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Sandia National Laboratories

Fiscal Year 2022 Site Sustainability Plan

U.S. DEPARTMENT OF ENERGY | NNSA National Nuclear Security Administration

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Acronyms and Abbreviations

Acronym	Definition
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
B20	biodiesel (20 percent biobased, 80 percent petroleum)
C&D	construction and demolition
CARA	concrete and asphalt recycle area
COVID-19	Coronavirus Disease 2019
DOE	United States Department of Energy
E85	ethanol-based fuel (85 percent ethanol, 15 percent unleaded)
ECM	energy conservation measure
EISA	Energy Independence and Security Act
EPA	United States Environmental Protection Agency
EPEAT	Electronic Product Environmental Assessment Tool
ES&H	Environment, Safety and Health
ESPC	energy savings performance contract
FY	fiscal year
GHG	greenhouse gas
GSA	U.S. General Services Administration
HERMES	High-Energy Radiation Megavolt Electron Source
HVAC	heating, ventilation, and air conditioning
ISO	International Organization for Standardization
IT	information technology
KAFB	Kirtland Air Force Base
LED	light-emitting diode
LEED	Leadership in Energy and Environmental Design
LLNL	Lawrence Livermore National Laboratory
M&O	management and operating
MBCx	monitoring-based commissioning
N/A	not applicable
NEPA	National Environmental Policy Act
NNSA	National Nuclear Security Administration
NTESS	National Technology & Engineering Solutions of Sandia, LLC
PUE	power usage effectiveness
R&D	research and development
Sandia	Sandia National Laboratories

Acronym	Definition
SF6	sulfur hexafluoride
SFO	Sandia Field Office
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
U.S.	United States
USC	United States Code

Units of Measure

Acronym	Definition
°F	degrees Fahrenheit
%	percent
Btu	British thermal unit
gal	gallon
GGE	gasoline gallon equivalent
GSF	gross square feet
kW	kilowatt
MMBtu	millions of British thermal units
mt	metric ton
$mtCO_2e$	metric tons of carbon dioxide equivalent
MWh	megawatt hour

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Executive Summary

Introduction

DOE O 436.1, *Departmental Sustainability*, requires each United States Department of Energy (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.

The Sandia National Laboratories (SNL) SSP and its associated DOE Sustainability Dashboard data entries encompass SNL 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 SNL, to deliver an annual sustainability plan to the DOE National Nuclear Security Administration (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 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

SNL 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. Mission activities are also conducted at other locations, including 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 the total energy, water, 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 11,325 acres. SNL 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. SNL purchases liquid petroleum gas and fuel oil independently from KAFB.

Sandia National Laboratories, California

SNL/CA is located 3 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. A land use permit between the NNSA and the U.S. Air Force is for the nonexclusive use, operation, and occupancy of an approximately 5.5-square-mile portion of the Nevada Test and Training Range at Nellis Air Force Base. The location is used to develop, validate, and certify NNSA-designed weapon systems and components. 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.

Sustainability Definition and Environmental Responsibility

SNL leadership seek to achieve innovative, large-scale institutional transformation toward a sustainable, carbon-neutral environment while increasing mission effectiveness, resource reliability, and resource security. Long-term management aimed at preserving and enhancing the quality of the environment has evolved at SNL sites for more than 50 years. Establishing community environmental partnerships, incorporating sustainable design in new and renovated facilities, increasing energy and water efficiency, and improving environmental restoration are all integral parts of SNL environmental stewardship.

For SNL, 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. NTESS recognizes that SNL is part of a larger community; the impacts of sustainable development on SNL sites extend beyond the physical boundaries. To that end, SNL 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 SNL goals:

- Use every opportunity to improve resource effectiveness for projects, operations, and activities, and 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 SNL 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 ISO 14001:2015, *Environmental Management Systems*, aspects and impacts evaluation process to facilitate identification of objectives relevant to energy, water, and materials sustainability measures, activities, and actions.

