/ Tonopah Test Range (SNL/TTR) in Nevada; and SNL/Kauai Test Facility (SNL/KTF) in Hawaii. Sandia personnel also conduct mission activities at other locations, Carlsbad, New Mexico; and Amarillo, Texas. Each location has unique energy, water, and transportation fuel resource management challenges. SNL/NM and SNL/CA account for most of Sandia's total energy, water, and transportation fuel use and building square footage. Therefore, although the goals and targets of this plan include all locations, sustainability activities focus predominantly on the SNL/NM and SNL/CA locations.

Sandia National Laboratories, New Mexico

SNL/NM is located on Kirtland Air Force Base (KAFB) at the base of the Manzano Mountains, adjacent to Albuquerque, New Mexico. The location has approximately 6.54 million gross square feet (GSF) of existing facilities on 13,761 acres. Sandia purchases electricity, natural gas, and water from external utility suppliers through an interagency support agreement with KAFB. The sanitary sewer connects to the City of Albuquerque system. Sandia purchases liquid petroleum gas and fuel oil independently from KAFB.

Sandia National Laboratories, California

SNL/CA is located three miles east of downtown Livermore and 40 miles east of San Francisco, California. The location has approximately 905,363 GSF of existing facilities on 410 acres. It is adjacent to Lawrence Livermore National Laboratory (LLNL), with residential areas to the west, industrial parks to the north, and agricultural lands to the east and south. Electricity, natural gas, sewer, and water are metered and billed by LLNL, which has contracts with outside agencies and municipalities. The sanitary sewer connects to the City of Livermore system after passing through the LLNL sewer system. SNL/CA maintains a separate Wastewater Discharge permit with the City of Livermore.

Sandia National Laboratories, Tonopah Test Range

The Tonopah Test Range is a full-scale test range and outdoor laboratory located north of Las Vegas, Nevada, on Nellis Air Force Base. The location is used to develop, validate, and certify NNSA-designed weapon systems and components. It has approximately 111,815 GSF of existing facilities on 179,200 acres. Electricity, liquid petroleum gas, sewer, and water are metered and billed independently of Nellis Air Force Base.

Sandia National Laboratories, Kauai Test Facility

SNL/KTF is a rocket-launch range at the north end of the Pacific Missile Range Facility on the island of Kauai. The range consists mainly of rocket- and payload-assembly facilities and a launch operations facility. The location has approximately 49,059 GSF of existing facilities on 133 acres.

Vision Statement and Sustainability Definition

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

For Sandia, sustainability means making balanced environmental, social, and economic decisions about developing, operating, and maintaining its sites to meet the human and mission needs of the present without compromising future generations. Management recognizes that the Laboratories are part of a larger community; the impacts of sustainable development on its sites extend beyond the physical boundaries. To that end, Sandia management is actively engaged in finding and implementing innovative sustainable solutions for its sites and the nation.

Best Management Practices

The following best management practices will continue to be implemented to achieve Sandia goals:

- Use every opportunity to improve resource effectiveness on projects, operations, and activities. Implement sustainable options.
- Pursue non-carbon-emitting renewable energy sources as they become more cost effective.
- Support research and development (R&D) efforts by using Sandia locations as test beds for new alternative and renewable technologies.

- Learn from and share best management practices with other institutions; incorporate innovative resource management techniques.
- Integrate efficient and sustainable resource strategies into all planning; building location; design; construction; operations; infrastructure; and Environment, Safety, and Health (ES&H) activities.
- Enable and encourage the workforce to reduce resource use and waste generation to meet the corporate goal of Zero Waste by 2025.
- Use the International Organization for Standardization (ISO) 14001:2015 certified Environmental Management System (EMS) aspects and impacts evaluation process to facilitate identification of objectives relevant to energy, water, and materials sustainability measures, activities, and actions.

DOE Strategic Sustainability Performance Plan and NNSA Goals

The Sandia commitment to sustainability goes beyond DOE SSPP and NNSA-mandated goals. Internal goals and initiatives are supported by upper-level management, as evidenced by the following:

- Dedicated energy and sustainability personnel in Facilities and ES&H organizations
- Sustained investment for energy activities
- Reinvestment of non-budget recycling revenue for actions and activities supporting the Zero Waste goal

Table E-1 summarizes the performance status and projected performance in support of DOE goals.

Table E-1. Performance status and projected performance

DOE Goal	Current Performance Status	Two-Year Performance and Plans	Five-Year Performance and Plans	Ten-Year Performance and Plans
Energy Management				
30% energy intensity (Btu per gross square foot) reduction in goal-subject buildings by FY 2015 from a FY 2003 baseline and a 1.0% YOY thereafter.	Energy intensity increased by 3.7% in FY 2019 from FY 2018.	Develop DOE 50001 Ready Program that establishes an energy management system to reduce and sustain energy reductions. Pursue ESPCs to achieve energy reductions. Develop a DOE Smart Labs plan to achieve energy reduction in labs. Develop a plan to upgrade BAS and metering systems to support implementation of analytics and continuous commissioning.	Implement DOE 50001 Ready Program to reduce and sustain energy reductions. Implement an ESPC project to achieve reductions in energy use. Implement a DOE Smart Labs plan to achieve energy reduction in labs. Implement a plan to upgrade BAS and metering systems to support implementation of analytics and continuous commissioning.	Implement DOE 50001 Ready Program to reduce and sustain energy reductions. Implement an ESPC project to achieve reductions in energy use. Implement a DOE Smart Labs plan to achieve energy reduction in labs. Implement a plan to upgrade BAS and metering systems to support implementation of analytics and continuous commissioning.
EISA Section 432 continuous (4-year	Completed 75% of required EISA Section 432 energy	Complete 100% of required EISA Section	Continue to meet EISA Section 432 energy and water audit requirements.	Continue to meet EISA Section 432 energy and water audit requirements.

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DOE Goal	Current Performance Status	Two-Year Performance and Plans	Five-Year Performance and Plans	Ten-Year Performance and Plans
cycle) energy and water evaluations.	and water audits in FY 2019 and met goal.	432 energy and water audits in FY 2020		
Meter all individual buildings for electricity, natural gas, steam, and water, where cost-effective and appropriate.	Not meeting goal. Started a draft Metering Life Cycle Plan in FY 2019 to address metering needs and sustainment of meters to meet federal requirements, guidance, and goals.	Complete a draft of a Metering Life Cycle Plan to address metering needs and sustainment of meters to meet federal requirements, guidance, and goals.	Implement a Metering Life Cycle Plan to meet federal metering requirements, guidance, and goals.	Implement a Metering Life Cycle Plan to meet federal metering requirements, guidance, and goals.
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.	Achieved 25.1% reduction in FY 2019 relative to FY 2007 baseline.	Continue to meet 0.5% YOY reduction target.	Continue to meet 0.5% YOY reduction target.	Continue to meet 0.5% YOY reduction target.
Non-potable freshwater consumption (Gal) reduction of industrial, landscaping, and agricultural (ILA). YOY reduction; no set target.	Data combined with potable water (see previous row).	Data combined with potable water (see previous row).	Data combined with potable water (see previous row).	Data combined with potable water (see previous row).
Waste Management				
Reduce at least 50% of nonhazardous solid waste, excluding construction and demolition debris, sent to treatment and disposal facilities.	Diverted 61% of waste at SNL/NM. Diverted 79.6% of waste at SNL/CA.	Divert 75% of waste at SNL/NM by implementing campus-wide composting. SNL/CA will continue to seek new materials to divert and improve existing processes.	Divert 75%–90% of waste at SNL/NM by building a materials recycling facility with automation. SNL/CA will continue to seek new materials to divert and improve existing processes.	Divert 85%–95% of waste at SNL/NM through process improvement, training and technology. SNL/CA will continue to seek new materials to divert and improve existing processes.
Reduce construction and demolition materials and debris sent to treatment and disposal facilities. YOY reduction; no set target.	Reduced debris by 23% through diversion at SNL/NM. Ending FY 2019: SNL/CA – 87.0% At SNL/CA, local regulations require diverting 90% of easily recycled recyclables and compostables by 2020.	Reduce debris by 20%–90% at SNL/NM if concrete and asphalt processing is funded. At SNL/CA, local regulations require diverting 90% of easily recycled recyclables and compostables by 2020. Continue to seek new materials to divert and improve existing processes.	Reduce debris by 20%–90% at SNL/NM if concrete and asphalt processing is funded. At SNL/CA, local regulations require diverting 90% of easily recycled recyclables and compostables by 2020. Continue to seek new materials to divert and improve existing processes.	Reduce debris by 20%–90% at SNL/NM if concrete and asphalt processing is funded. At SNL/CA, local regulations require diverting 90% of easily recycled recyclables and compostables by 2020. Continue to seek new materials to divert and improve existing processes.

DOE Goal	Current Performance Status	Two-Year Performance and Plans	Five-Year Performance and Plans	Ten-Year Performance and Plans
Fleet Management				
20% reduction in annual petroleum consumption by FY 2015 relative to a FY 2005 baseline and 2.0 % YOY thereafter.		Will continue to encourage use of alternative fuel and driving behavior to reduce fuel use.	Will continue to encourage use of alternative fuel and driving behavior to reduce fuel use.	Will continue to encourage use of alternative fuel and driving behavior to reduce fuel use.
10% increase in annual alternative fuel consumption by FY 2015 relative to a FY 2005 baseline; maintain 10% increase thereafter.		Will continue to encourage use of alternative fuel and driving behavior to reduce fuel use.	Will continue to encourage use of alternative fuel and driving behavior to reduce fuel use.	Will continue to encourage use of alternative fuel and driving behavior to reduce fuel use.
75% of light duty vehicle acquisitions must consist of alternative fuel vehicles (AFV).		Goal will be met in future years. Fleet Services always acquires alternative fuel vehicle when available.	Goal will be met in future years. Fleet Services always acquires alternative fuel vehicle when available.	Goal will be met in future years. Fleet Services always acquires alternative fuel vehicle when available.
Clean and 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.	SNL locations exceeded this goal using RECs and implementing small RE projects. In FY 2019 REC purchases accounted for 15% of total SNL electric consumption. In addition, SNL/CA receives an approximate 7% share (or 436 MWh) of electricity generated annually by the LLNL onsite solar power production facility.	NTESS will continue to purchase RECs to meet this requirement. NTESS will also pursue opportunities for a PPA/ESPC/UESC to obtain onsite renewable energy, based on economic viability. SNL/CA will continue to receive approximately 7% of the electricity generated by the LLNL solar power production facility.	NTESS will continue to purchase RECs to meet this requirement. NTESS will also pursue opportunities for a PPA/ESPC/UESC to obtain onsite renewable energy, based on economic viability. SNL/CA will continue to receive approximately 7% of the electricity generated by the LLNL solar power production facility.	NTESS will continue to purchase RECs to meet this requirement. NTESS will also pursue opportunities for a PPA/ESPC/UESC to obtain onsite renewable energy, based on economic viability. SNL/CA will continue to receive approximately 7% of the electricity generated by the LLNL solar power production facility.
Continue to increase nonelectric thermal usage. YOY increase; no set target but an indicator in the OMB scorecard.	SNL consumes approximately 445 MMBtus of thermal energy annually. Solar hot water systems are evaluated for new building construction projects.	SNL consumes approximately 445 MMBtus of thermal energy annually. Solar hot water systems are evaluated for new building construction projects.	SNL consumes approximately 445 MMBtus of thermal energy annually. Solar hot water systems are evaluated for new building construction projects.	SNL consumes approximately 445 MMBtus of thermal energy annually. Solar hot water systems are evaluated for new building construction projects.
Green Buildings				
At least 15% (by count) of owned existing buildings to be compliant with the revised <i>Guiding Principles</i> for HPSB by FY 2020, with	Achieved compliance with the <i>Guiding Principles</i> at 18.4% of buildings.	Achieve compliance with the <i>Guiding Principles</i> at an additional 1% of buildings.	Achieve compliance with the <i>Guiding Principles</i> at an additional 1% per of buildings.	Achieve compliance with the <i>Guiding Principles</i> at an additional 1% of buildings.

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DOE Goal	Current Performance Status	Two-Year Performance and Plans	Five-Year Performance and Plans	Ten-Year Performance and Plans
annual progress thereafter.				
Net Zero Buildings: All new buildings (> 5,000 GSF) entering the planning process designed to achieve energy net-zero beginning in FY 2020.	Currently, Building 848 is working toward achieving net zero energy this FY. It is under 5,000 GSF, so it will not meet the goal of the previous executive order.	No plans to achieve net zero energy or water for additional existing buildings. Until it is a mandate, it is difficult to justify.	No plans to achieve net zero energy or water for additional existing buildings. Until it is a mandate, it is difficult to justify.	No plans to achieve net zero energy or water for additional existing buildings. Until it is a mandate, it is difficult to justify.
Increase regional and local planning coordination and involvement.	Maintained coordination with local and regional planning organizations regarding land use, transportation, and zoning issues that affect Sandia campuses.	Maintain coordination with local and regional planning organizations regarding land use, transportation, and zoning issues that affect Sandia campuses.	Maintain coordination with local and regional planning organizations regarding land use, transportation, and zoning issues that affect Sandia campuses.	Maintain coordination with local and regional planning organizations regarding land use, transportation, and zoning issues that affect Sandia campuses.
Acquisition & Procurement				
Promote sustainable acquisition and procurement to the maximum extent practicable, ensuring BioPreferred and biobased provisions and clauses are included in all applicable contracts.	Efforts are underway to improve the promotion of sustainable acquisition and procurement, including establishing a process to ensure that BioPreferred and biobased provisions and clauses are included in 95% of applicable contracts and to ensure that mechanisms are in place that would allow staff to review new contracts, properly track purchases of BioPreferred and biobased items, and ensure collected data will be analyzed and reported appropriately.	Efforts are underway to improve the promotion of sustainable acquisition and procurement, including establishing a process to ensure that BioPreferred and biobased provisions and clauses are included in 95% of applicable contracts and to ensure that mechanisms are in place that would allow staff to review new contracts, properly track purchases of BioPreferred and biobased items, and ensure collected data will be analyzed and reported appropriately.	Efforts are underway to improve the promotion of sustainable acquisition and procurement, including establishing a process to ensure that BioPreferred and biobased provisions and clauses are included in 95% of applicable contracts and to ensure that mechanisms are in place that would allow staff to review new contracts, properly track purchases of BioPreferred and biobased items, and ensure collected data will be analyzed and reported appropriately.	Efforts are underway to improve the promotion of sustainable acquisition and procurement, including establishing a process to ensure that BioPreferred and biobased provisions and clauses are included in 95% of applicable contracts and to ensure that mechanisms are in place that would allow staff to review new contracts, properly track purchases of BioPreferred and biobased items, and ensure collected data will be analyzed and reported appropriately.
Measures, Funding, & Training				
Annual targets for sustainability investment with appropriated funds and/or financed	There were no appropriated funds or ESPCs for FY 2019.	Continue to work with NNSA to pursue and ESPCs in FY 2020.	Not yet developed.	Not yet developed.

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DOE Goal	Current Performance Status	Two-Year Performance and Plans	Five-Year Performance and Plans	Ten-Year Performance and Plans
contracts to be implemented in FY 2019 and annually thereafter.				
Electronic Stewardship				
Purchases: 95% of eligible acquisitions each year are EPEAT-registered products.	Waived compliance for FY 2019 was 98.3%.	Maintain current process.	Maintain current process	Maintain current process
Power management: 100% of eligible PCs, laptops, and monitors have power management enabled.	100% of eligible machines have power management enabled.	Continue to implement and monitor power management program.	Continue to implement and monitor power management program.	Continue to implement and monitor power management program.
Automatic duplexing: 100% of eligible computers and imaging equipment have automatic duplexing enabled.	84.8% of printers are set up for automatic duplexing. The remaining printers are offline and are not being used.	Maintain current process.	Maintain current process.	Maintain current process.
End of Life: 100% of used electronics are reused or recycled using environmentally sound disposition options each year.	100% of used electronics were reused or recycled.	Maintain existing system and seek ways to improve reuse and refurbishment opportunities.	Maintain existing system and seek ways to improve reuse and refurbishment opportunities.	Maintain existing system and seek ways to improve reuse and refurbishment opportunities.
Data Center Efficiency: Establish a power usage effectiveness target for new and existing data centers; discuss efforts to meet targets.	Power usage effectiveness target has not been established. Continue to improve cooling equipment operation and power efficiencies in all data centers.	Continue to improve cooling equipment operation and power efficiencies in all data centers.	Continue to improve cooling equipment operation and power efficiencies in all data centers.	Continue to improve cooling equipment operation and power efficiencies in all data centers.
Organizational Resilience				
Discuss overall integration of climate resilience in emergency response, workforce, and operations procedures and protocols.	The Climate Vulnerability Assessment is in progress and will be integrated into future emergency response operations and building plans.	The Climate Vulnerability Assessment is in progress and will be integrated into future emergency response operations and building plans.	The Climate Vulnerability Assessment is in progress and will be integrated into future emergency response operations and building plans.	The Climate Vulnerability Assessment is in progress and will be integrated into future emergency response operations and building plans.
Multiple Categories				
YOY scope 1 & 2 GHG emissions reduction from a FY 2008 baseline.		Continue to improve management of SF6 and facility energy consumption.	Continue to improve management of SF6 and facility energy consumption.	Continue to improve management of SF6 and facility energy consumption.

DOE Goal	Current Performance Status	Two-Year Performance and Plans	Five-Year Performance and Plans	Ten-Year Performance and Plans
YOY scope 3 GHG emissions reduction from a FY 2008 baseline.		Continue to promote alternative commuting options and expand participation in the Commuter Profile.	Continue to promote alternative commuting options and expand participation in the Commuter Profile.	Continue to promote alternative commuting options and expand participation in the Commuter Profile.

AFV = alternative fuel vehicle
 BAS = building automation system
 ESPC = Energy Savings Performance Contract
 GHG = greenhouse gas
 HPSB = High Performance and Sustainable Buildings
 REC = renewable energy credit
 SME = subject matter expert
 YOY = year over year

Mission Change

Sandia National Laboratories develops advanced technologies to ensure global peace. This strategic direction will continue to be advanced over the next two to three decades. Given the increasing rapidity of global events, such a long-range view is essential in order to avoid technological surprises and ensure that the United States is prepared to meet future threats.

For the foreseeable future, the national demands for Sandia’s technologies and services are expected to be high. In FY 2019 alone, the workforce was increased by about 1,900 persons (totaling 14,100 as of September 2019) to meet national demands.

The nation is asking Sandia personnel to reduce the nuclear deterrence development cycle. This will be accomplished by additional sounding rocket R&D flights at SNL/KTF as well as by increases in advanced computational modeling, rapid prototyping, additive manufacturing, and advances in microelectronics. To support national security, Sandia expects growth in delivering advanced pathfinder systems, predictive analytics, and model validation through physical experimentation.

Engineering, science, and technology capabilities are ready to support Sandia’s diverse mission set. Advanced Science and Engineering R&D personnel will develop advancements in key areas, such as hypersonics, synthetic aperture radar, unattended remote sensing, cybersecurity, space systems, critical infrastructures, additive manufacturing, microsystems, and advanced computing.

Effectively managing future demand is critical if Sandia is to meet its goals. Should the mission grow or change over the planning period, there is likely to be associated growth in energy and water use. Planning for mission change before it occurs and managing change during program implementation will increase the probability of sustainability success.

1.0 Energy Management

Energy management focuses on all energy-related topics, such as energy intensity, EISA Section 432 benchmarking, facility metering, and non-fleet fuel use.

1.1 Energy Usage and Intensity

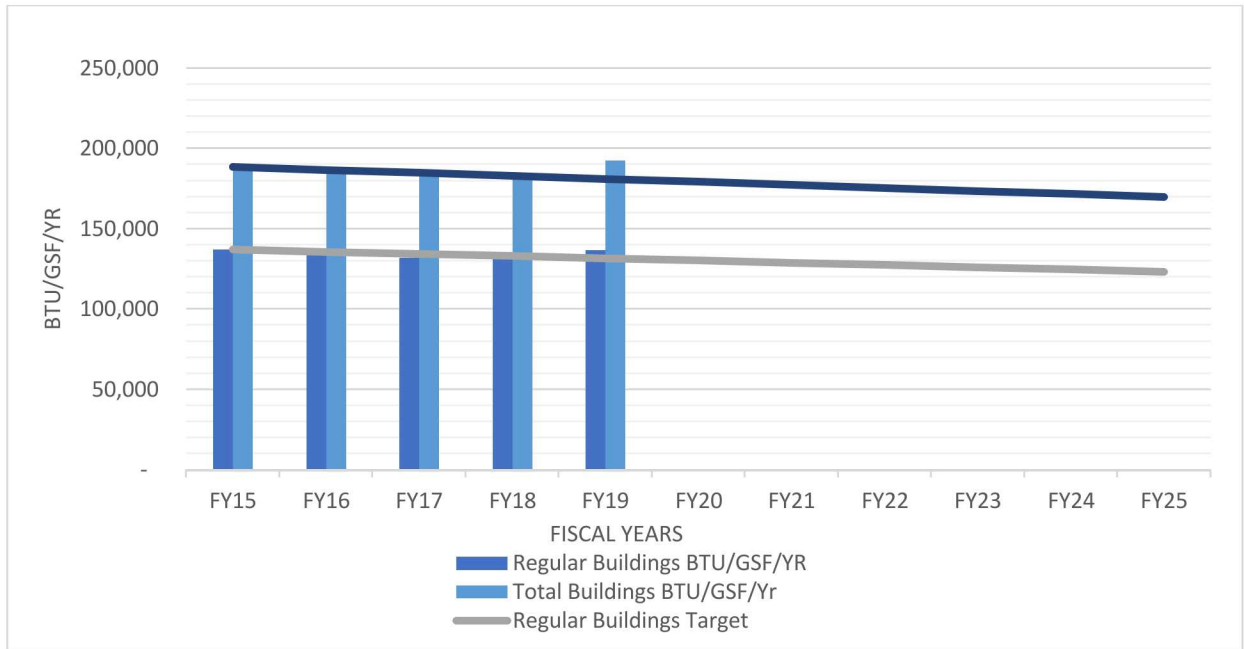
1.1.1 Performance Status

Sandia management continues to pursue initiatives, projects, and actions to increase energy savings in FY 2019 and beyond. Facilities and infrastructure projects that reduce deferred maintenance are being leveraged to increase energy efficiency. SkySpark energy analytics software is used to measure and manage energy in buildings. This tool can automatically detect issues with building systems and can identify opportunities for operational improvements. The tool can also calculate key performance indicators, perform weather normalization for analyzing energy use, perform measurement and verification, and perform continuous commissioning. The analytics tool currently collects data from the BAS, weather stations, and building meters at seven buildings at SNL/NM and four buildings at SNL/CA. Only information from buildings that are equipped with meters to collect and transfer data is integrated into SkySpark analytics. Information from buildings that are not metered or whose meters cannot collect and transfer data is not integrated into SkySpark. The Facilities Metering Plan will address those metering needs.

Setbacks are an important tool for achieving energy savings. The temperature in offices is set back to a 55°F heating set point and a 90°F cooling set point during unoccupied hours. Setbacks will continue to be applied in the future.

In FY 2019, Sandia personnel, in collaboration with one of the organizations identified as a Sandia technical partner and a team from the Federal Energy Management Program, drafted a Notice of Opportunity to pursue an ESPC in FY 2020. Sandia management is currently working with NNSA to obtain contracting support for this initiative. The Notice of Opportunity identified high-priority energy conservation measures, which include a BAS upgrade, advanced energy metering, automated diagnostics and analytics, chilled and hot water plant upgrades, heating ventilation and air conditioning upgrades, lighting improvements, and renewable energy improvements. An ESPC will help Sandia achieve its energy reduction goals.

Figure 1-1 shows building energy intensity for FY 2015 through FF 2025, and Figure 1-2 and Figure 1-3 show energy usage progress and forecast progress from FY 2003 through FY 2029 for goal subject and excluded buildings.



Note: Building energy intensity was rebaselined in 2015 and the excluded building list was updated; therefore, the baseline is different from 2003. The target is a 1 percent decrease per year from the 2015 baseline.

Figure 1-1. Building energy intensity

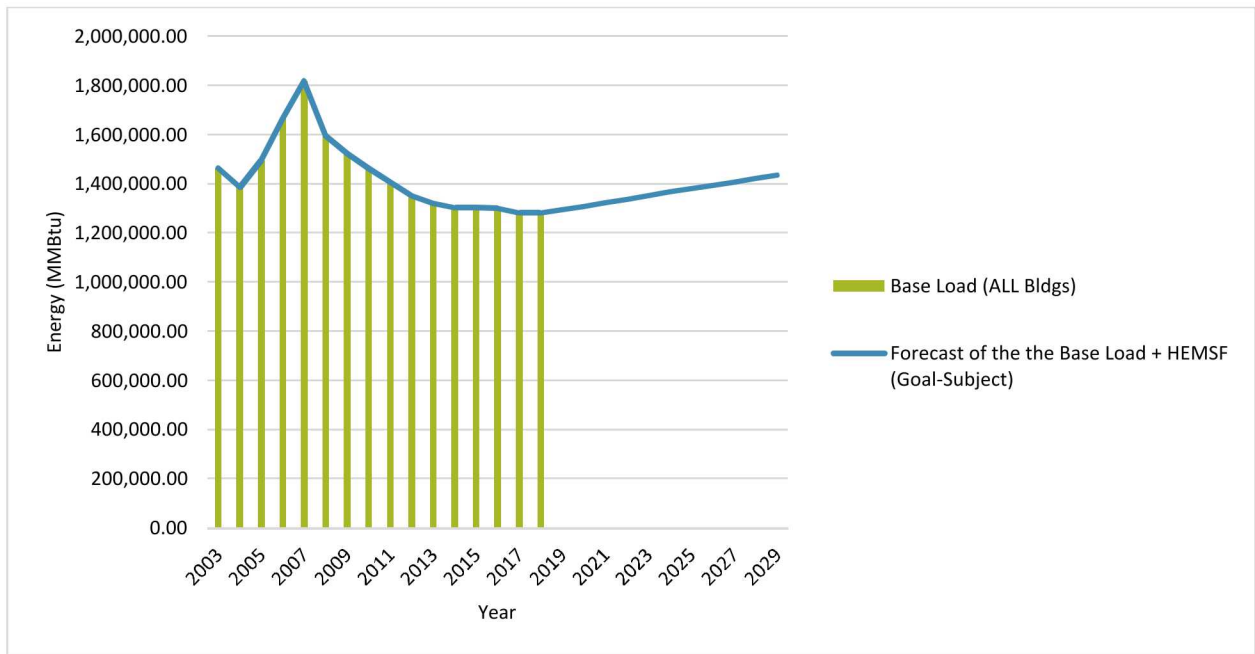


Figure 1-2. Energy usage progress and forecast progress goal subject buildings at SNL/NM and SNL/CA, FY 2003–FY 2029

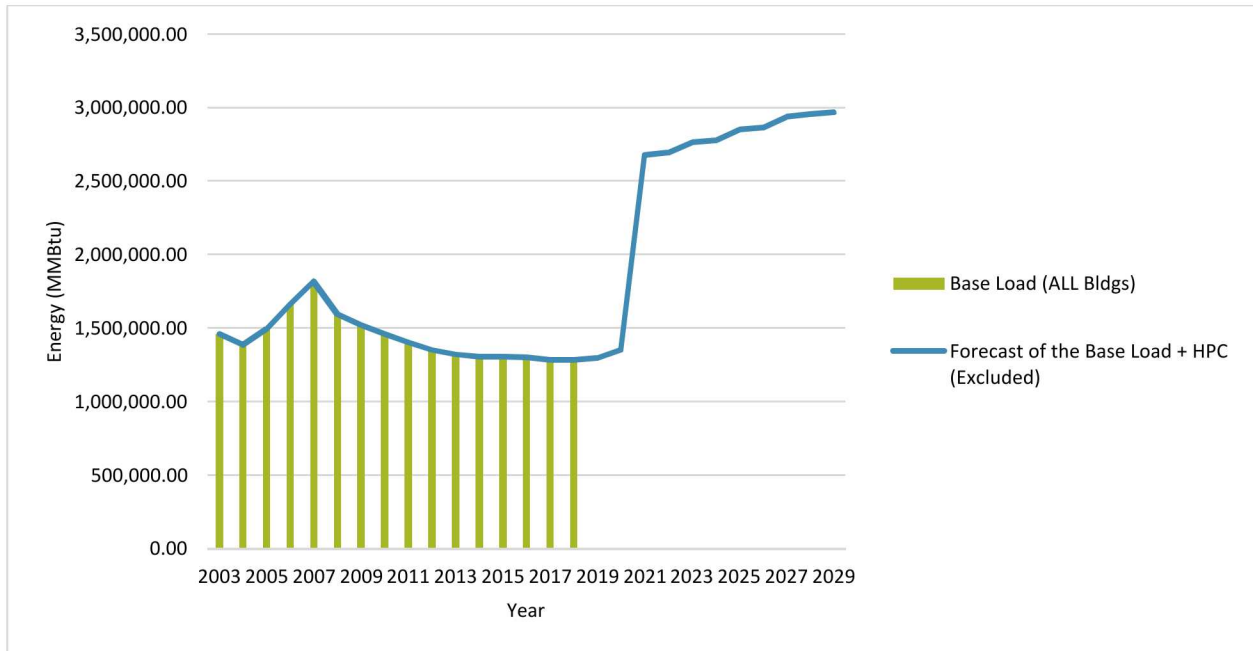


Figure 1-3. Energy usage progress and forecast progress excluded buildings at SNL/NM and SNL/CA, FY 2003–FY 2029

Despite efforts to increase energy savings, extenuating factors affect performance regarding the energy intensity reductions and increases reported in FY 2019, and multiple factors may have foreseeable impacts in the upcoming 10 years.

Energy intensity performance increased by 3.7 percent from 131,784 Btu/GSF/yr in FY 2018 to 136,669 Btu/GSF/yr in FY 2019. This was due to both (1) an increase in staffing on-site and (2) cold weather from late December 2018 to early January 2019 that prompted building operations to run 24/7 to prevent freezing conditions in buildings. Furthermore, due to limited funding, energy conservation measures have not been pursued on a larger scale to reduce this energy intensity.

Energy intensity goals are measured from an FY 2015 baseline instead of the FY 2003 baseline. The excluded building list was updated in FY 2015, and the energy intensity was re-baselined at that time. The FY 2015 baseline is shown in Figure 1-1. The FY 2003 baseline is not shown because that excluded building list does not match the current excluded building list developed in FY 2015.

The energy intensity reduction goal for FY 2020 through FY 2025 will be challenging to achieve. The goal to reduce energy intensity 30 percent from an FY 2003 baseline was achieved in FY 2015, in part by implementing many of the large energy conservation measures with short payback periods. Going forward, low utility rates will make it challenging to fund future energy conservation measures with longer paybacks. An ESPC will be pursued as an option to reduce energy intensity through energy conservation measures that can be financed over a 25-year period with no upfront capital.

Additional potential energy saving initiatives have not been pursued. For example, there is no plan to use energy management tools such as remote building energy performance assessment auditing technology or a Green Button data access system. There is no energy demand charge and no

incentive to participate in energy demand management programs, with no plan to pursue them. However, FAC002, *Space Management Policy*, directs management and optimization of building space and plans. Life cycle cost analysis is not being used to prioritize efficiency measures.

1.1.2 Plans and Projected Performance

A strategy to improve energy performance in buildings in the future is to continue to expand SkySpark analytics for buildings at SNL/NM and SNL/CA sites. This effort is on hold at this time and cannot be applied to more buildings due to the need for a BAS upgrade. The BAS tool has reached its capacity for collecting and transferring trend data to SkyPark. A BAS upgrade plan is being developed to increase the tool’s capacity along with an upgrade to an Ethernet platform to increase data throughput. There is no committed funding to upgrade the BAS at this time, and requests for project funding have been submitted to the NNSA G2 project database.

There are no significant planned facility dispositions that would impact energy intensity. Figure 1-4 through Figure 1-8 and Table 1-1 show projected increases in energy use and energy intensity through FY 2029.

The DOE Smart Labs initiative was explored in FY 2019, and Sandia personnel will be attending Smart Labs workshops in FY 2020. A plan will be developed for a pilot Smart Labs project in FY 2020. In addition, there is a plan to join the DOE 50001 Ready Program and begin using the DOE online tool in FY 2020. This tool guides organizations through the 25 tasks in the program.

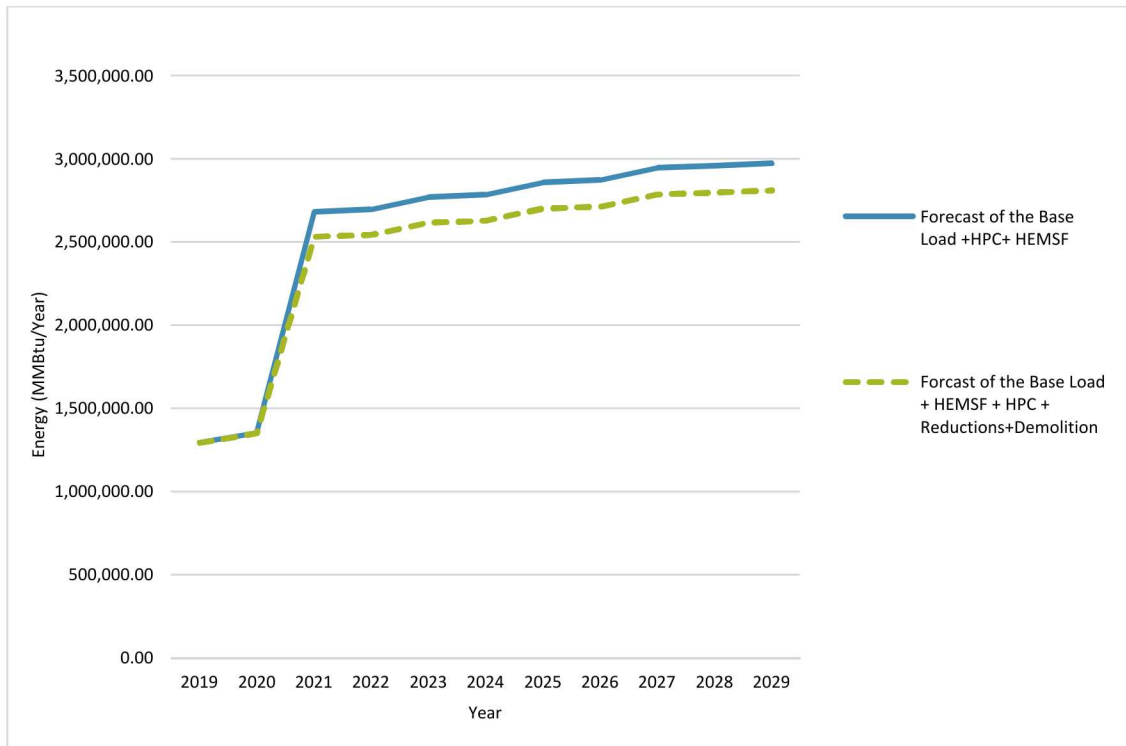


Figure 1-4. Projected changes in energy demand at SNL/NM and SNL/CA, FY 2019–FY 2029

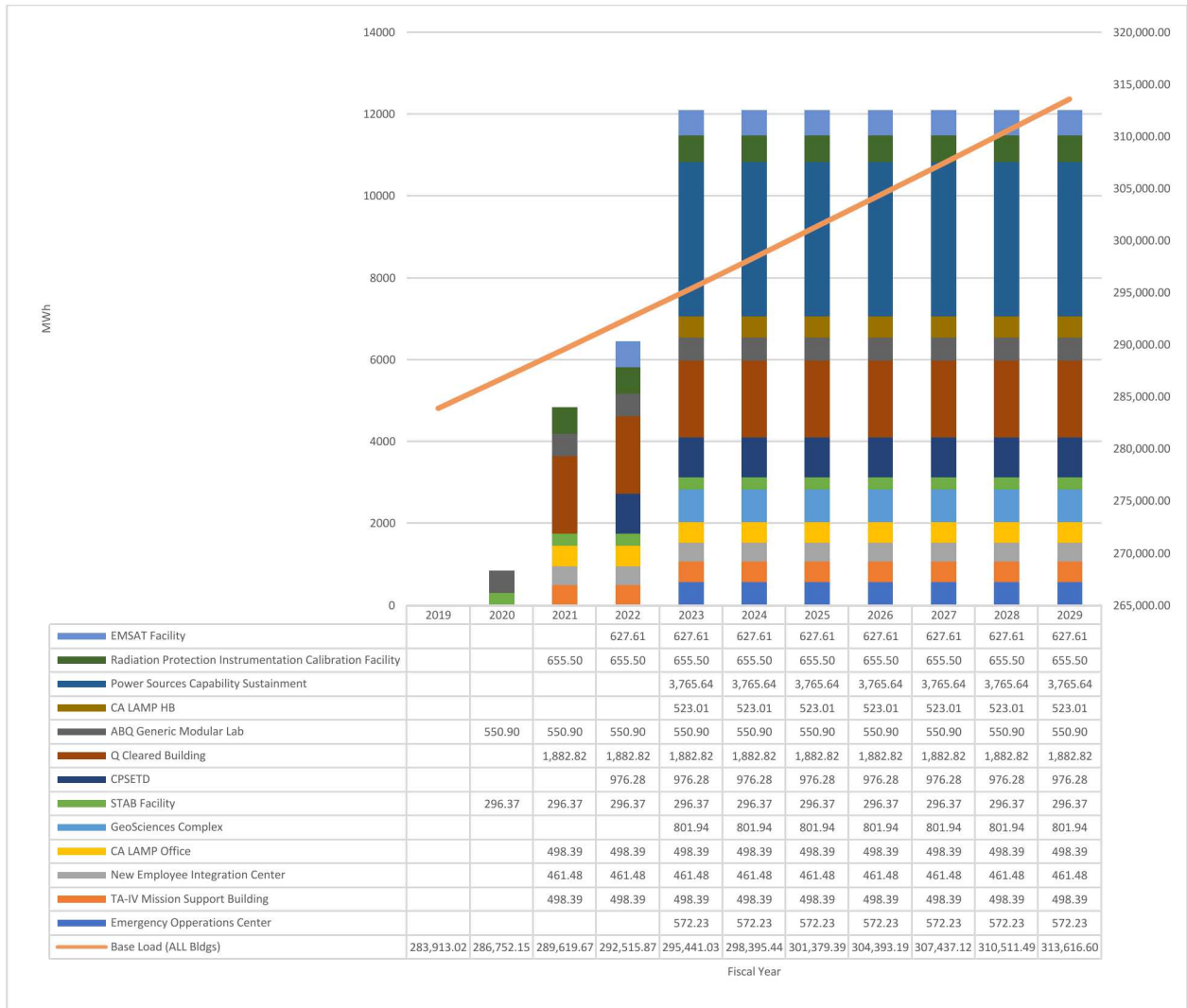


Figure 1-5. Electrical energy usage actual and projected HEMSF at SNL/NM and SNL/CA, FY 2019–FY 2029