Site Sustainability Performance Status and Projected Performance

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

Table E-1. Performance status and projected performance

Prior DOE Goal	Current Performance Status	Planned Actions and Contributions	Overall Risk of Nonattainment
Energy Management			
Reduce energy use intensity (Btu per gross square foot) in goal-subject buildings.	The target for FY 2021 was a 6% reduction from FY 2015, and the performance was a 4% reduction. FY 2021 performance was 4% reduction relative to FY 2020.	Pursue an ESPC in FY 2022 to fund energy conservation measures. Reinvest utility savings to fund energy conservation measures such as MBCx, Smart Labs, and energy efficiency upgrades.	• Medium risk of nonattainment • Financial and management risk • Low utility rates and the high cost of projects make it challenging to justify projects.
EISA Section 432 continuous (4-year cycle) energy and water evaluations.	Completed 18 EISA energy and water audits in this first year of a new four-year cycle, and operations are on track to meet the plan for the four-year cycle.	Continue completing 25% of the audits each year to be on track to complete 100% of the audits by the end of the four-year cycle.	• Low risk of nonattainment • There have been adequate funds and support for EISA audits, and continued funding is expected.
Meter all individual buildings for electricity, natural gas, steam, and water, where cost-effective and appropriate.	Not meeting the goal. Continued to implement the *Utility Meters Life Cycle Asset Management Plan* that was developed in FY 2020.	Implement the *Utility Meters Life Cycle Asset Management Plan* at SNL/NM and SNL/CA.	• High risk of nonattainment • Expectation is that full implementation of the *Utility Meters Life Cycle Asset Management Plan* will facilitate SNL operations to achieve the goal.

Prior DOE Goal	Current Performance Status	Planned Actions and Contributions	Overall Risk of Nonattainment
Water Management			
Reduce potable water use intensity (Gal per gross square foot).	Reduced potable water intensity by 39.4% relative to the FY 2007 baseline. Reduced potable water intensity by 9.5% relative to FY 2020.	SNL/NM: Continue to use the Building 858 reclaim water system and investigate other areas where reclaim could be utilized. SNL/CA: Current plans do not include specific water use reduction activities.	• Low risk of nonattainment
Reduce non-potable freshwater consumption (Gal) for industrial, landscaping, and agricultural.	N/A (SNL does not have any non-potable water)	N/A	N/A
Waste Management			
Reduce non-hazardous solid waste sent to treatment and disposal facilities.	Reduced nonhazardous solid waste sent to disposal facilities.	Continue to look for recycle and reuse avenues in FY 2022. Continue to meet this DOE goal and strive to improve diversion from year to year.	• Low risk of nonattainment
Reduce construction and demolition materials and debris sent to treatment and disposal facilities.	Met this goal in FY 2021. Increased diversion of wood from the C&D Landfill.	Work to remove the stored concrete and asphalt at CARA.	• Low risk of nonattainment
Fleet Management			
Reduce petroleum consumption.	Did not meet the goal in FY 2020. Increased the use of petroleum.	Maintain motor vehicle and electric cart loan pools to reduce the number of vehicles and motorized equipment assigned to individual organizations. Continue with E85 marketing efforts.	• High risk of nonattainment • Management risk
Increase alternative fuel consumption.	Did not meet this goal in FY 2020. Decreased the consumption of alternative fuel.	Continue to implement an E85 marketing program in FY 2022.	• High risk of nonattainment • Management risk
Acquire alternative fuel and electric vehicles.	In FY 2020, 91% of all vehicle acquisitions (not just light duty) were alternate fuel vehicle models.	Continue to order alternate fuel vehicle models from GSA when available.	• Medium risk of nonattainment • Technical risk
Clean and Renewable Energy			
Increase consumption of clean and renewable electric energy.	Exceeded this goal. Used purchased renewable energy credits and implemented small renewable energy projects.	Continue to procure renewable energy credits. SNL/CA: Continue receiving shares of the LLNL on-site solar power production facility.	• Low risk of nonattainment

Prior DOE Goal	Current Performance Status	Planned Actions and Contributions	Overall Risk of Nonattainment
Increase consumption of clean and renewable non-electric thermal energy.	Did not increase consumption of clean and renewable non-electric thermal energy. Consumption was approximately 445 MMBtus of thermal energy, the same as in FY 2020.	Have no plans to increase non-electric thermal use. Perform life-cycle cost analyses on these systems, which are not currently financially viable systems.	• High risk of nonattainment • Financial risk • There is a lack of dedicated funds for these efforts.
Sustainable Buildings			
Increase the number of owned buildings that are compliant with the *Guiding Principles for Sustainable Buildings*.	Achieved goal through implementation of the *Guiding Principles* at 18.4% of buildings. Redid the investment plan to bring existing buildings into full implementation of the 2020 *Guiding Principles*. Changed specifications to ensure the certification of all new buildings.	Continue to ensure the certification of all new buildings.	• Low risk of nonattainment
Acquisition and Procurement			
Promote sustainable acquisition and procurement to the maximum extent practicable, ensuring all sustainability clauses are included as appropriate.	Placed a contract with Ecomedes to enhance the Sustainable Facilities Tool so it can be used as a data aggregation tool. Dependent on Procurement putting green product purchasing language with reporting requirements into applicable contracts.	Have interdepartmental team members continue implementing applicable changes to existing work processes and implement new workflows required to add sustainable acquisition requirements where needed to ensure proper establishment of program elements.	• Medium risk of nonattainment • Technical and management risks • A tool is recommended to be created for subcontractors to use in order to submit data; this will require upper management support so work processes are updated to ensure overall success.
Efficiency and Conservation Measure Investments			
Implement life cycle cost effective efficiency and conservation measures with appropriated funds and/or performance contracts.	Developed an independent government cost estimate to support the procurement process for an ESPC.	Continue to pursue an ESPC to release a Notice of Opportunity and select an energy service contractor to complete a preliminary assessment of life cycle cost-effective ECMs.	• Medium risk of nonattainment • Financial risk due to low utility rates and high cost of construction
Electronic Stewardship and Data Centers			
Electronics stewardship from acquisition, operations, to end of life.	Managed electronics stewardship with 93.1% for acquisition, 100% for operations, and 100% for end-of-life acquisitions and operations.	Continue to pursue improvements to this goal.	• Medium risk of nonattainment • Supply chain risk