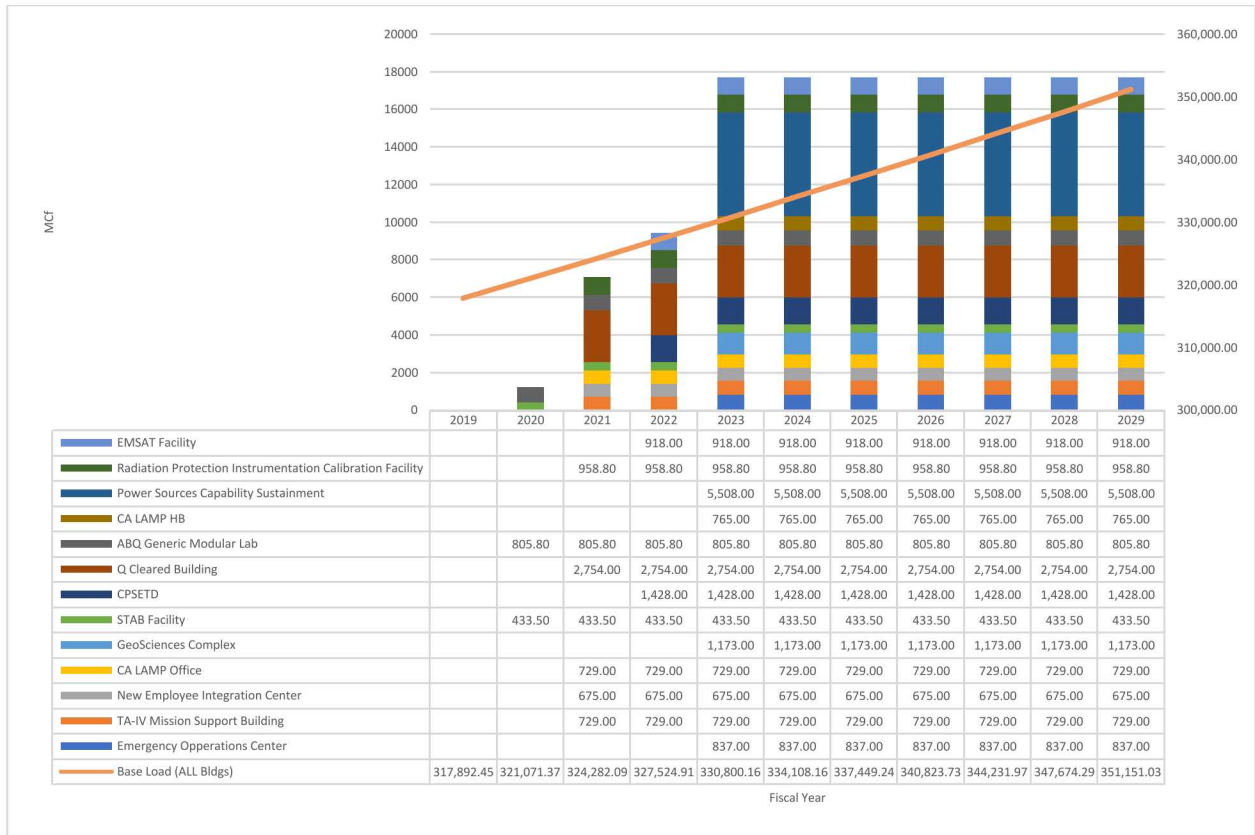


Figure 1-6. Natural gas energy usage actual and projected HEMSF at SNL/NM and SNL/CA, FY 2019–FY 2029

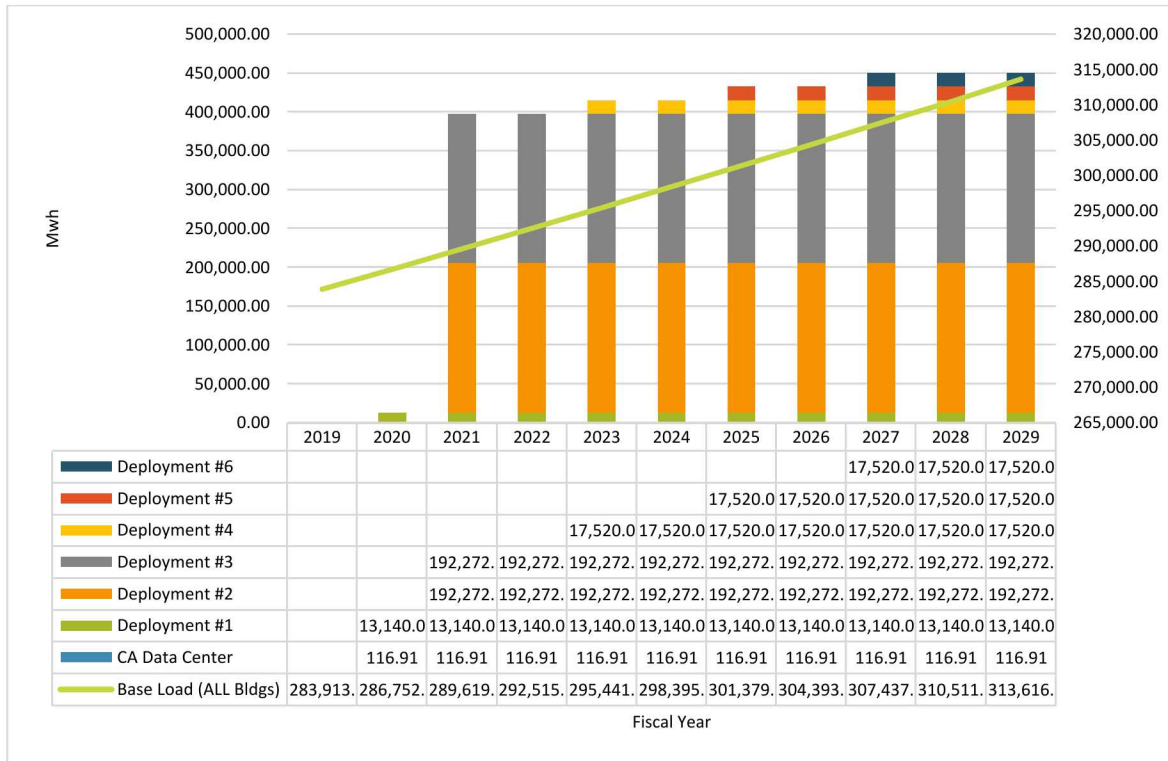


Figure 1-7. Electrical energy use actual and projected, high-performance computing at SNL/NM and SNL/CA, FY 2019–FY 2029

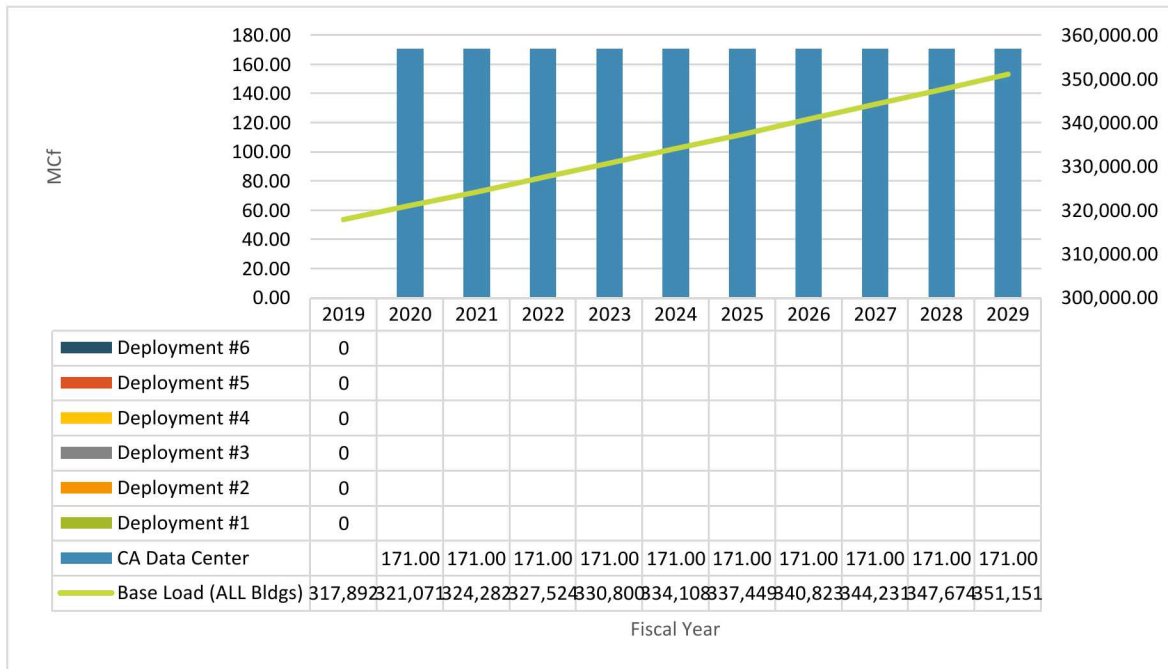


Figure 1-8. Natural gas energy use actual and projected, high-performance computing at SNL/NM and SNL/CA, FY 2019–FY 2029

Table 1-1. Projected changes in energy demand at SNL/NM and SNL/CA, FY 2019–FY 2029

Measure (MMBtu)	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Total base consumption	1,294,868.48	1,307,817.16	1,320,895.34	1,334,104.29	1,347,445.33	1,360,919.79	1,374,528.98	1,388,274.27	1,402,157.02	1,416,178.59	1,430,340.37
HEMSF per demand growth components	0.00	4,131.00	23,617.00	31,437.00	59,047.00	59,047.00	59,047.00	59,047.00	59,047.00	59,047.00	59,047.00
HPC per demand growth components	0.00	45,403.68	1,357,467.81	1,357,467.81	1,417,246.05	1,417,246.05	1,477,024.29	1,477,024.29	1,536,802.53	1,536,802.53	1,536,802.53
Energy efficiencies	0.00	0.00	-148,227.34	-149,709.62	-151,206.71	-152,718.78	-154,245.97	-155,788.43	-157,346.31	-158,919.78	-160,508.97
TOTALS	1,294,868.48	1,357,351.84	2,553,752.80	2,573,299.48	2,672,531.67	2,684,494.05	2,756,354.30	2,768,557.13	2,840,660.23	2,853,108.34	2,865,680.93
HEMSF per demand growth components	Facility #1				Est. 2,790 MMBtu and 31,000 sq ft						
	Facility #2			Est. 2,430 MMBtu and 27,000 sq ft							
	Facility #3			Est. 2,250 MMBtu and 25,000 sq ft							
	Facility #4			Est. 2,430 MMBtu and 27,000 sq ft							
	Facility #5					Est. 3,910 MMBtu and 23,000 sq ft					
	Facility #6		Est. 1,445 MMBtu and 8,500 sq ft								
	Facility #7				Est. 4,760 MMBtu and 28,000 sq ft						
	Facility #8			Est. 9,180 MMBtu and 54,000 sq ft							
	Facility #9		Est. 2,686 MMBtu and 15,800 sq ft								
	Facility #10					Est. 2,550 MMBtu and 15,000 sq ft					

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Measure (MMBtu)		2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
	Facility #11					Est. 18,360 MMBtu and 108,000 sq ft						
	Facility #12			Est. 3,196 MMBtu and 18,800 sq ft								
	Facility #13				Est. 3,060 MMBtu and 18,000 sq ft							
HPC per demand growth components	Facility #14		Est. 5,700 MMBtu and 9,500 sq ft									
	Deployment #1		Est. 44,833.68 MMBtu									
	Deployment #2			Est. 656,032.064 MMBtu								
	Deployment #3			Est. 656,032.064 MMBtu								
	Deployment #4					Est. 59,778.24 MMBtu						
	Deployment #5							Est. 59,778.24 MMBtu				
	Deployment #6									Est. 59,778.24 MMBtu		
Energy Efficiencies				ESPC	ESPC	ESPC	ESPC	ESPC	ESPC	ESPC	ESPC	ESPC

HPC = high-performance computing

1.2 EISA Section 432, Benchmarking and Evaluations

1.2.1 Performance Status

EISA Section 432 requires DOE to complete energy and water evaluations (audits) on its covered facilities every four years. EISA defines covered facilities as those facilities using at least 75 percent of an organization's total energy use. July 2018 marked the end of the third year in the current four-year cycle. Sandia personnel completed the required EISA Section 432 energy audits (cumulative FY 2017–FY 2020) for covered facilities on schedule.

Sandia personnel developed a comprehensive process for performing building-level energy and water audits. This process is equivalent to the American Society of Heating and Air-Conditioning Engineers (ASHRAE) Level 2 energy audit. The process includes individual discipline checklists, energy load profiles, energy baselines, a summary report, and identification of conservation measures. Building energy models are also used to calculate the savings for energy conservation measures and to generate the energy use breakdown. This helps to better understand how energy is used in each audited building. The energy and water audits are also used to meet EPA *Guiding Principles for Federal Leadership in High Performance and Sustainable Buildings (Guiding Principles)* requirements.

The energy and water audits are not combined with condition assessments. The EISA Section 432 energy and water audits are on a four-year schedule and the condition assessments are on a five-year schedule. The schedules need to be realigned to occur at the same time. There is an opportunity to combine these two efforts in the future. Continuous commissioning is not performed at this time but may be pursued in the future. Once the BAS system is upgraded and integrated to the analytics system, the analytics system could be used to perform continuous commissioning.

A third party retro-commissioned Building 701 in FY 2019 to meet the *Guiding Principles* for HPSB.

EISA requires benchmarking for energy and water use. Sandia personnel use the U.S. Environmental Protection Agency (EPA) Portfolio Manager system to benchmark monthly data on building energy and water use. In addition, SkySpark analytics software is used to perform internal benchmarking and evaluate performance of buildings using hourly or 15-minute interval meter data. SkySpark can also be used to perform weather normalization.

1.2.2 Plans and Projected Performance

One hundred percent of the required EISA Section 432 energy audits for covered facilities will be completed by June 2020, meeting the four-year cycle timeline. The approach to be used for retro-commissioning in FY 2020 is being evaluated, and the use of an internal team to perform ongoing commissioning for a small office building is being piloted.

Energy management projects are not measured and verified currently. Following the required investment, SkySpark analytics will be used to perform measurement and verification in the future. In order for measurement and verification to be implemented an investment in metering is

necessary. The *SNL FY 2017 Energy and Water Metering Implementation Plan* will be updated in FY 2020 to address metering and funding needs.

1.3 Facility Metering

1.3.1 Performance Status

The DOE Sustainability Dashboard contains building-level electric, natural gas, chilled water, hot water, and potable water meter information. Steam is not used at any Sandia location.

The *SNL FY 2017 Energy and Water Metering Implementation Plan* (provided as a separate attachment on the DOE Sustainability Dashboard) provides more detailed information.

Efforts to improve the metering systems at SNL/NM and SNL/CA have been funded through a sustainability budget. As these small metering projects are completed, the benefits of advanced meters are realized, and many more opportunities for metering arise. When new meters are installed, benchmarking, reporting, modeling, and data analytics become more accurate. In many cases, newly installed advanced meters also prevent skilled craftsmen and engineers from having to spend time reading meters manually. Having advanced meters and a modernized building management system would enable the efficient management of buildings. This would help achieve the *Guiding Principles* and complete measurement and verification on any future energy projects. NTESS has purchased several temporary meters that will be used to validate the functionality of existing meters and commission the metering system.

SNL/NM owns and operates several layers of meter data. The site meters at SNL/NM are used to produce the site's monthly utility invoices, benchmarking, and the data most commonly used for energy reporting metrics. All other meters on SNL/NM are used for benchmarking, measurement and verification of savings, energy modeling, energy analytics, system diagnosis, and energy reporting. SNL/NM uses meter data to verify utility invoices, perform measurement and verification, energy modeling, energy analytics, and energy reporting. In the future meter data at both sites will be crucial for resiliency planning.

The metering system at SNL/CA has been modernized and is currently operating in an easily maintainable state. The metering system at SNL/NM is not as advanced. Many meters at SNL/NM are either stand-alone or communicate via an antiquated copper phone line network. At SNL/NM, meters are slowly being transitioned to a more robust and modernized communication network, but the meters that remain on the old system or as stand-alone have increased maintenance needs. The copper network is not always reliable, and these meters require maintenance more frequently than the new meters. The meters that are completely stand-alone are unfortunately some of the highest-risk meters because they are commonly operated on the site level. Furthermore, since they are read manually, an issue with the meter will not be detected until the next scheduled reading. There is no existing programmatic maintenance program for utility meters at SNL/NM. A programmatic maintenance and replacement program is being developed in the Life Cycle Asset Management Plan to address these concerns.

1.3.2 Plans and Projected Performance

To improve and maintain the SNL/NM and SNL/CA metering systems, a comprehensive Life Cycle Asset Management Plan is being developed. This plan will define the state of the existing metering systems, identify associated risks, and prioritize meters for future replacement or repair. This plan includes the development of a modernized metering and analytics tool, SkySpark. The strategy for improving the metering system is a phased approach that starts at the site level and moves down to the covered buildings, plant systems, remaining buildings, and facility subsystems. The meters with the most risk will be addressed first. Major barriers to achieving this plan are funding and the approval of a security plan for the metering system. To more clearly define these issues and the funding amounts needed to execute this effort, a Statement of Work for a metering study is being developed. One of the more long-range aspects to this Life Cycle Asset Management Plan is the maintenance of the metering system.

SNL/CA has an advanced metering system with an automated front end. However, there needs to be a plan in place to maintain this system and a plan to replace the metering system when it reaches obsolescence. Metering is also listed as a high-priority energy conservation measure on Sandia's draft Notice of Opportunity for an ESPC.

The planned actions identified in the *SNL FY 2017 Energy and Water Implementation Metering Plan* will continue to be pursued, including the installation of meters at the individual building level to meet federal metering goals where cost effective and appropriate over the next five years. SNL/CA personnel will continue to replace existing electrical meters that are beyond useful life with advanced metering.

1.4 Non-Fleet Vehicles and Equipment

1.4.1 Performance Status

Non-fleet vehicle and equipment use is an important aspect of executing mission work and conducting operation and maintenance activities at each site. Diesel- and gasoline-fueled power generators are used throughout Sandia to ensure backup power for critical building functions and operations as well as to enable outdoor field test activities in remote locations. Heavy equipment is also used to support operation and maintenance requirements associated with buildings, utility and site infrastructure, material handling and movement, and remote field-testing activities. Based on the campus nature of Sandia sites, a significant number of gasoline-powered carts are used for on-site personnel transportation needs. Landscape maintenance is not a significant source of non-fleet vehicle and equipment fuel use at any Sandia site.

Overall, there was a 44 percent increase in non-fleet vehicle and equipment GHG emissions compared to FY 2018.

1.4.2 Plans and Projected Performance

Opportunities to reduce non-fleet vehicle and equipment fuel consumption as appropriate will be evaluated. The following plans and measures will continue to be implemented:

- Replace gas-powered personnel carts with solar-powered carts.

- Implement xeriscape low-water use and low-maintenance landscape designs.

2.0 Water Management

Water management focuses on all water-related topics, such as potable water intensity and industrial, landscaping, and agricultural water consumption.

2.1 Performance Status

Water used at SNL/NM is purchased from KAFB, which has on-site water wells, at a cost of 3.15 cents per kgal. The Albuquerque Bernalillo County Water Utility Authority, which is the secondary water supplier, is currently pursuing aquifer recharge activities; Sandia personnel are not involved in these efforts.

Potable water used at SNL/CA is purchased from LLNL and is primarily supplied by the San Francisco Public Utility Commission from the Hetch Hetchy watershed. The Alameda County Flood Control and Water Conservation District, Zone 7, supplements this primary water source as needed. No alternative water sources for SNL/CA have been identified.

2.1.1 Water Use at SNL/NM

At SNL/NM, non-potable water uses consist of process, comfort cooling (14 percent of site total), and irrigation (7.5 percent of site total) operations. Potable water is used primarily for domestic (38 percent of site totals), construction, and laboratory purposes. Accurately measuring potable and non-potable water use is an ongoing process, as some water uses are not currently metered individually. In FY 2019, potable water accounted for 65 percent of the site consumption, non-potable water accounted for 29 percent, and the remaining 6 percent was classified as unmetered flow (Figure 2-1). The portion of unmetered flow decreased by 2 percent in FY 2019 thanks to the addition of 14 building meters. Unknown end uses are estimated at 5.6 percent and can be attributed largely to construction activities, water leaks, and other unmetered flows.

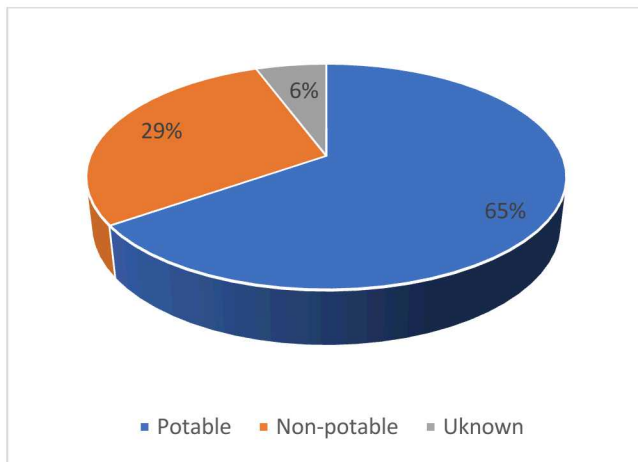


Figure 2-1. Water use for SNL/NM, FY 2019

Currently, 55 building meters report to the Facilities Control System, while the remaining 29 meters lack connectivity and are read manually. The central irrigation system includes 57 meters. The percent of unmetered flow is expected to continue to decrease as more automated meters are

installed. The plan is to eventually have all meters report to a centralized system. Due to the lack of metering on-site outflows, a site water balance has not been completed in the last five years. However, a water balance is performed on the cooling towers quarterly.

In 2019, high water use and high water intensity buildings continued to operate at SNL/NM as shown in [Figure 2-2](#) and [Figure 2-3](#). The Microsystems and Engineering Sciences Application complex and deionized water use changed little over the past year and account for approximately 21 percent and 6 percent (respectively) of the total water consumption at SNL/NM.

Currently there is no water management plan based on a conservation perspective, though water conservation goals continue to be managed through the maintenance and operation of water-conserving systems. The implementation of a site-wide centralized metering system will help in understanding water use at SNL/NM and will assist in water conservation efforts. This is an ongoing process and an important part of water conservation efforts. Other water conservation efforts include the implementation of building audits. The audits are conducted to estimate domestic use based on the water fixtures installed in a building. When the audits deem it necessary, the fixtures are replaced with low-flow fixtures. This continues to drive down total domestic water consumption.

Various federal, state, and local water regulations have been integrated into management practices in order to maintain compliance. For example, the EISA requirements and Leadership in Energy and Environmental Design (LEED) standards are incorporated into design and construction documents.

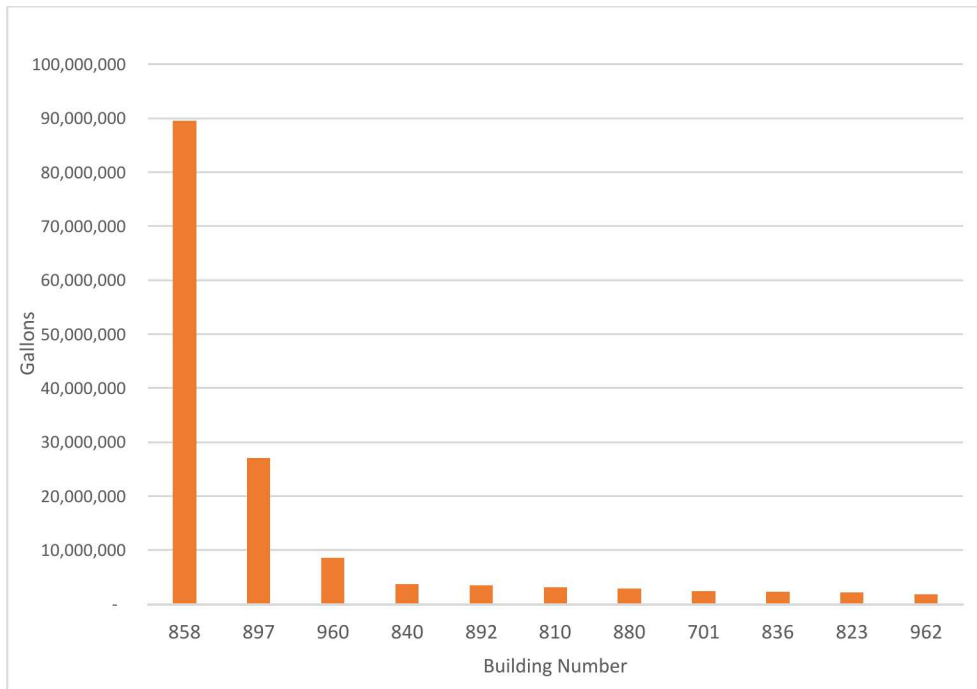


Figure 2-2. Top potable water use by building at SNL/NM, FY 2019

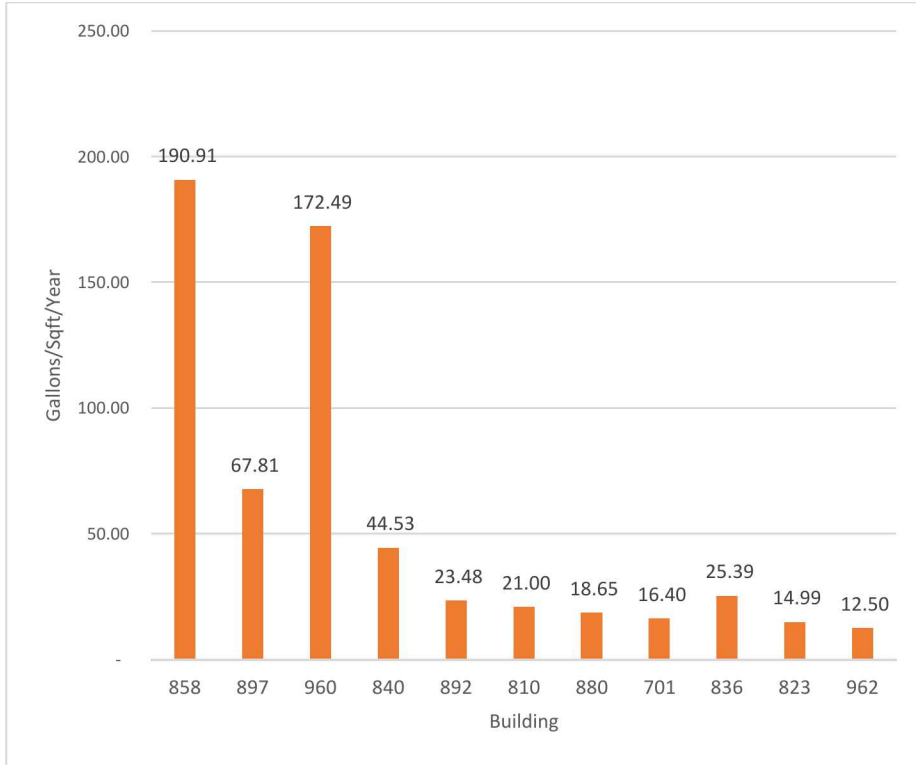


Figure 2-3. Water intensity by building at SNL/NM, FY 2019

Table 2-1. Forecasts progress for potable water and non-potable water consumption at SNL/NM

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Total water consumption (millions of gallons)	266	268	270	273	295	313	304	326	326	327	329	362	367	367	367	367	368	368	368	371	371	371	371
Potable	178	180	181	183	198	210	204	218	218	219	220	243	246	246	246	246	247	247	247	249	249	249	249
Non-potable	88	88	89	90	97	103	100	108	108	108	109	119	121	121	121	121	121	121	121	122	122	122	122
HEMSF per demand growth components (millions of gallons)														2			1			3			
Facilities														Building 725 Data Center (15,000 sq ft)	New Q IGPP Office Building (45,000 sq ft)	Center for Security Technology Analysis (20,000 sq ft)	Saturn Accelerator Recap (42,000 sq ft)	Emergency Operations Center (30,000 sq ft)		MESA Annex (100,800 sq ft)	Security Solutions Center (20,000 sq ft)		

IGPP = institutional general plant project
 MESA = Microsystems and Engineering Sciences Application

2.1.2 Water Use at SNL/CA

There is no non-potable water usage at SNL/CA. Water uses at SNL/CA include cooling, heating, sanitizing, irrigating, and processing operations. A water balance for the site (Figure 2-4) is updated based on available meter data. The “unknown” category consists of 31 percent of water usage and includes system leaks and construction activities. Sandia personnel continue to better analyze the “unknown” category so that more water use in this category will be accounted for in future years.

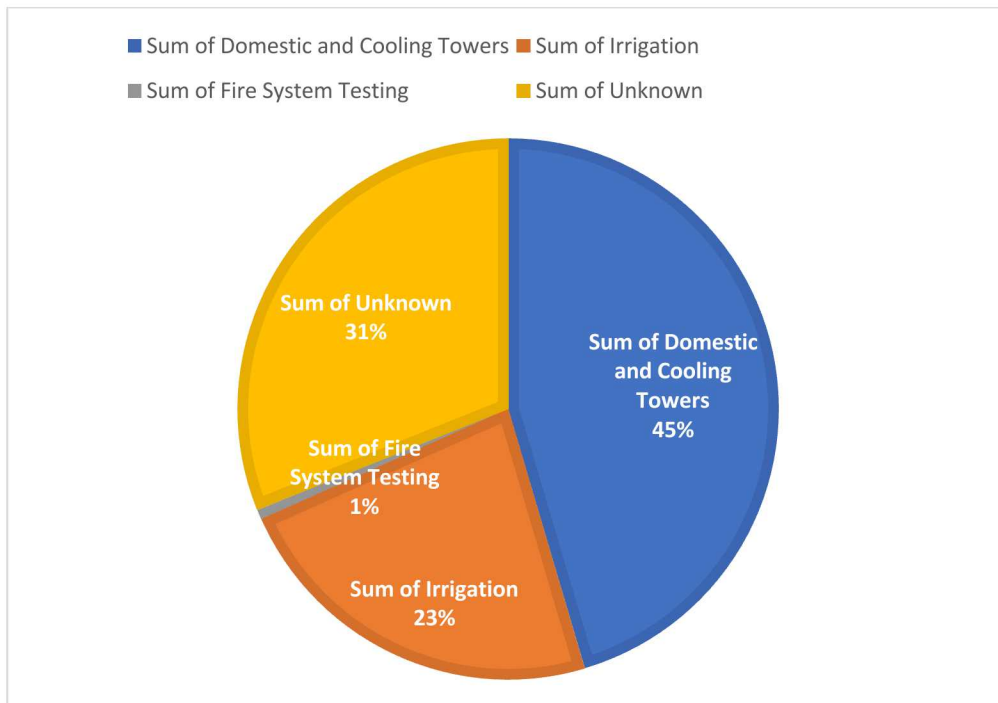


Figure 2-4. Water use at SNL/CA, FY 2019

Figure 2-5 shows potable water consumption at SNL/CA from FY 2007 to FY 2019. Water consumption is expected to remain in the range of 2017–2018 use through 2029. Factors likely to impact water consumption are new building construction, water main breaks and repairs, and unpredictable rainfall and weather patterns.

Though there is no water management plan based on a conservation perspective, water conservation goals continue to be maintained. In FY 2019, the cooling tower at Building C907 was replaced with an air-cooled unit, resulting in a decrease in water consumption. This cooling tower consumed approximately 2.25 million gallons of potable water during calendar year 2018.

To better account for water consumption, all major buildings have been metered. Irrigation lines that are not metered along with building use are not currently being metered.

Various federal, state, and local water regulations have been integrated into management practices. For example, California’s water restriction guidelines are followed during droughts. In addition, EISA requirements and LEED standards are incorporated into design and construction documents.

A Landscape Master Plan has been developed for SNL/CA, and stormwater is managed in compliance with federal and state regulations.

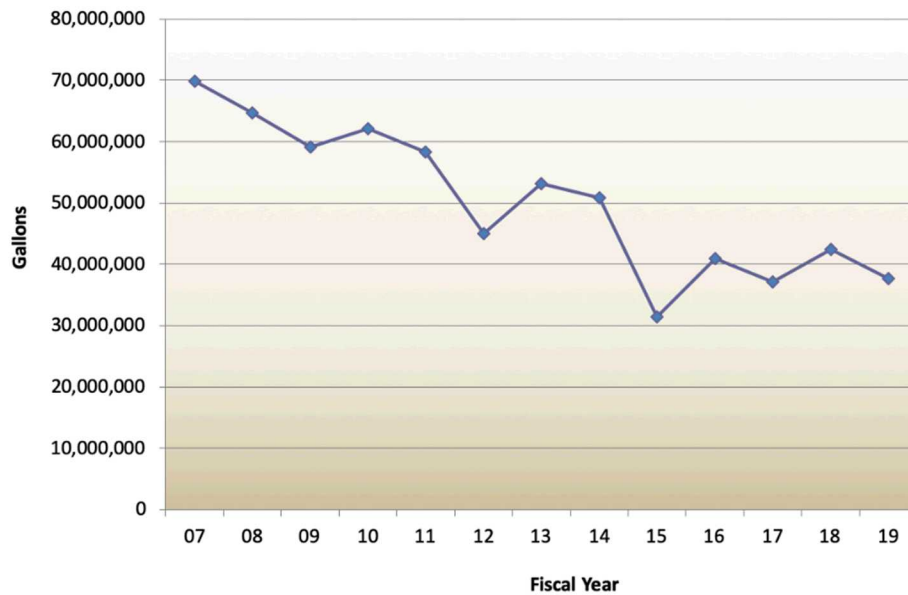


Figure 2-5. Water consumption at SNL/CA, 2007–2019

2.2 Plans and Projected Performance

Sandia personnel will continue to explore water conservation opportunities.

2.2.1 Water Use at SNL/NM

Variables associated with cooling at SNL/NM include weather and significant changes to water chemistry caused by increased aquifer drawdown. At SNL/NM, cooling loads due to data centers and other process cooling demands are expected to create challenges to maintaining the current reduction numbers until FY 2025. However, conservation projects will be implemented wherever feasible. Some of these projects for SNL/NM include the following:

- The Infrastructure Services organization has created a long-term plan to address the aging water infrastructure. This plan will systematically replace domestic water lines that are deemed to be at the end of their useful life.
- Restrooms will be retrofitted with high-efficiency fixtures.
- Green building guidelines will be followed and recycled water will be used wherever possible to realize water savings when designing and constructing new data centers.
- Metering will be improved and added to further account for building water usage, including user process equipment. Meters will be installed in buildings that are not currently metered.
- Water lines will be replaced to help reduce the frequency of flushing due to line and/or valve repairs or replacements.
- Implement the use of reclaimed water from the 858 Acid Waste Neutralization system in the 858 cooling towers. This is currently on hold due to the quality of the reclaim water affecting

the cooling performance. When appropriate treatment systems are installed, the use of the reclaimed water will be reimplemented.

Sandia personnel conduct building water audits as part of internal energy audits and condition assessments. Findings from these audits range from bathroom retrofits to the elimination of once-through cooling loops. Inefficient and outdated fixtures will be replaced as funding becomes available, particularly in buildings identified to meet the *Guiding Principles* for HPSBs.

2.2.2 Water Use at SNL/CA

At SNL/CA, water consumption is expected to remain in the range of 2017–2018 usage through 2029. Water conservation efforts will be continued in FY 2020 that include the following:

- Convert existing landscaping to low-water use landscape, as funding allows.
- Pursue a water line replacement project.

3.0 Waste Management

Waste management focuses on all waste-related topics, such as waste diversion, municipal solid waste, wastewater treatment, and associated GHG emissions.

3.1 Waste Diversion and Municipal Solid Waste

3.1.1 Performance Status

3.1.1.1 Waste Diversion at SNL/NM

Off-site solid waste disposal, which is referred to as commercial solid waste disposal in program documents, is subcontracted. At SNL/NM, the City of Albuquerque Cerro Colorado landfill and the Waste Management-owned Rio Rancho landfill are used for off-site solid waste disposal.

SNL's Materials Sustainability and Pollution Prevention Program has continued to pursue Zero Waste by 2025 with Laboratories management support. The campus-wide awareness campaign is growing, and local training sessions for departments have increased.

New custodians are periodically given tours and training on their impact and part in the waste diversion process. This has resulted in positive participation and feedback for infrastructure and process improvements. The significant increase in personnel renders these efforts difficult to quantify on a campus scale. Local waste assessments on a building level have shown a decrease in pounds of waste generated per person, as readily recyclable and compostable materials are diverted to existing or new recovery streams.

For construction and demolition waste at SNL/NM, concrete and asphalt debris is the most variable and hardest to manage. Policy and contractual changes, subcontractor awareness training, and support are planned for FY 2020.

In FY 2019, commercial solid waste increased by more than 10 percent. The following diversion rates were achieved:

- 61 percent of nonhazardous solid waste, excluding construction and demolition debris
- 23 percent of construction and demolition debris

Incineration is used to meet security destruction requirements. Only some locations used waste-to-energy plants; therefore, the total incineration number reported in the DOE Sustainability Dashboard will be more than reported in this SSP as waste to energy. As waste-to-energy, 28.4 metric tons of material was diverted.

The ChemPro tool is well established, helping to control and grant approval for the purchase of all new chemicals. ChemPro customers are encouraged to use acceptable nontoxic or less-toxic alternative chemicals and processes, while minimizing acquisition of hazardous chemicals and materials. Increased inventory maintenance and reductions are an ongoing part of Sandia's Environmental Management System.

Impacts from changes in New Mexico's recycling fees are as follows:

- Scrap metal recycling revenues are steady.
- Cardboard prices have been depressed, and mixed paper is now a fee commodity, not a revenue generator.
- Office pack (white paper) is unable to be moved due to security constrictions on the material. In FY 2020, commercial white paper will be shredded on-site at SNL/NM with vendor-managed recycling.
- Higher-grade plastics continue to return revenues when maintained separately, while mixed plastics incur fees that are similar to landfill fees.
- Glass recycling has been discontinued within the metropolitan area.

3.1.1.2 Waste Diversion at SNL/CA

At SNL/CA, the Facilities Management organization owns and manages the solid waste disposal contracts and works in conjunction with the SNL/CA Pollution Prevention Program to ensure that reporting and recycling requirements are met.

To meet the Alameda County recycling ordinance to divert 90 percent of easily recyclable and compostable materials by 2020, SNL/CA personnel continue to evaluate and improve solid waste management activities. Facilities Management personnel haul trash and mixed recycling directly to the Vasco Road Landfill owned by Republic Services. Organic wastes are collected under contract by Livermore Sanitation and transported to the Vasco Road Landfill for composting. Livermore Sanitation also picks up asphalt, cardboard, carpeting, concrete, construction and demolition debris, green waste, wood, and trash, which are transferred to the Vasco Road Landfill for recycling or disposal.