Prior DOE Goal	Current Performance Status	Planned Actions and Contributions	Overall Risk of Nonattainment
Increase energy and water efficiency in high-performance computing and data centers.	Designed Building 725E, which houses high-performance computing systems, designed for 85% water cooling and 15% air cooling. This design helps the data center to run efficiently, maintaining a PUE of around 1.07 during the colder months. During warmer months, the chiller plant in Building 726 is used to maintain the necessary water temperature, causing the PUE to rise to 1.13, nearly doubling the infrastructure power use.	Install a new cooling system adjacent to the data center. This system will utilize hybrid fluid coolers to improve the data center's energy efficiency. These fluid coolers will be able to return PUE back to 1.07, even during summer months.	• Low risk of nonattainment
Adaptation and Resilience			
Discuss overall integration of climate resilience in emergency response, workforce, and operations procedures and protocols.	Addressed climate resilience by continuity of operations and emergency management risk-based planning and assurance measures that address a variety of hazards to assist in the prioritization of assets, efforts, and personnel. Included the impacts of climate change included in risk mitigation efforts. Focused continuity efforts on incorporating resilience measures to provide emergency backup power to buildings supporting mission essential functions.	Evaluate long-term opportunities to enhance capabilities of emergency power generation through the integration of a microgrid. The microgrid would include renewable energy sources that mitigate GHG emissions, enhance power resiliency, and defer costly investments in additional power generation.	• Medium risk of non-attainment • Management risk • If planned resiliency efforts are not completed, there is a risk that impacts on mission essential functions will significantly increase to an unacceptable level.
Multiple Categories			
Reduce Scope 1 & 2 greenhouse gas emissions.	Reduced Scope 1 and Scope 2 GHG emissions by 59.3% relative to the 2008 baseline with a 2% increase relative to FY 2020. This does not include fleet vehicle emissions data.	Continue to improve management of SF6 and facility energy consumption.	• High risk of nonattainment • Management risk

Prior DOE Goal	Current Performance Status	Planned Actions and Contributions	Overall Risk of Nonattainment
Reduce Scope 3 greenhouse gas emissions.	Reduced Scope 3 GHG emissions from commuting by 35.1% from the FY 2008 baseline, with a year-over-year increase of 36% relative to FY 2020. This is 13% lower than the pre-COVID-19 emissions levels recorded in FY 2019. Reduced overall Scope 3 greenhouse gas emissions by 29.3% relative to the FY 2008 baseline.	Continue supporting full-time and part-time telecommuting post COVID-19 as much as is feasible.	• Medium risk of nonattainment when a greater percentage of the workforce resumes on-site operations • Management risk

C&D = construction and demolition
CARA = Concrete and Asphalt Recycle Area
COVID-19 = Coronavirus Disease 2019
E85 = ethanol-based fuel (85 percent ethanol, 15 percent unleaded)
ECM = energy conservation measure
ESPC = energy savings performance contract
FY = fiscal year
GHG = greenhouse gas
GSA = U.S. General Services Administration
Guiding Principles = *Guiding Principles for Sustainable Federal Buildings and Associated Instructions*
MBCx = monitoring-based commissioning
N/A = not applicable
PUE = power usage effectiveness
SF6 = sulfur hexafluoride

Mission Change

SNL personnel develop 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 SNL technologies and services are expected to be high. Since 2009, the workforce has increased by over 5,000 persons to meet national demands.

Effectively managing future demand is critical if SNL 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

Energy intensity is measured and reported for goal subject buildings and for total buildings at the SNL/NM, SNL/CA, and SNL/TTR sites as one combined performance measurement. The measurement for total buildings includes all goal subject and excluded buildings.