In FY 2019, commercial solid waste increased by more than 15 percent. The following diversion rates were achieved:

- 80.0 percent of nonhazardous solid waste, excluding construction and demolition debris
- 87.0 percent of construction and demolition debris

Impact from changes in California's recycling fees are as follows:

- Electronic waste recycling revenues are steady.
- Scrap metal recycling revenues have declined slightly; there has been a revenue decrease due to weakness in scrap metal pricing.
- The mixed recycling (e.g., cardboard, aluminum, glass, or plastic) and the mixed paper recycling is not a revenue generator; both streams incur fees, which are steady.

3.1.2 Plans and Projected Performance at SNL/NM

Sandia's mission and population grew significantly over the past year, and will likely grow through FY 2020. This will directly impact the volume of waste generated. Specifically, construction and demolition waste is expected to increase as aging infrastructure is demolished or upgraded and new construction is erected.

Participation in the U.S. Department of Agriculture BioPreferred program is under active assessment, and actions to improve data collection and identify areas for improvement are continuing into FY 2020. This is expected to increase the use of acceptable nontoxic or less-toxic alternative chemicals and processes while minimizing acquisition of hazardous chemicals and materials.

3.1.2.1 Waste Diversion at SNL/NM

Over the past decade, efforts to capture and divert organic waste have included all food service locations along with buildings housing approximately 10 percent of the workforce. In FY 2020, a new campus-wide composting contract is anticipated to be released and will service approximately 90 percent of the personnel at SNL/NM. Organic waste accounts for at least 25 percent of the nonhazardous solid waste. The increase in capture of compostables will have a large impact on the waste diversion rate.

Additionally, some leased office facilities have access to the City of Albuquerque's modified single-stream recycling services. In FY 2020, the newest location with over 500 personnel will pilot the use of City of Albuquerque resources in a modified dual-stream recycling service. This will simplify participation for the workforce, while maintaining SNL's security requirements.

3.1.2.2 Waste Diversion at SNL/CA

A SNL/CA, a site-wide evaluation was conducted in FY 2019 to determine whether the recycling station locations are reasonably accessible to all employees and contractors. A Solid Waste Management Improvement Plan is currently being developed based on the evaluation's findings. The plan will address solid waste management challenges and provide a pathway to ensure that solid waste is managed as required by local regulations by the end of FY 2020. Information will be provided to employees and contractors through education and signage regarding recyclable or compostable materials.

3.2 Integrated Pest Management

3.2.1 Performance Status

The goal of the Integrated Pest Management program is to pursue environmentally sensitive pest-management strategies at all locations by using preventive and control strategies that protect human health and the surrounding environment, relying on least-toxic pesticides for control and eradication, minimizing the quantity of pesticides applied, and notifying building occupants of Integrated Pest Management Program activities.

At SNL/NM, Facilities and Emergency Management personnel promote the use of least-toxic pesticides whenever possible. Pesticides are applied to the interiors or exteriors of buildings only if visual inspections or monitoring devices indicate the presence of pests in the area, and the Integrated Pest Management lead, a Facilities and Emergency Management staff member, or a services subcontractor determines that the situation warrants the use of pesticides. Volatile organic compound propellants shall be used only as needed and only if pneumatic hand-pump spray applications are not applicable for the targeted pest.

At SNL/NM, the services subcontractor must submit all pesticides to the Sandia Delegated Representative for approval before use. The services subcontractor must also indicate each pesticide's specific uses. The Sandia Delegated Representative maintains a list of approved pesticides indicating that the pesticides have been approved for specific uses.

At SNL/CA, pesticides, herbicides, and rodenticides to be used outdoors require review and evaluation by an environmental monitoring and ecology SME prior to use.

3.3 Wastewater Treatment

3.3.1 Performance Status

Wastewater discharge permits with the local Publicly Owned Treatment Works are in place for SNL/NM and SNL/CA. The number of employees served by the wastewater treatment system at SNL/NM increased from 11,415 persons to 12,491 persons in FY 2019. This resulted in an increase in wastewater treatment-related GHG emissions from 54.34 MT in FY 2018 to 59.46 MT in FY 2019.

At SNL/CA, the number of employees served by the Livermore Water Reclamation Plant increased from 1,499 persons in FY 2018 to 1,486 persons in FY 2019. There was also a decrease in wastewater treatment-related GHG emissions from 9.16 MT in FY 2018 to 9.08 MT in FY 2019.

Wastewater at SNL/TTR is discharged to an evaporation lagoon owned and operated by the U.S. Air Force.

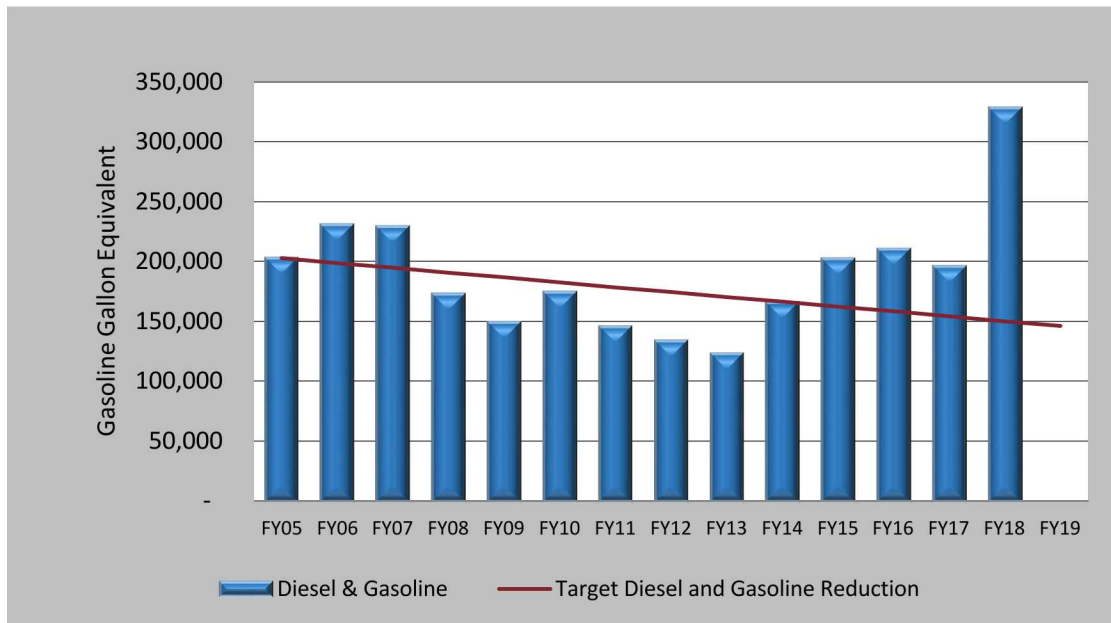
4.0 Fleet Management

Fleet management focuses on all fleet-related topics, such as GHG emissions and fleet inventory, mileage, and fuels, including petroleum reduction and alternative fuel use. The FY 2019 Federal Automotive Statistical Tool data is not yet available on the DOE Sustainability Dashboard. The data discussed in this section, is through FY 2018.

4.1 Performance Status

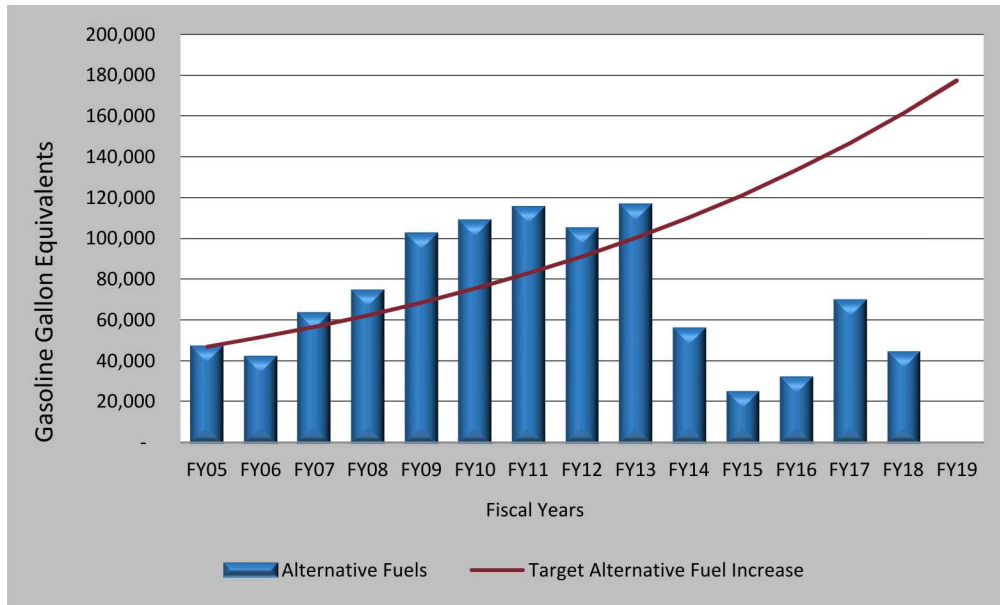
Figure 4-1 and Figure 4-2 depict fleet petroleum and alternative fuel use through FY 2018. The increase in petroleum use in fleet vehicles during FY 2018 resulted from an interruption in the availability of ethanol-based fuel (E85) fuel at the KAFB refueling station. As a result, SNL/NM fleet vehicles consumed more gasoline and less E85 during FY 2018.

Similarly, in FY 2018 security patrol vehicles at SNL/CA experienced performance issues when using E85 that were resolved by using gasoline. As a result, E85 is no longer used for SNL/CA security patrol vehicles. Additionally, there has been a significant increase in mission work activities, which has resulted in an increase in the fleet vehicle inventory and associated fleet vehicle fuel use. This trend is expected through FY 2019.



Notes: Includes all sites. Petroleum fuels include gasoline, diesel, and diesel portion of B20 (biodiesel). Data is presented in GGEs.

Figure 4-1. Petroleum fuel use



Notes: Includes all sites. Alternative fuels include B20 (nondiesel portion), E85, compressed natural gas, and electricity; electrical use includes only SNL/NM data. Data is presented in GGEs.

Figure 4-2. Alternative fuel use

Table 4-1 illustrates the fleet light-duty AFV acquisition status through FY 2018. In FY 2019, 85 percent of the fleet vehicle inventory (not acquisitions) was comprised of AFVs (E85, B20, hybrid, or electric). Alternative fuel, light-duty vehicles are acquired when available and when “functional need” exceptions are not required.

Table 4-1. Light-duty AFV acquisitions

Year	Replacement with AFVs	Year	Replacement with AFVs
FY 2005	98.2%	FY 2013	100.0%
FY 2006	98.5%	FY 2014	98.0%
FY 2007	95.0%	FY 2015	91.0%
FY 2008	96.0%	FY 2016	100%
FY 2009	98.0%	FY 2017	62%
FY 2010	88.0%	FY 2018	72%
FY 2011	100.0%	FY 2019	TBD

Note: Includes all sites.

All the light-duty AFVs acquired in FY 2018 were flex fuel vehicles that can use E85. Flex fuel vehicle offerings from the manufacturers are declining, and availability will have an impact in the future. High-efficiency vehicles were purchased or leased when cost competitive and available on the U.S. General Services Administration schedule.

Fueling stations for E85, biodiesel (B20), and compressed natural gas are available for SNL/NM fleet vehicles at KAFB. The interruption in access to E85 fuel at KAFB described previously has been resolved. Additionally, E85 fueling stations are available for use at SNL/CA. AFVs are required to use these fueling stations. Vehicle operators at SNL/NM and SNL/CA are encouraged

to use E85 and B20 fuels. However, remote sites (e.g., SNL/TTR, SNL/KTF, or Alaska) do not have alternative fuel options available, and have requested waivers.

No additional all-electric vehicles were acquired in FY 2019. The inventory of all-electric vehicles remains at four (all are Chevrolet Bolt models), with three located at SNL/NM and one at SNL/CA. However, the availability of charging infrastructure was increased for all electric and/or plug-in hybrid electric vehicles.

- Two portable, self-contained, solar powered, Level II charging stations were installed at SNL/NM. Overall, now SNL/NM has three stations, and SNL/CA has one station.
- In FY 2019, installation of permanent Level II electric vehicle charging stations was completed in two separate parking lots at SNL/CA. There are now four charging stations in each parking area location (eight total), with two charging ports per charger and 16 designated parking spaces for charging vehicles. Two permanent Level II electric vehicle charging stations with two charging ports each are maintained at SNL/NM.
- Sixty-one solar-powered electric carts were acquired in FY 2019, 54 of which are located at SNL/NM and the remaining 7 are located at SNL/CA.

4.2 Plans and Projected Performance

The DOE SSPP sets petroleum fuel (diesel and gasoline) reduction goals; however, property management requirements and the high cost of AFVs pose a challenge to meeting these goals. Although hybrid vehicles (gas-electric configurations) are considered AFVs and impact the 75 percent AFV-replacement goal for light-duty vehicles, hybrid vehicles do not increase alternative fuel consumption.

Petroleum fuel consumption will be reduced by doing the following:

- Purchase AFVs (E85 and B20) to reduce reliance on petroleum fuels. Through 2022, 164 of the planned 217 gasoline-capable vehicles to be acquired will be E85 capable.
- Continue to monitor and manage fleet vehicle utilization to minimize vehicle miles driven and optimize future acquisitions.
- Continue to replace gas-powered carts with electric and/or solar powered carts.
- Convert existing Club Cars with solar photovoltaic (PV) powered capability.
- Right-size the inventory of fleet vehicles, based on determination of the most fuel-efficient vehicle for the required task, and provide the appropriate type and number of vehicles relative to need.
- Employ strategies that improve fuel use efficiency, including use of low-rolling-resistance tires and use of synthetic oil to extend replacement frequencies.
- Employ anti-idling measures, including telematics technology, on all fleet vehicles to monitor compliance with the anti-idling policy.
- Continue to encourage vehicle operators at SNL/NM to use E85 fuel at the KAFB fueling station as well as other locally available E85-dispensing stations.
- Continue to encourage vehicle operators to acquire B20 fuel at the KAFB fueling station.

- Evaluate additional electric vehicle charging capacity for FY 2020 to support acquisition of additional fleet zero emission vehicles and plug-in hybrid emission vehicles.
- Continue to evaluate opportunities to accommodate and encourage the use of personally owned electric and hybrid-electric vehicles for employee commuting, e.g., by expanding the existing charging infrastructure.
- Purchase or lease high-efficiency vehicles when cost competitive and available on the U.S. General Services Administration schedule.

5.0 Clean and Renewable Energy

Clean and renewable energy focuses on clean and renewable energy use as a percentage of overall energy use.

5.1 Performance Status

Renewable energy goals are based on total electricity and energy consumption at all facilities, including those excluded from energy intensity reduction requirements.

These goals are accomplished by purchasing RECs and through on-site and existing R&D renewable energy projects. RECs are primarily purchased through an existing contract with an energy service provider. In addition, a power purchase agreement for SNL/CA electricity generation is associated with a PV farm located at LLNL. In FY 2019, SNL/CA received an approximate 7 percent share (or 436 Mwh) of electricity generated (and associated RECs) by the LLNL PV system that came online in February 2016.

Sandia's PV R&D technologies are leveraged to support renewable energy and sustainability goals. High-energy users on-site can take advantage of power generated by Sandia R&D activities. These high-energy users, such as computer services, have partnered with R&D solar researchers to share PV acquisition and installation costs in return for reduced energy charges.

In FY 2018, a new 60 kW PV system installation was completed at the Photovoltaic Systems Evaluation Laboratory, Building 848, at SNL/NM through a cost-share arrangement with one of Sandia's computer services organizations.

In FY 2019 at SNL/NM, the Distributed Energy Technology Laboratory, Building 833, generated approximately 61.9 Mwh of electric power from systems totaling 98 kW. Similarly, the Photovoltaic Systems Evaluation Laboratory, Building 848, generated approximately 622 Mwh of electrical power during FY 2019 from systems totaling approximately 310 kW. The total capacity of PV electric power generation at SNL/NM increased in FY 2019 compared to FY 2018 due primarily to the addition of PV capacity at the Photovoltaic Systems Evaluation Laboratory.

Figure 5-1 shows renewable electric generation through FY 2019.

The estimated total renewable energy generation for FY 2019 is approximately 990 Mwh for electric and 445 MMBtu for thermal. On-site renewable electricity generation represents only 0.246 percent of the total energy consumption. Since on-site renewable energy generation capacity is limited, clean and renewable energy goals are satisfied by purchasing RECs (to cover both site electric consumption and total energy use). Therefore, the purchase of RECs will be increased in subsequent years to meet future renewable electric energy goals.

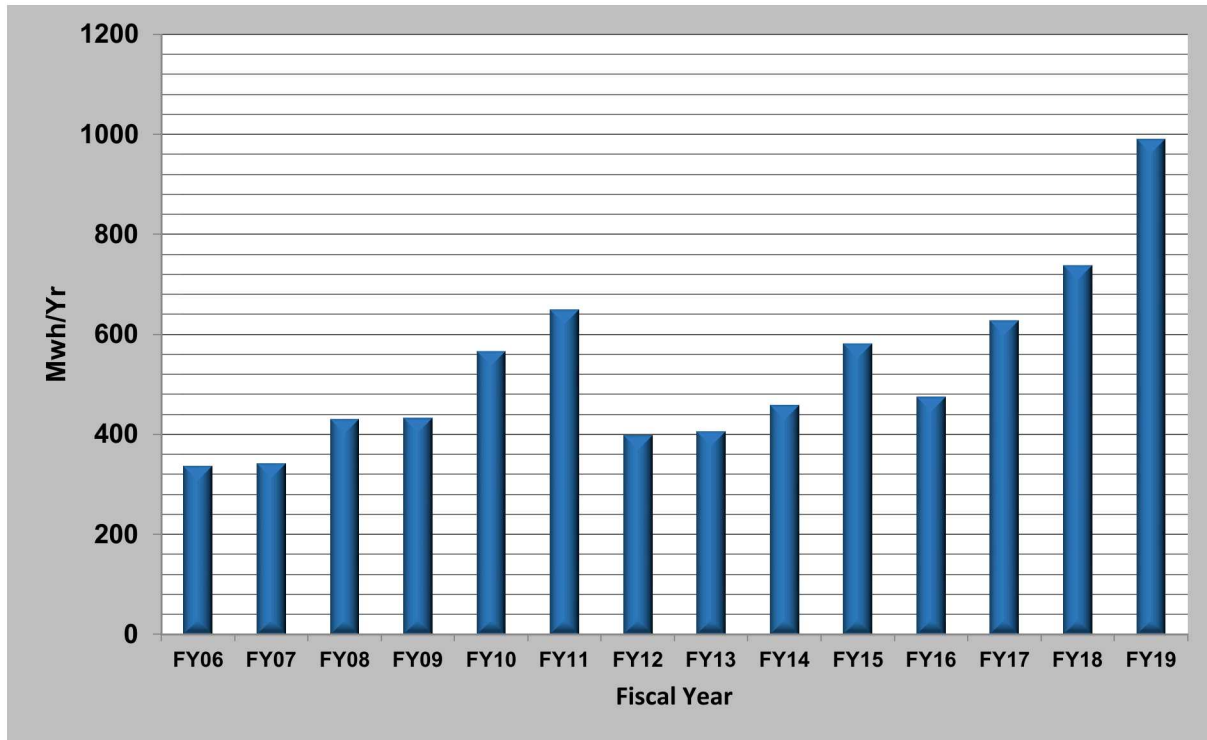


Figure 5-1. Renewable electric generation at SNL/NM and SNL/CA, FY 2006–FY 2019

Actual metered data from some renewable energy systems continued to be unavailable during FY 2019. Energy produced by non-metered PV systems is estimated based on the system capacity and an assumed 5.5 sun-hours per day and 365 days of operation per year. Several renewable energy systems are associated with mission-related renewable energy R&D activities. As a result, these specific systems are not considered permanent installations and might not be operated continuously. The Stirling engine concentrated solar systems at the National Solar Thermal Test Facility stopped running in October 2011, which decreased renewable energy generation in FY 2012 and future years (see Figure 5-1).

Solar-powered light-emitting diode (LED) lights are installed in parking lots and walkways when cost effective. These systems are typically small and reduce construction costs for projects by avoiding digging, trenching, and running wire and conduit. They also avoid increases in lighting energy use and promote solar and LED technologies. A solar-powered lighting system was installed at a new parking lot area at SNL/NM in FY 2019.

Another renewable energy application used to reduce infrastructure costs and energy is solar-powered (or PV) carts. The PV carts are used for on-site personnel transportation as well as other light-duty activities. Currently, there are 206 PV carts, with 188 at SNL/NM and 18 at SNL/CA. In FY 2019, 54 PV carts were acquired for SNL/NM, and 7 PV carts were acquired for SNL/CA.

In FY 2018, Facilities and Emergency Management and Photovoltaics and Materials Technology personnel collaborated to install a new 500 kVA/480 V transformer at Building 848, which expanded the site grid-tied infrastructure capacity up to approximately 750 kW. This enabled the addition of approximately 43 kW of renewable energy capacity in FY 2019, with an additional 25 kW planned for FY 2020.

Two new electric PV charging stations were installed at SNL/NM in FY 2019 for personally-owned electric vehicles. These charging stations are intended to accommodate and encourage use of personally owned electric and hybrid-electric vehicle use for commuting, reducing Scope 3 GHG emissions. Employees who use these charging stations pay a monthly fee.

In FY 2017, Facilities and Emergency Management personnel joined several R&D organizations in developing and issuing a renewable energy power purchase agreement Request for Information for the installation of a PV energy system at SNL/NM based on potential 5 MW and 10 MW capacity systems consisting of ground-mounted, parking lot structures, and/or roof-top systems. The goal was to gauge vendor interest, determine potential costs, and evaluate the feasibility relative to current electricity cost rates. While favorable cost estimates and vendor interest were obtained, evaluations continue for funding, siting, and configuring energy systems, and for identifying energy resiliency opportunities that could be implemented by a power purchase agreement at the SNL/NM and SNL/CA sites.

5.2 Plans and Projected Performance

Sources of clean and renewable energy are continually sought when life-cycle cost effective. Planned and projected efforts to add clean and renewable energy capacity include the following:

- Purchase RECs to meet the goals for FY 2020 and beyond.
- Continue to leverage renewable energy R&D activities to reduce and offset energy consumption. Installation of an additional 25 kW in PV capacity is planned for Building 848 in FY 2020. The Building 848 site has rack space available for installing approximately 100 kW in future PV capacity.
- Install solar-powered LED lights for new external installations (parking lots and walkways), where life-cycle cost effective. In FY 2020, install additional parking area PV lighting systems at SNL/NM and SNL/CA.
- Continue to replace gas-powered carts with solar-powered carts.
- Continue to identify, analyze, and select development opportunities for small- and large-scale PV and concentrating PV systems at SNL/NM and SNL/CA, where life-cycle cost effective.
- Continue to pursue the use of power purchase agreements to construct and operate renewable generation systems, based on an FY 2017 Request for Information for the installation of a PV energy system at SNL/NM that would support energy security and resilience for mission critical buildings.
- Evaluate opportunities to use ESPCs and/or utility energy service contract mechanisms to implement on-site renewable energy projects.
- Continue to identify locations to install renewable energy projects.
- Investigate the incorporation of renewable energy systems, especially solar hot-water heaters, in new buildings.
- Evaluate microgrids for mission-critical energy-security applications.
- Explore the uses of power from fuel cells, wind, geothermal sources, and nuclear R&D work.

- Explore solar ventilation project systems as recommended in the National Renewable Energy Laboratory renewable energy resource assessment.
- SNLs current five-year REC purchasing contract does not include a preference for purchase from Indian Tribes. The future REC purchasing contract will include preference for purchasing from Indian Tribes.

Table 5-1 projects on-site renewable electric energy generation, purchased green energy, RECs, and total electricity consumption through FY 2025. All onsite renewable electric energy generation is consumed onsite.

Table 5-1. Renewable electric energy consumption

Renewable Electric Energy (MMBtu)	Actual FY 2019	Planned FY 2020	FY 2021	FY 2022	FY 2023	F 20Y24	FY 2025
Onsite Renewable Energy Generation¹	3,378	3,610	3,610	3,610	3,610	3,610	3,610
Onsite Renewable Energy Consumption	3,378	3,610	3,610	3,610	3,610	3,610	3,610
Purchased Green Energy²	1,488	1,488	1,488	1,488	1,488	1,488	1,488
Renewable Energy Credits³	172,313	221,789	221,789	279,796	279,796	313,917	348,038
Total SNL Electricity Consumption⁴	994,592	994,592	994,592	994,592	994,592	994,592	994,592

Notes:

¹Generation for FY 2019 is for projects installed. Generation for FY 2020 is based on FY 2019 plus an increase of 25 kW to the PV system at the Photovoltaic Systems Evaluation Laboratory and 9 kW planned PV parking lot lighting projects at SNL/NM and SNL/CA. No contracted, funded, or otherwise specific renewable energy generation systems can be projected beyond FY 2020.

²Purchased green energy is based on the approximate 7 percent provided from the LLNL PV system.

³REC purchases are based on goal requirements and no increase in total site energy use from FY 2019.

⁴Total electricity consumption is based on no increase from FY 2019.

Table 5-2 projects total renewable energy (electric and thermal) consumption relative to total site energy consumption.

Table 5-2. Total renewable energy consumption (electric and thermal)

Renewable Energy (MMBtu)	Actual FY19	Planned FY20	FY21	FY22	FY23	FY24	FY25
Onsite Renewable Electric Energy Generation¹	3,378	3,610	3,610	3,610	3,610	3,610	3,610
Onsite Renewable Thermal Energy Generation²	445	445	445	445	445	445	445
Purchased Green Energy³	1,488	1,488	1,488	1,488	1,488	1,488	1,488
Renewable Energy Credits⁴	172,313	221,789	221,789	279,796	279,796	313,917	348,038
Total SNL Energy Consumption⁵	1,372,317	1,372,317	1,372,317	1,372,317	1,372,317	1,372,317	1,372,317

Notes:

¹Electric energy generation for FY 2019 is for projects installed. Generation for FY 2020 is based on FY 2019 plus an increase of 25kW to the PV system at PSEL and 9 kW planned PV parking lot lighting projects at NM and CA. No contracted, funded, or otherwise specific RE generation systems can be projected beyond FY 2020.

²Thermal energy generation for FY 2019 is for the Building 848 geothermal energy system.

³Purchased green energy is based on the approximate 7% provided from the LLNL PV system.

⁴REC purchases are based on goal requirements and no increase in total site energy use from FY 2019.

⁵Total SNL energy consumption is based on no increase from FY 2019.

6.0 Green Buildings

Green building development focuses on green building-related topics, such as the *Guiding Principles* for HPSB and building inventory changes and design.

6.1 Guiding Principals

6.1.1 Performance Status

The Council on Environmental Quality published the revised *Guiding Principles* and associated instructions in February 2016. The instructions state that buildings that achieved compliance by September 30, 2015, will be grandfathered in as meeting the *Guiding Principles* until 2025 if they meet certain ongoing requirements. Buildings that met over 50 percent of the 2008 *Guiding Principles* metrics had until September 30, 2017, to reach compliance using the old *Guiding Principles*. The new instructions also allow some buildings to be removed from the baseline starting in FY 2016.

Sandia personnel are tracking approximately 160 buildings in the EPA ENERGY STAR Portfolio Manager using the federal HPSB checklist (based on the 2008 *Guiding Principles*). In FY 2019, 34 buildings, or 18.4 percent, complied with the 2008 *Guiding Principles*. [Table 6-1](#) provides more detail.

Table 6-1. Compliance with the 2008 *Guiding Principles*

	FY 2019 Total (All Locations)	15% Required to Meet the <i>Guiding Principles</i>
Number of buildings > 5,000 GSF	184	28
GSF for buildings > 5,000 GSF	6,407,545	961,132

Compliance is currently at 18.4 percent.

Thirty-two buildings were grandfathered under the 2008 version of the *Guiding Principles*. In 2019, Building 1012, a new building, and Building 701, an existing building, were brought into compliance, bringing the total to 34 buildings.

6.1.2 Plans and Projected Performance

Going forward, the HPSB federal checklist will be used to demonstrate when a building meets the *Guiding Principles*. This information will also be reported in the DOE Sustainability Dashboard.

Currently, the most difficult *Guiding Principles* to achieve on existing buildings are energy efficiency, water efficiency, commissioning, and ASHRAE 55 and ASHRAE 62 compliance. The most difficult *Guiding Principles* to achieve on new buildings are energy efficiency, ASHRAE 55 and ASHRAE 62 compliance, and renewable energy. The indirect budget was cut by 5 percent, making funding for sustainability efforts challenging.

Efforts will be made to achieve *Guiding Principles* compliance for as many buildings as possible. Sandia personnel will review buildings that were eligible per the 2008 version, starting with those that are closest to compliance (see [Table 6-2](#)). However, there are buildings listed in the EPA

ENERGY STAR Portfolio Manager that will never comply, so 100 percent compliance is not a realistic goal.

Table 6-2. Completion status for *Guiding Principles* checklist for existing buildings

Building	Yes (%)	No (%)	In Process (%)	Not Assessed (%)	Building Square Foot
Building 701	100	0	100	0	151,055
Building 770	92	0	8	0	15,699
Building 827	92	0	4	4	58,683
Building 836	92	0	4	4	93,461
Building 859	96	0	4	0	21,031
Building 861	96	0	0	4	13,914
Building 885	80	4	95	5	5,120
Building 886	80	0	95	5	10,565
Building 954	96	4	0	0	36,223
Building 957	96	0	4	0	53,323
Building 962	92	0	95	5	151,425
Building 954	96	4	0	0	36,223

Although EO 13834 does not require buildings to be maintained at an HPSB level once *Guiding Principles* are achieved, it does require that HPSBs meet certain ongoing requirements. Sandia personnel will maintain *Guiding Principles* compliance in HPSBs and grandfathered buildings to meet the 25 percent goal.

All new staff received training on the 2016 *Guiding Principles* in January 2019. Additionally, the planning process for new construction incorporates integrated design and simple box energy models to help achieve energy performance at 30 percent more efficient than the baseline in ASHRAE 90.1-2013, *Energy Standard for Buildings Except Low-Rise Residential Buildings*. Further, a Building Systems Engineering Department was formed to help develop standards to achieve sustainable buildings and systems.

Table 6-3. Plan to meet the *Guiding Principles*

	LEED (Grand-fathered)	FY 2010	FY 2011	FY 2012	FY/CY 2013	FY/CY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025
Buildings	518 720 898 899 858EL 858EF		750 C903 new	753 969	1090 752 971 704 new 811 877 879 858J (CUB) 899A (CUB)	730 new 727 758 726 (CUB)	6584 6587 700 705 725 856	895 756 new	C926 new		701 1012 new	812 (NM) new Agile Lab (NM) New data center (CA) 972 (NM) new STAB (NM) new 962 885 886	CSTART (NM) new	TBD	TBD	TBD	TBD
Number for Guiding Principles	6	0	2	2	9	4	6	2	1	0	2	8	1	TBD	TBD	TBD	TBD
Total Guiding Principles	6	6	8	10	19	23	29	31	32	32	34	42	43	43	43	43	43
Percent of Buildings (> 5,000 GSF)	3.1%	3.1%	4.2%	5.2%	10.1%	11.9%	15.5%	17.7%	18.1%	18.1%	18.3%	22.1%	22.5%	22.5%	22.5%	22.5%	22.5%
GSF	629,746	0	23,047	26,353	124,797	149,200	173,093	101,506	20,796	0	158,995	279,588	25,000	0	0	0	0
Total GSF	629,746	629,746	652,793	679,146	803,943	953,143	1,126,236	1,227,742	1,248,538	1,248,538	1,407,533	1,687,121	1,712,121	1,712,121	1,712,121	1,712,121	1,712,121
Percent of GSF (> 5,000 GSF)	9.5%	9.5%	9.8%	10.2%	12.2%	14.4%	17.1%	19.7%	19.9%	19.9%	22.2%	26.1%	26.4%	26.4%	26.4%	26.4%	26.4%

Notes:

Building 1012 is a new general plant project (GPP) with 7,940 GSF. It is LEED Gold.

Building count and GSF include central unit buildings > 5,000 GSF.

No buildings > 5,000 GSF were demolished in FY 2019.

Building 1008 is included in the building count and GSF even though it does not appear in the Facilities Information Management System. It is a Department of Homeland Security building.

Starting in FY 2018, buildings will meet the 2016 *Guiding Principles*.

FY 2015 is the new baseline for *Guiding Principles* compliance. Consistent with 2016 *Guiding Principles* guidance, buildings that are leased, buildings below the Federal Real Property Profile de minimis thresholds, and surplus/excess were removed from the baseline in FY 2016.

Although the Building 725 Data Center addition is expected to receive LEED Gold, it does not count toward *Guiding Principles* since it is an addition and Building 725 is already compliant.

CSTART = Center for Security Technology, Analysis, Response, and Testing

CUB = central utility building

CY = calendar year

STAB = Stabilization Facility

TBD = to be determined

6.2 New Building Design

6.2.1 Performance Status

The DOE SSPP requires that all new buildings, major renovations, and alterations of buildings greater than 5,000 GSF must comply with the *Guiding Principles* for HPSBs. To prove *Guiding Principles* compliance, the NTESS Prime Contract requires U.S. Green Building Council's LEED Gold certification for New Construction. In addition, in accordance with the Energy Policy Act of 2005, Section 109, all new federal buildings must be designed so that their energy consumption is 30 percent below the ASHRAE standard. DOE recently adopted ASHRAE 90.1-2013 as the new baseline for energy consumption performance if it is life-cycle cost effective.

The following initiatives were accomplished in FY 2019:

- Completed occupation of two Institutional General Plant Projects, Building 1012 and the Building 725 Data Center addition, which meet the *Guiding Principles*.
Note: The Building 725 Data Center addition is expected to receive LEED version 4 Gold for Data Centers; it will be the first LEED-certified data center at SNL. Because it is an addition to an existing building, it will not change the LEED building count.
- Received LEED 2009 Gold certification for New Construction for Building 102, which brings the total number of LEED buildings at SNL to 13.
- Received a Reduced Parking Footprint preapproved credit for the LEED for Campus. The LEED for Campus now includes SNL/NM and SNL/CA.
- Continued to ensure that plans for proposed projects consider locations that are pedestrian friendly, contiguous to the existing development footprint, and accessible to public transit, and that emphasize development within an existing employment center. Sandia personnel have integrated LEED for Campus into the development siting process. All specifications were scrubbed for *Guiding Principles* language.

6.2.2 Plans and Projected Performance

The following will be accomplished:

- Meet or exceed LEED Gold for New Construction and *Guiding Principles* requirements. The Building 725 Data Center addition is the first LEED version 4 project.
- Construct a Building 972 GPP, Building 812, and the Agile Lab at SNL/NM, plus a Data Center Replacement at SNL/CA, which will bring the total number of LEED for New Construction-certified buildings to 17.
- Use energy, water, and transportation resource-efficient practices when locating, designing, constructing, and operating new buildings.
- The new Building Systems Engineering Department will ensure that design standards and specifications support sustainable design.
- Include a preference for buildings that are LEED Gold-certified and meet *Guiding Principles* requirements (and/or ENERGY STAR metrics) and that maximize energy, water, and

transportation resource performance credits in all procurement specifications and selection criteria for acquiring new leased space, such as build-to-suit lease solicitations and alternatively financed statements of work.

- Ensure that planning for new facilities or new leases considers sites that are pedestrian and cyclist friendly, near existing employment centers, and accessible to public transit.
- Balance development with the conservation of sensitive land resources.
- As plans are refined for proposed projects, ensure that the proposed project locations are pedestrian friendly, contiguous to the existing development footprint, accessible to public transit, and emphasize development within an existing employment center.
- Meet LEED version 4 for Campus requirements, which includes pedestrian and cyclist accessibility, infill and brownfield development, and access to public transit.
- Incorporate integrated design, simple box energy models, and water calculations when planning new construction to help achieve energy performance at 30 percent more efficient than the baseline in ASHRAE 90.1-2013.
- Incorporate climate-resilient design strategies into the siting of new buildings to prevent siting in a floodplain. Work toward incorporating strategies into programming and design documents.
- Include *Guiding Principles* for New Construction as well as LEED version 4 Gold certification as strategies for design when implementing 42 USC 6834, *Federal Building Energy Efficiency Standards*, for reducing fossil fuel in new buildings and major renovations.
- List compliance with *Guiding Principles* in existing buildings as a desired energy conservation measure in the ESPC Notice of Opportunity.

7.0 Acquisitions and Procurement

Acquisitions and procurement focus on nonelectronic acquisitions, procurement, and GHG supply chain topics.

7.1 Performance Status

To maximize acquisition of sustainable products, purchasing agreements adhere to DOE Acquisition Regulations Clause 970.5223-7, “Sustainable Acquisition Program,” contained in the NTESS M&O Contract.

FY 2019 improvements in purchasing included the following:

- Allied with the just-in-time contracts procurement department to put controls in place that prohibit the purchase of original equipment manufacturer black toner cartridges.
- Teamed with Facilities and Emergency Management Systems personnel, which included building architects and construction project managers, to evaluate the feasibility of piloting a tool to help subcontractors procure environmentally preferable products.

Strides were made toward including BioPreferred and biobased provisions or clauses in eligible contract actions and in tracking the procurement of biobased products. Personnel in the Integrated Supply Chain Management department established a system to identify and track construction and service contracts that (1) had new actions and (2) were required to specify the need for giving preference to environmentally preferable products. [Table 7-1](#) and [Table 7-2](#) demonstrate progress toward complying with sustainable acquisition requirements in FY 2019.

Table 7-1. Sustainable acquisition progress applicable to contracts with Federal Acquisition Regulation clauses

Metric	Recycled	Energy Efficient	Biobased	Multi-Statutory	EPP	Statutory+	Total
Number of eligible contract actions							
Number of contract actions with sustainable acquisition clauses				5 SNL/NM 1 SNL/CA			5 SNL/NM 1 SNL/CA
<i>Percent of contract actions with sustainable acquisition clauses</i>							
Total eligible contract dollars							
Total contract dollars with sustainable acquisition clauses				\$31,095,485 SNL/NM \$400,147 SNL/CA			\$31,095,485 SNL/NM \$400,147 SNL/CA
<i>Percent of contract dollars with sustainable acquisition clauses</i>							

Note: Gray boxes do not require data.
 EPP = environmentally preferable purchasing

Table 7-2. Sustainable acquisition progress applicable to contracts with DOE Acquisition Regulations clauses

Metric	Total
Number of eligible contract actions	5 SNL/NM, 1 SNL/CA
Number of contract actions with sustainable acquisition clauses	5 SNL/NM, 1 SNL/CA
<i>Percent of contract actions with sustainable acquisition clauses</i>	
Total eligible contract dollars	\$31,095,485 SNL/NM, \$400,147 SNL/CA
Total contract dollars with sustainable acquisition clauses	\$31,095,485 SNL/NM, \$400,147 SNL/CA
<i>Percent of contract dollars with sustainable acquisition clauses</i>	

In an effort review and implement EPA recommendations for specifications, labels, and standards that designate environmentally preferable products and services, a process was established to obtain construction submittals for materials and resources from an architectural and engineering firm that uses a database of products that meet EPA recommendations and have the approved green labels. This process is being evaluated for future expansion into other construction activities and other environmentally preferable purchasing categories.

7.2 Plans and Projected Performance

BioPreferred and biobased provisions or clauses in eligible contract actions will continue to be pursued, and biobased product purchases will be tracked. In addition, the process may be expanded for obtaining construction submittals for materials and resources from firms that use a database containing products that meet EPA recommendations and have the approved green labels.

8.0 Measures, Funding, and Training

Measures, funding, and training focus on efficiency and conservation measures, performance contracts, appropriations and direct obligations, and training and education.

8.1 Efficiency and Conservation Measures

8.1.1 Performance Status

To prioritize and implement efficiency and conservation measures, a scoring process is used. A range is used to score criteria in each category, such as: achieving compliance with federal requirements; reducing the use of electricity, gas, and water; and achieving a simple payback period. Life-cycle cost analysis is not currently being used but may be considered in the future.

Energy efficiency and conservation projects are not currently measured and verified. The plan is to use SkySpark to measure and verify analytics in the future. In order to implement measurement and verification practices, an investment in metering is needed.

In addition to a limited budget, utility rates are low, there are no demand charges, and costs to perform work are high, making it challenging to implement energy conservation projects. Indirect funding has been used to support relatively small projects in FY 2019, and the funding for energy projects is at risk every year due to other competing needs of the organization.

8.1.2 Plans and Projected Performance

Depending on the availability of funding, SkySpark will be used to measure and verify analytics in the future. The SNL *FY 2017 Energy and Water Metering Implementation Plan* will be updated in 2020 to address the metering and funding needed.

8.2 Performance Contracts

8.2.1 Performance Status

NTESS does not have an ESPC. However, a Notice of Opportunity has been developed to pursue an ESPC and plans to partner with NNSA in this effort. NTESS used the Federal Energy Management Program and one of the organizations identified as a Sandia technical partner as resources in FY 2019 to assist in developing the Notice of Opportunity for the ESPC. A barrier to implementing performance contracting at SNL/NM is that NTESS has low utility rates, which makes it challenging to implement performance contracting.

8.2.2 Plans and Projected Performance

In FY 2020, NTESS plans to partner with NNSA to pursue an ESPC and to continue using the Federal Energy Management Program and a Sandia technical partner as resources throughout the process.

8.3 Appropriations/Direct Obligations

8.3.1 Performance Status

NTESS did not receive appropriations and direct obligations for facility efficiency improvements in FY 2019 and does not plan on receiving any appropriations or direct obligations in future. NTESS uses a relatively small amount of indirect funding to support sustainability compliance measures, and funding is at risk every year due to other competing needs. The indirect funding that is received for sustainability compliance is allocated through a scoring process.

8.3.2 Plans and Projected Performance

DOE O 436.1, *Departmental Sustainability*, mandates that verified monetary savings from sustainability projects at the site are reinvested, consistent with federal regulations, 42 USC 8256, *Incentives for Agencies*, (e), “Retention of Energy and Water Savings,” and DOE guidance to further additional sustainability projects at the site. Sandia does not currently have a savings reinvestment program but will explore opportunities in future.

8.4 Training and Education

8.4.1 Performance Status

Energy managers are provided training to achieve and maintain Certified Energy Manager certification through the Association of Energy Engineers. This provides energy managers with core competencies and complies with the Federal Buildings Personnel Training Act.

8.4.2 Plans and Projected Performance

Training and certification efforts will continue pending funding availability. Federally sponsored trainings and online training that are offered at no cost to the site will be pursued.

9.0 Travel and Commute

Travel and commuting focuses on all travel-related topics such as Scope 3 GHG emissions, air travel, ground travel, and commuting.

9.1 Employee Commuting

9.1.1 Performance Status

A pilot 4/10 workweek was implemented at SNL/CA in FY 2016 and then implemented as a standard option for all SNL/CA employees in 2017. In 2019, this alternative work schedule option was offered to all employees at SNL/NM.

The total Scope 3 GHG footprint accrued annually by employee commuting is 17,433.46 mtCO_{2e}. More specifically, SNL/CA accrues about 2,787.62 mtCO_{2e} annually, while SNL/NM (which includes all sites except SNL/CA) accrues approximately 14,645.84 mtCO_{2e}.

Communication tools—such as newsletters, letters from Associate Lab Directors, Labs-wide public awareness communications, Earth Day events, and EMS objectives—encourage SNL personnel to change their commuting habits and use alternatives to single-passenger vehicles. In addition, the following incentive and assistance programs are offered:

- Commuter Assistance website: This is an internal website where SNL personnel can create a commuter profile and use it to track their annual Scope 3 GHG emissions and commuting habits. This website also provides links to the following resources:
 - Carpooling and vanpooling: All ridesharing is registered and managed through a web application on the Commuter Assistance website. Users can find carpools in their area or create new carpools; each member of the carpool can print a parking pass, which they can use to park in preferred parking spaces.
 - Bike commuter SharePoint site: This site provides information about biking gear, routes, shower and locker facilities, safety, traffic, and the “Bike Buddy” bike-commuter connector.
 - Mass transit: The City of Albuquerque ABQ Ride bus system has express routes from the west side of the city to serve KAFB. Discounted monthly bus passes are available from the Sandia Employee Recreational Program. Additionally, the New Mexico Rail Runner has 13 different stations from Santa Fe to Belen. For all mass transit and cycling participants, the City of Albuquerque also provides the Guaranteed Ride Home program. This program will provide a free ride to any registered user to any requested destination within the ABQ Ride bus route service area.
 - Personal electric vehicles: Employees are allowed to use designated fleet vehicle charging stations to charge personal electric vehicles at the New Mexico and California sites, when available.
- Alternative work schedules: NTESS offers a 9/80 schedule, a 4/10 schedule, or telecommute part-time as options to a standard workweek. These options all reduce the total number of days driven to and from work by the workforce, and therefore reduce the total emissions produced by the workforce annually.

- A number of additional incentives and programs at SNL/CA make it easier for employees to take advantage of alternative forms of transportation for their commute to and from work.
 - Rideshare: There are several rideshare options. SNL personnel can designate a personal vehicle for the vanpool if the vehicle has seats for at least seven people and is used 80 percent of the time for the vanpool. SNL/CA personnel have partnered with VRide, a local vanpool company, and can lease a vehicle through VRide. SNL/CA personnel may also ride on LLNL vanpools when room is available. Vanpool options include numerous cities in the region.
 - Bike commuting: Fully enclosed bicycle lockers are provided in parking lots throughout the site.

9.2 Business Ground and Air Travel

9.2.1 Performance Status

Specific initiatives have not been established to reduce ground or air travel for the purpose of reducing Scope 3 GHGs; however, corporate travel policy (FIN001, *Travel and Expense Report Policy*) encourages efficiency in business travel. Corporate travel may be undertaken only when alternative methods are not suitable. Employees are expected to help minimize rental expenses by sharing a vehicle.

9.2.2 Plans and Projected Performance

Efforts will continue to increase the number of employees who have set up a commuter profile in the Commuter Assistance website. This will help educate employees about their carbon footprint and improve the accuracy of commuter vehicle emissions data reporting. The target of SNL personnel who have a commuter profile is 50 percent of the workforce by the end of FY 2020. That would mark a 25 percent increase from FY 2019. The following efficiency measures to reduce vehicle miles traveled will also be undertaken:

- Encourage trip consolidation through carpooling and vanpooling.
- Increase the use of teleconferencing, videoconferencing, web conferencing, and web-based collaboration tools.
- Investigate purchasing carbon offsets or RECs to offset business travel emissions, which make up the second greatest contribution to Sandia's Scope 3 emissions.
- Encourage electric vehicle use: install on-site charging stations as an incentive to personnel to buy electric vehicles.

10.0 Fugitives and Refrigerants

Fugitives and refrigerants focus on the management, use, and emissions of fugitive gases and refrigerants. Data on the use and emissions of fugitives and refrigerants for FY 2019 has been reported in the DOE Sustainability Dashboard.

10.1 Fugitives

10.1.1 Performance Status

The primary source of Scope 1 GHG emissions is fugitive emissions, which are considered to be any emissions that cannot reasonably pass through a stack, chimney, vent, or otherwise be collected. At SNL/NM and SNL/CA, the primary source of fugitive GHG emissions is sulfur hexafluoride (SF₆).

SF₆ used in pulsed power and high-voltage R&D applications accounts for the majority of use at SNL/NM. Based on the equipment and processes involved, currently there is no suitable alternative to SF₆ for these applications. The programs and the buildings that house them use large quantities of SF₆; leak detection and repair processes are in place, and SF₆-reclamation units are associated with them. Various other activities conducted throughout Sandia do not recapture the gas. However, the amount of SF₆ involved in those processes is minimal, typically less than 5 percent, in comparison to the pulsed power applications.

Since FY 2012, personnel have been tracking SF₆ additions to the systems at several of the pulsed power facilities (the Z Pulsed Power Facility, High-Energy Radiation Megavolt Electron Source [HERMES] III, Saturn, Short Pulse Nano Second X-radiator [SPHINX], the Sandia Lightning Simulator, and the ElectroMagnetic Environment Simulator). This method of tracking provides better information about SF₆ emissions at the equipment level than only tracking purchases of SF₆. Emissions from all other operations continue to be estimated based on purchases. GHG purchases and estimated use are reported in the DOE Sustainability Dashboard.

SF₆ usage at Saturn, HERMES III, and SPHINX was reduced from 2018 by more than 500 pounds. This was despite a very full shot schedule at all three accelerators.

The department that operates the Saturn, HERMES III, and SPHINX systems initiated several strategies to reduce SF₆ emissions in FY 2019:

- Installed and put into service a new SF₆ reclaimer for Saturn that has a weighed reservoir tank and data logger for real-time usage trending
- Replaced old and/or leaking SF₆ manifolds at HERMES III
- Replaced the connectors for Marxes and Marx trigger generators at the Saturn accelerator with quick-release connectors to prevent the loss of SF₆ during replacement operations

The department that operates the Saturn, HERMES III and SPHINX systems will be installing a new SF₆ reclaimer for HERMES during FY 2020. The new reclaimer has a number of operational improvements over the old system and will help to minimize SF₆ leaks.

The department that operates the Sandia Lightning Simulator and the Electromagnetic Environment Simulator extended the leak detection and repair activities in FY 2019 and replaced gas manifold components. This department has also purchased a portable SF₆ reclaimer and makes it available throughout SNL/NM for recovery of SF₆ that would otherwise be vented to atmosphere.

Fiscal year 2019 was a transition year for the Z machine, as many of the experienced technologists responsible for operating the machine left the department to work on other programs. A new initiative led by the Pulsed Power Sciences Center's leadership team is underway to begin rebuilding the staff to levels appropriate for normal operations with progress realized. This loss of staff created a need to lower the shot rate from 160 shots per year to 100 shots per year. This has impacted the measurable use of SF₆, changing from 26.9 pounds per shot to 47.4 pounds per shot. The annual SF₆ use for the Z machine went from 4,116 pounds in FY 2018 to 4,783 pounds in FY 2019, an increase of 667 pounds. This increased usage came from two human-error-driven releases where 450 pounds of SF₆ was lost in June 2019 and another 750 pounds of SF₆ was lost in September 2019. Both events were reported to DOE/NNSA/SFO in accordance with DOE O 232.2A, *Occurrence Reporting and Processing of Operations Information*, with results of an investigation determining corrective actions and process improvements for implementation.

Even though there were significant losses of SF₆ in FY 2019, much progress was realized in the efforts to reduce use of SF₆ for the Z machine. The Pulsed Power Sciences Center invested \$80,000 in a gas-recovery reclaimer that is being used to remove all the gas from the laser-triggered gas switches and Marx bank switches during rebuild. This required a redesign of the gas switch and Marx interfaces with the SF₆ delivery system. The gas savings is expected to be 15 pounds per laser-triggered gas switch rebuild and 5 pounds per Marx bank rebuild for a reduction of 750 pounds per year.

The Z Pulsed Power Facility team also removed legacy equipment that had leak potential. A second reclaimer was purchased for \$40,000 to assist in the removal of gas from the system to vacuum levels (99.9 percent of SF₆ removed from the components and gas lines prior to its removal). This significant investment has resulted in SF₆ loss or release. Pulsed Power Sciences Center personnel continue to work toward reducing gas use for the Z machine, continuously inspecting and repairing any leaks found in the system regardless of size or complexity (due to location). The Pulsed Power Sciences Center team remains dedicated to reducing the use of SF₆ on the Z machine.

SNL/CA operations have relatively minor usage and emissions of SF₆ from research activities and gas-insulated switchgear compared to other DOE sites. In 2011, the California Air Resources Board's *Regulation for Reducing Sulfur Hexafluoride Emissions from Gas Insulated Switchgear* (CCR 95350–95359) set a maximum allowable leak rate of 10 percent. The leak rate limit declines by 1 percent each year until 2020, when it reaches a final allowable leak rate of 1 percent. To meet the increasingly strict emissions limit for SF₆ emissions from gas-insulated switchgear at SNL/CA, a five-year project was implemented to refurbish or replace all switchgear. The project was completed in 2018. The success of the switchgear refurbishment and/or replacement project is evidenced by the steady decrease in SF₆ emissions at SNL/CA from 17 pounds in 2012 to zero pounds in 2019.

A monthly preventative maintenance program captures early leaks from the switchgears. Personnel will continue to pursue strategies to reduce or replace SF₆ at SNL/CA.

10.1.2 Plans and Projected Performance

SNL/CA is experiencing a significant increase in site infrastructure and operations. With the addition of two new switchgear systems, FY 2021 will see a 15 percent increase in SF6 in equipment. Preventative maintenance will continue to be performed monthly and will identify any leaking switchgear promptly.

Recent climate policy and potential amendments to the California Air Resources Board's regulation on SF6 emissions from gas-insulated switchgear per California Senate Bill 32, *California Global Warming Solutions Act of 2006: Emissions Limit*, requires GHG emissions to be reduced 40 percent below the 1990 level by 2030. Potential revisions will include phasing out the use of SF6 in gas-insulated equipment in the future. Sandia personnel will comply with the requirements at SNL/CA when it becomes applicable.

Anticipated growth in Sandia's pulsed power mission presents a challenge to achieving Scope 1 reduction goals. While SF6 emissions per experiment are expected to decrease, overall emissions may increase, depending on the total work scope.

10.2 Refrigerants

10.2.1 Performance Status

MN471022, *ES&H Manual*, "Refrigerants/Ozone-Depleting Substances in Equipment and Appliances," applies to all operations and activities that involve the purchase and use of refrigerants and ozone-depleting substances, or that involve the purchase, servicing, or disposal of fugitive and ozone-depleting substance-containing appliances or equipment.

The Facilities and Emergency Management organizations maintain a procedure that defines the process for storing and handling refrigerants at SNL/NM. This procedure includes requirements for labeling cylinders containing refrigerant, which meets Federal Acquisition Regulation ozone-depleting substance requirements.

SNL/CA operations have relatively minor usage and emissions of fluorinated gases and refrigerants compared to other DOE facilities. However, operations and emissions are highly regulated by the California Air Resources Board, the Bay Area Air Quality Management District, and EPA.

SNL/CA operations refrigerant usage and emissions are regulated by both the California Air Resources Board and EPA. Appliances containing Board-regulated refrigerants are leak-tested annually or have automatic leak detection systems. Any detected leaks are repaired within 14 days as required by the California Air Resources Board. In addition, in FY 2019 special attention was given to developing a process for ensuring an appliance's refrigerants are recovered at the end of life. Also, an annual refrigerant-inventory reconciliation has been instituted to help maintain control over the refrigerant supply.

Production and importation of chlorodifluoromethane, a refrigerant, is being phased out at SNL/CA, where it is being stockpiled. The relatively large quantity of this refrigerant in the FY 2019 inventory reflects the efforts to stockpile it for future needs.

Most equipment currently in use has been evaluated for substitute gases or other alternatives to using SF₆. In the cases where an alternative or substitute was feasible, it was implemented (e.g., in 2014 the majority of the flash x-ray systems used by the Structural Dynamics X-Ray Department were retrofitted to operate using compressed air rather than SF₆).

10.2.2 Plans and Projected Performance

The Facilities and Emergency Management Services organization has developed an implementation plan for the revised Federal Acquisition Regulation ozone-depleting substance requirements. The plan describes manual and potential automated solutions to meet tracking and reporting requirements.

11.0 Electronic Stewardship

Electronic stewardship focuses on all electronics-related topics, such as acquisitions, operations, end-of-life disposal strategies, and data centers.

11.1 Acquisition

11.1.1 Performance Status

Integrated Supply Chain Management personnel have incorporated the expectation for just-in-time providers of electronic products to register and submit a quarterly report of furnished products in the Electronic Product Environmental Assessment Tool (EPEAT). The report identifies EPEAT product categories, quantity of products purchased, dollar amount of products purchased, EPEAT ratings, and other identifiers. There is also a restricted items list, which identifies EPEAT requirements for personnel when using a corporate purchasing credit card. Electronic items that fall into an EPEAT category must be registered gold or silver in order to be procured with a corporate purchasing credit card.

Computer and display purchases in FY 2019 were 99 percent EPEAT compliant at both SNL/NM and SNL/CA. Applicable imaging equipment purchases (i.e., printers, scanners, and multifunction devices) in FY 2019 were 96 percent and 100 percent EPEAT compliant at SNL/NM and SNL/CA, respectively.

Fleet copiers are corporate-supported, networked, multifunction (print, copy, scan, and/or fax) devices.

- They are standardized on two models, both of which are registered EPEAT gold.
- There are 655 machines in operation at SNL/NM, which provide printing, copying, and scanning functions for multiple personnel at each machine. Assuming on average 12 personnel are served per machine, then approximately 7,860 personnel are served by fleet copiers at SNL/NM.
- There are 76 fleet copiers at SNL/CA; of those 67 are networked. Assuming on average 12 personnel are served per machine, then approximately 804 personnel are served by fleet copiers at SNL/CA.

Updates to Institute of Electrical and Electronics Engineers standards that govern EPEAT criteria for achieving the various ratings has drastically decreased the availability of gold- and silver-rated products. The updates caused a lot of previously gold-rated items to drop to either silver or bronze. Silver-rated items have either dropped to bronze or are no longer rated. Therefore, a request was made to DOE to have the EPEAT clauses in the NTESS M&O Contract amended to remove the Alternate 1 verbiage. This verbiage indicates that certain products must be gold- or silver-rated in order to be purchased. The Alternate 1 clause should only be applied when there are ample EPEAT-compliant products available on the market.

11.2 Operations

11.2.1 Performance Status

Power consumption of Windows computers is managed centrally. Power management features on Windows computers connected to internal networks are enabled with monitor standby after 15 minutes of non-use.

As of November 2019, 100 percent of the eligible machines at SNL/NM and SNL/CA, approximately 31,000 Windows computers, are managed by the power management program.

In addition to the Windows computers, the Konica Minolta fleet copiers are enabled with:

- Power Control and Sleep Mode: After one hour of inactivity, a machine assumes Sleep Mode.
- Energy efficient toner: Konica Minolta Simitri high-definition polymerized toner, used for both office and production printing, has a markedly lower environmental impact during its production, use, and recycling than conventional pulverized toner because the toner fuses at a lower temperature.
- Energy-efficient scanner light: The scanner's light source has been changed from conventional fluorescent lighting to LED, which no longer contains mercury. Customers benefit from power savings and low heat performance, while brightness and scanning speed are increased.
- Low typical electricity consumption value: Konica Minolta office products have especially low typical electricity consumption values; these represent a product's typical electricity consumption weekly based on average office use as defined in the ENERGY STAR program.
- Induction heating fusing technology: Energy consumption is significantly reduced, as the temperature needed for fusing is reached much faster and can be controlled precisely.
- Ozone-free roller charging: High-resolution output is possible over long periods, while suppressing ozone generation.

Just-in-time imaging equipment contracts require EPEAT-registered duplexing-capable desktop printing equipment. This was first made contractual in FY 2013 when EPEAT-registered equipment became the requirement. The Konica Minolta fleet copiers are set up with duplex printing by default. In addition, the print driver is configured for duplex printing. To opt out of duplex printing, users must manually adjust the printer settings for each print job.

11.2.2 Plans and Projected Performance

Power management program personnel will continue to perform the following activities:

- Advertise the preference for fleet copiers and large, networked printers as opposed to individual desk printers.
- Document the quantity of new EPEAT-registered imaging equipment (duplexing capable) deployed.

11.3 End of Life

11.3.1 Performance Status

All electronic assets and equipment at SNL/NM are required to be processed through the Property Management and Reapplication Department to ensure that all federal regulations are adhered to. At end of life, all functional electronics are first made available to the Sandia workforce, then DOE, and then other federal entities in the Albuquerque area. Additionally, functional computers, laptops, monitors, and peripherals are batched and donated annually to school systems across the state, with over 1,250 computers and laptops donated in FY 2019. Remaining functional monitors are sent to a local auction house. All remaining broken or outdated computers and equipment are sent for recycle with a vendor that is both Responsible Recycling and e-Steward certified.

Currently, SNL/CA personnel remove all batteries and hard drives from electronic devices prior to shipment for recycling. Batteries are recycled as universal waste through the Waste Management Program as required by the State of California. Hard drives are shipped to SNL/NM for destruction following standard processes.

11.4 Data Centers

11.4.1 Performance Status

In FY 2019, five corporate data center buildings were identified: Building 880A, Building 725, Building 725E, Building 899, and Building C912. In accordance with the NTESS M&O Contract, site data center inventories and sustainability performance metrics will be reported to the DOE Chief Information Officer via the Integrated Data Call process.

The vision is to move data centers toward energy efficiencies both through procurement and through operational practices such as metering and environmental monitoring. Power efficiencies are being achieved by requesting the procurement of high-performance computing machines that are on the Green500 list, which ranks energy-efficient supercomputers. Additionally, the use of 480V circuits and new close-coupled cooling and power systems will enable larger energy efficiencies in the future.

New cooling strategies for high-performance computing include using 100 percent warm water to cool equipment, eliminating the need to cool the data centers mechanically. This complies with ASHRAE 3-4. Nonmechanical cooling would require a constant power usage effectiveness of 1.03 or less and then reuse energy on the mechanical side.

New thermosyphon technology is being explored, which, at full install, could save up to 20 million gallons of water that would otherwise be lost through evaporation and flow down. Thus far, one thermosyphon has been installed, resulting in savings of approximately 800,000 gallons of water over nine months of operation, while maintaining a power usage effectiveness of 1.09/1.11.

Below are the data center energy and water reduction measures implemented in FY 2019.

Data Center Power Metering and Environmental Monitoring

In SNL/NM, power usage at corporate data center locations, such as Building 880A and Building 725, is tracked at the transformer or switchboard level. Corporate data center metering capabilities were improved in FY 2019, and automated metered data was acquired and monitored to enable automated calculations of efficiency metrics, such as power usage effectiveness.

In FY 2019, 100 percent of the data center rooms in Building 880A, Building 725 East and West, and Building 899 were metered and monitored at the electrical infrastructure level. Rack-level metering and monitoring were also implemented in these buildings.

The corporate data centers were transitioned to a new electrical energy monitoring system, operational since FY 2018, and the Data Center Infrastructure Management tool along with the Facilities Control System have enabled the automated system to provide more accurate measurements.

Cooling equipment operations and power efficiencies were improved in all data center rooms in Building 725, Building 880A, and Building 899 to improve associated power usage effectiveness values. The newest data center, Building 725 East, completed construction at the end of FY 2018 and is anticipated to receive LEED v.4 for Campus Certification and highlighted a design for being 85 percent direct liquid cooled and 15 percent indirect cooled using air-side economization.

Water Consumption Usage

In addition, Sandia's M&O contractor collaborated with National Renewable Energy Laboratory and Johnson Controls on a new hybrid cooling system that reduces water consumption when rejecting heat from the data center.

Air Flow Management

In FY 2019, the cooling unit in the Building 880A continued to provide ancillary cooling for the uninterruptible power supply battery banks and allowed door swipes to be used at each room entrance. This provided increased air-flow management at the room level, optimally configured equipment, and improved Data Center Infrastructure Management tool utilization. An exhaust install was completed in Building 725, and an outdoor air-side economizer was used in Building 725E. The Data Center Infrastructure Management tool was deployed in FY 2015 and has been fully implemented in buildings 880A, 899, 725E, and 725. Data center C912 is in the beginning stages of implementation and is currently using Asset Management in Data Center Infrastructure Management.

Since FY 2014, standardized energy-efficient racks have been adopted and, in FY 2019, older racks continued to be phased out through attrition. New technologies that can decrease the demand on computer room air-conditioning units continued to be tested and evaluated, thereby reducing energy consumption and allowing for higher incoming temperatures, further reducing the number of hours needed for mechanical cooling.

New technologies are being explored and installed while futuristic designs are being tested, including rack-level warm-water liquid cooling along with other methods to reduce chilled water consumption and manage air and water flow more efficiently through the use of elevated ambient operating

temperatures. Goals to reconfigure rack rows to hot aisle/cold aisle configurations to eliminate hot aisle/cold aisle air mixing and reduce energy consumption remained on track.

Data Center Consolidation Project

NTESS continued The data center consolidation project continued to identify, prioritize, and partially or totally combine numerous line-owned data centers, including virtualization or relocation of servers and information technology (IT) equipment on the Sandia Restricted Network, Sandia Classified Network, and Sandia Open Network. As part of this effort, personnel worked with data center consolidation customers to actively defer proposed equipment purchases to virtualization, which reduces server energy consumption, heat output, and rack space footprint.

Efforts continued to decommission most of the IT equipment located in Building 899 and deploy the services and applications supported by that equipment into new, energy-efficient equipment and racks in Building 880A. Building 880A space was reconfigured to provide for equipment from collapsed on-site data centers. The effort included moving a training operation off raised floor space to non-raised floor space. This move was part of an ongoing strategic plan to segregate high-performance computing systems (liquid cooled) from the enterprise environment (air cooled). This is expected to improve airflow efficiency and utilization of available data center space.

Data Center Infrastructure Management

SNL personnel began deploying the Data Center Infrastructure Management DCIM tool was deployed in FY 2015 and has been fully implemented in buildings 880A, 899, and 725East, and 725/West. Data center C912 is in the beginning stages of implementation and is currently utilizing using Asset Management in Data Center Infrastructure Management.

Operating Temperature Increases

Computer room air-conditioning unit temperature set points were increased to decrease cooling-load requirements at data center and server room locations. The combination of increased computer room air-conditioning unit temperature set points and the deployment of plate frame heat exchangers have allowed the Building 880A and Building 725 data centers to increase ambient room operating temperatures to range between 68°F and 75°F. This will enable nonmechanical cooling strategies to be used during more of the calendar year.

Standardization of IT Equipment

IT equipment is being standardized, including racks, as part of data center consolidation, the enterprise environment, and the network infrastructure in all data centers. These racks are self-contained units for air-cooled racks requiring no additional cool air delivery. In FY 2019, the network infrastructure communication room in Building 880A underwent major renovations, which included installation of energy-efficient capabilities. In addition, rows were organized in hot aisle/cold aisle configurations and upgrades included labelling standardization. Energy-efficient switches and routers are being installed, and old equipment is being decommissioned

Data Center Component Recycle and Reuse

SNL personnel continue to seek opportunities to recycle and reuse Components continue to be reused and recycled, including deployment of metal and foam recycle containers inside data center staging areas. Decommissioning activities continued to divert copper and recyclable components from landfill and waste streams.

Review of Availability Requirements for IT Resources

SNL personnel continue to evaluate IT services and applications continue to be evaluated to determine opportunities for placing those services in an idle condition during non-core business hours, thus reducing after-hours energy consumption.

11.4.2 Plans and Projected Performance

Several measures implemented in FY 2019 will continue through FY 2020 in addition to new initiatives to improve data center power metering and environmental monitoring.

At SNL/NM corporate efforts to improve power usage effectiveness at the data centers will include the following:

- Ensure that meters are connected and programmed into the BAS.
- Tie all computer room air-conditioning units into the BAS, and then monitor and control them. The units are equipped with variable frequency drives to provide air delivery in response to increased or decreased IT demand (load).
- Raise supply water temperatures to enable a larger percentage of nonmechanical cooling to be used for a longer duration during the year.
- Ensure that IT procurements are evaluated to consider opportunities for using liquid-cooled equipment instead of air-cooled equipment, which will allow for elevated operating temperatures.
- The Server Consolidation/Virtualization Project will result in significant reductions in server purchases, operations and disposal, and associated power consumption and electronic equipment footprints. This project is ongoing and will continue in FY 2020. It is closely associated with the data center consolidation and cloud computing projects.
- Increase computer room air-conditioning unit temperature set points to decrease cooling-load requirements at data center and server room locations. Maintain intermediate distribution rooms at cool temperatures, and review this as part of the data center consolidation initiative.
- Deploy new IT equipment into standard energy-efficient racks while taking advantage of opportunities to consolidate rack equipment and reduce the electronics footprint.
- Continue efforts to standardize racks as part of data center consolidation, the enterprise environment, and the network infrastructure in all three SNL/NM data centers. Concurrently, rack placements will be configured for hot/cold aisle configurations to optimize efficiencies.
- Integrate the Data Center Infrastructure Management tool with IT equipment operations to ensure optimal placement of equipment in order to maximize energy savings and reduce use.
- Use 480 V direct power to racks for additional energy efficiency by removing transition losses on the power side.
- Reconfigure Building 880A for optimization use of space. Decommission old equipment, install new energy-efficient racks, and move existing equipment into those racks. Concurrently, update the network infrastructure, move it into overhead trays to minimize cabling, and standardize the infrastructure. This room configuration will be studied as a model for future room configurations. The goals are to maximize space use, locate

equipment to maximize energy use, and maximize utilization of the Data Center Infrastructure Management tool.

- Incorporate a design for a generator in Building 725 and make a decision for moving forward with installation.
- Identify and prioritize opportunities to eliminate, virtualize, and co-locate servers from line-owned data centers and server rooms to corporate data centers. Decommission additional data centers and server rooms at all sites.
- Evaluate system availability needs in relation to current operating requirements and look for opportunities to reduce energy consumption, particularly during non-core business hours. Continue efforts to be prepared to collaborate with the New Mexico power company in order to temporarily minimize electrical consumption spikes experienced during severe weather conditions.
- Continue to seek opportunities to recycle and reuse components.

12.0 Organizational Resilience

Organizational resilience focuses on activities that impact resiliency at the Laboratories level.

12.1 Risk and Vulnerability

12.1.1 Performance Status

NTESS recognizes the need to continue the performance of essential functions and operations during disruptive events. The Sandia Leadership Team established two organizations to oversee distinct continuity activities. The National Security Program Operations and Assurance Organization was established in part to ensure ongoing support of the federal government's national essential functions, the DOE and NNSA primary mission essential functions, mission essential functions, and other federal agency primary mission essential functions and mission essential functions. This organization manages all activities related to the Continuity of Operations Program as defined by DOE O 150.1A, *Continuity Programs*. In addition, the Contractor Assurance Laboratories Resilience and Continuity Management Organization was established to oversee business continuity planning for the Laboratories' non-mission essential function programs and activities. Both programs partner with the Emergency Preparedness and Information Technology Disaster Recovery Programs. While these organizations have distinct assigned responsibilities, collectively they ensure sustainment of Sandia's mission.

Based on requirements from DOE O 151.1A and the U.S. Department of Homeland Security *Federal Continuity Directives, Continuity of Operations Program* personnel are actively working to mitigate the impacts of identified risks and will begin the process of identifying and prioritizing additional risks to essential functions.

Using a Plan-Do-Check-Act model, Continuity of Operations Program personnel are implementing a Mission Readiness Program. The program includes corrective actions and lessons learned to evaluate and assess the readiness of the Continuity of Operations Program and plans to ensure that essential functions can be performed during a continuity event. In addition, Continuity of Operations Program personnel prepare an annual Continuity Readiness Assurance Report, which documents the readiness of the program's planning and preparedness activities.

The Continuity of Operations Plan was revised and submitted to DOE through SFO on August 21, 2019. The plan provides the framework for sustaining operational capability for Sandia-identified mission essential functions and essential supporting activities across a range of elevated conditions and ensures that mission essential functions can be performed for up to 30 days, and in the case of pandemic or infectious disease, for up to 60 days.

Continuity of Operations Program personnel have also implemented a Testing, Training, and Exercise Program, with support from the Emergency Preparedness Organization. Testing, Training, and Exercise Program personnel assess, demonstrate, and improve the ability of cognizant organizations to respond to a continuity event.

The Pandemic Disease Response Plan outlines the approach that would be used to respond to a pandemic disease impacting site operations.

EM003, *Mission Critical Policy*, was revised and will be published in FY 2020.

The Environmental Systems organization is responsible for developing and documenting a Climate Vulnerability Assessment for the Laboratories. The Climate Vulnerability Assessment is being developed using DOE tools and guidance. Various stakeholders and key organizations are being consulted to ensure that the report includes adequate, actionable details. Specific climate stressors will be associated with each vulnerability type and scored using established protocols. These stressors and vulnerabilities will be evaluated against key resources to help identify risk. The plan will include recommended resiliency actions where appropriate. Depending on the assessment's outcome, specific mission-critical facilities may require additional quantitative evaluations.

It should be noted that many of the actions currently implemented to support site sustainability—such as designing green buildings, increasing energy savings, and protecting water resources—directly support resiliency actions to reduce potential climate impacts.

12.1.2 Plans and Projected Performance

In FY 2020, the Laboratories Resilience and Continuity Management organization will assess and evaluate Laboratories-level risks during a disruption for non-mission essential function programs and activities through business impact analyses methodology. A business questionnaire will be deployed to determine whether a disruption to programs, operations, or functions could impact the entire Laboratories. Business continuity plans will be provided to organizations that participate in a business impact analysis in FY 2020. Program personnel will assist with the development of organizational business continuity plans throughout the Laboratories over the next three to five years.

A business impact analysis, identification of key core processes, systems interdependency mapping, and recovery time objectives are elements of business continuity planning for the business resiliency of non-mission essential function programs and activities. Collaboration with various centers will be fundamental to the success of maintaining the Laboratories in a readiness posture during a disruption.

In FY 2020, a more efficient site-wide personnel accountability tool will be implemented, and EM004 *Continuity of Operations Policy*, will be submitted for revision.

Infrastructure and long-term plans for business continuity include several guiding policies that will enhance the resiliency of programs. The FY 2019 update to the Long-Range Development Plan and the Campus and Technical Area Master Plans includes the goal to create campus facilities and infrastructure that are resilient and equipped to respond to changing internal and external conditions. Objectives moving forward will include the following:

- Holistic strategies will aim to increase the resiliency of at-risk campus infrastructure systems, particularly those that have the potential to shut down critical mission work and/or result in environmental violation or fines.
- Green infrastructure and low-impact development techniques will be used in new infrastructure where applicable.
- LEED for Campus will be used as a guide for development.

- Shade and vegetation will be used in development projects to reduce the heat island effect.
- Comprehensive planning in undeveloped areas will ensure that new development can utilize sustainable design regarding transportation, energy, stormwater, and landscape.

The ES&H and Facilities and Emergency Management organizations will collaborate to develop a plan to identify innovative stormwater solutions. The goals of the plan are to treat stormwater as a resource, conserve water, and preserve the environment to fully leverage the resiliency of the local natural environment. While this may be a multiyear effort, the goal is to develop an *Arid Green Stormwater Infrastructure Guidance Manual* to be implemented in facilities design standards.

12.2 Emergency Response and Preparedness

12.2.1 Performance Status

The Emergency Preparedness organization conducts the All Hazards Survey for SNL/NM to address natural, technological, and human-caused hazards. The All Hazards Survey must be reviewed and revised every three years or upon significant changes and must be conducted in accordance with DOE O 151.1D, *Comprehensive Emergency Management System*.

Emergency Preparedness personnel create Emergency Planning Hazards Assessments for SNL/NM facilities that were identified in an All-Hazards Survey as possessing quantities of hazardous materials that, if released, could produce impacts consistent with the DOE O 151.1D definition of an “operational emergency” and thus potentially cause serious health and safety or environmental impacts. Emergency Planning Hazards Assessments must be reviewed and revised every three years or upon significant changes and are conducted in accordance with DOE O 151.1D. Emergency Preparedness personnel have plans to conduct All-Hazards Surveys, Emergency Planning Hazards Assessments (if applicable), and threat and hazard identification and risk assessment for remote and leased sites in accordance with a DOE O 151.1D Implementation Project Plan. This effort is part of the Sandia-wide effort to develop service-level agreements with remote and leased sites that encompass multiple mission-support services and organizations.

The SNL/NM and SNL/CA Emergency Operations Centers provide resources and information through a multiorganizational response effort. Organizations that typically respond to Emergency Operations calls include Facilities and Emergency Management Center personnel and other representatives with subject matter expertise related to infrastructure services. Processes exist for alternate Emergency Operations Centers, including virtual operations.

Emergency Preparedness personnel coordinate emergency notification, communication, and Emergency Operations Centers, as well as exercise support for Continuity of Operations plans to enhance resilience measures for related programs. Emergency Preparedness processes and procedures provide a measure for incorporating best practices.

DOE O 151.1D, *Implementation Project Plan*, guides the enhancement and modernization of emergency response procedures for SNL/NM, remote sites, and leased sites.

12.2.2 Plans and Projected Performance

Continuity of Operations Program personnel have identified the buildings that are critical for ensuring sustained operations for mission essential functions. Collaboration efforts have begun with NNSA and Sandia Facilities and Emergency Management personnel to ensure that infrastructure capabilities are available and operational during an incident.

Resources

Related Laboratory Policies and Processes

EM004, *Continuity of Operations Policy*
EMC003, *Mission Critical Personnel Policy*
FAC002, *Space Management Policy*
FIN001, *Travel and Expense Report Policy*

References

42 USC 6834, *Federal Building Energy Efficiency Standards*
42 USC 8256, *Incentives for Agencies*
ASHRAE 90.1-2013, *Energy Standard for Buildings Except Low-Rise Residential Buildings*
California Air Resources Board, CCR 95350–95359, *Regulation for Reducing Sulfur Hexafluoride Emissions from Gas Insulated Switchgear*
California Senate Bill 32, *California Global Warming Solutions Act of 2006: Emissions Limit*
DOE O 151.1D, *Comprehensive Emergency Management System*
DOE O 232.2A, *Occurrence Reporting and Processing of Operations Information*
DOE O 436.1, *Departmental Sustainability*
DOE O 150.1A, *Continuity Programs*
DOE *Strategic Sustainability Performance Plan*
Energy Policy Act of 2005
Energy Independence and Security Act (EISA) of 2007
MN471022, *ES&H Manual*
National Energy Conservation Policy Act
SNL FY 2017 Energy and Water Metering Implementation Plan
U.S. EPA, *Guiding Principles for Federal Leadership in High Performance and Sustainable Buildings*
U.S. Department of Homeland Security, Federal Continuity Directives, *Continuity of Operations Program*