Historically, SNL has not reported energy data for SNL/KTF. In fiscal year (FY) 2021, SNL personnel identified energy consumption data for the site; however, baseline energy consumption data is not yet available. Thus the energy consumption data for that site is not reported in the DOE Sustainability Dashboard for this fiscal year. In FY 2022, SNL personnel will continue the search for baseline data to ensure complete and accurate records.

SNL personnel continue to pursue initiatives, projects, and actions to increase energy savings in FY 2021 and beyond. In FY 2021, the goal subject building energy intensity was 131,517 Btu per square foot per year. Goal subject building energy intensity was 4 percent less in FY 2021 than the FY 2015 baseline. Energy intensity was 2 percent above the FY 2021 target but was 4 percent less than in FY 2020.

In FY 2021, the total building energy intensity was 183,397 Btu per square foot per year. The total building measurement includes both goal subject and excluded buildings. Total building energy intensity was 2.8 percent less in FY 2021 than the FY 2015 baseline. Energy intensity was 3 percent above the FY 2021 target but was 7.4 percent less than in FY 2020.

Figure 1-1 shows total and goal subject building energy intensity for FY 2015 through FY 2021.

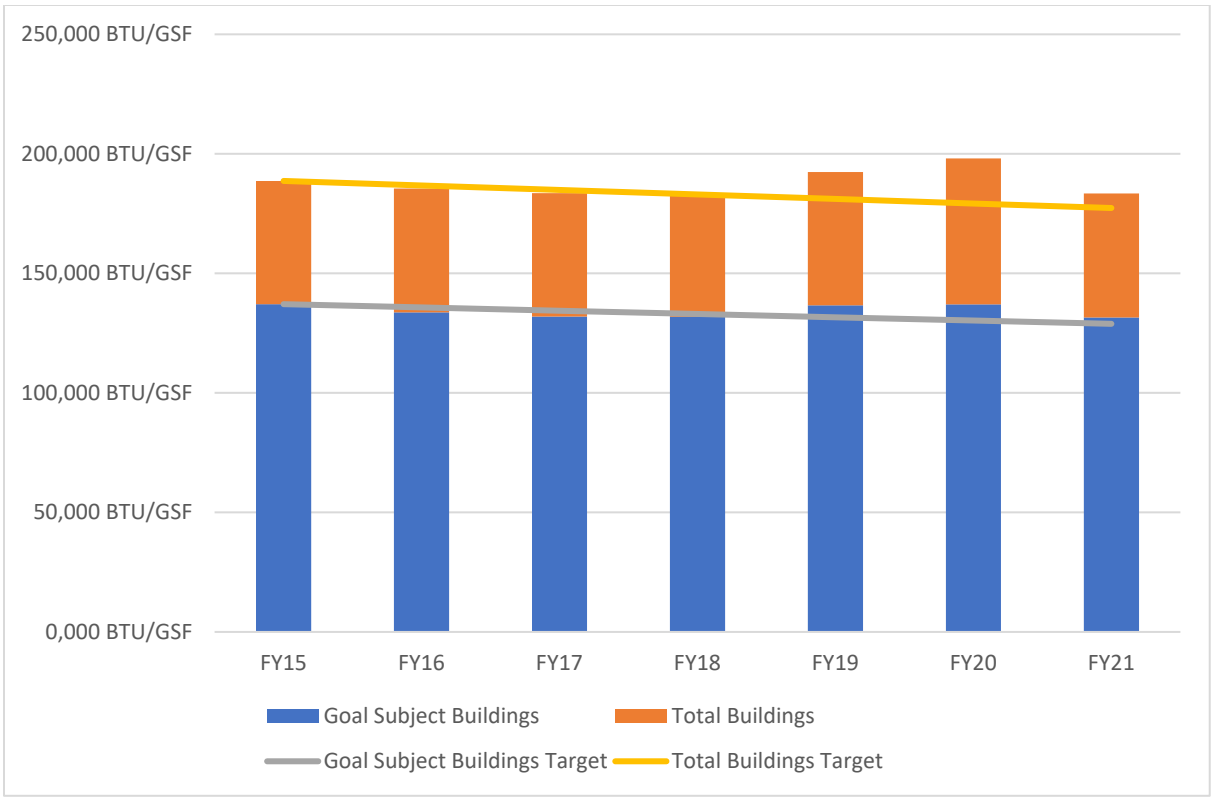


Figure 1-1. Total and goal subject building energy intensity for SNL/NM, SNL/CA, and SNL/TTR (Btu/GSF), FY 2015–FY 2021

Figure 1-2 shows total building energy intensity for SNL/CA, SNL/NM, and SNL/TTR by site.

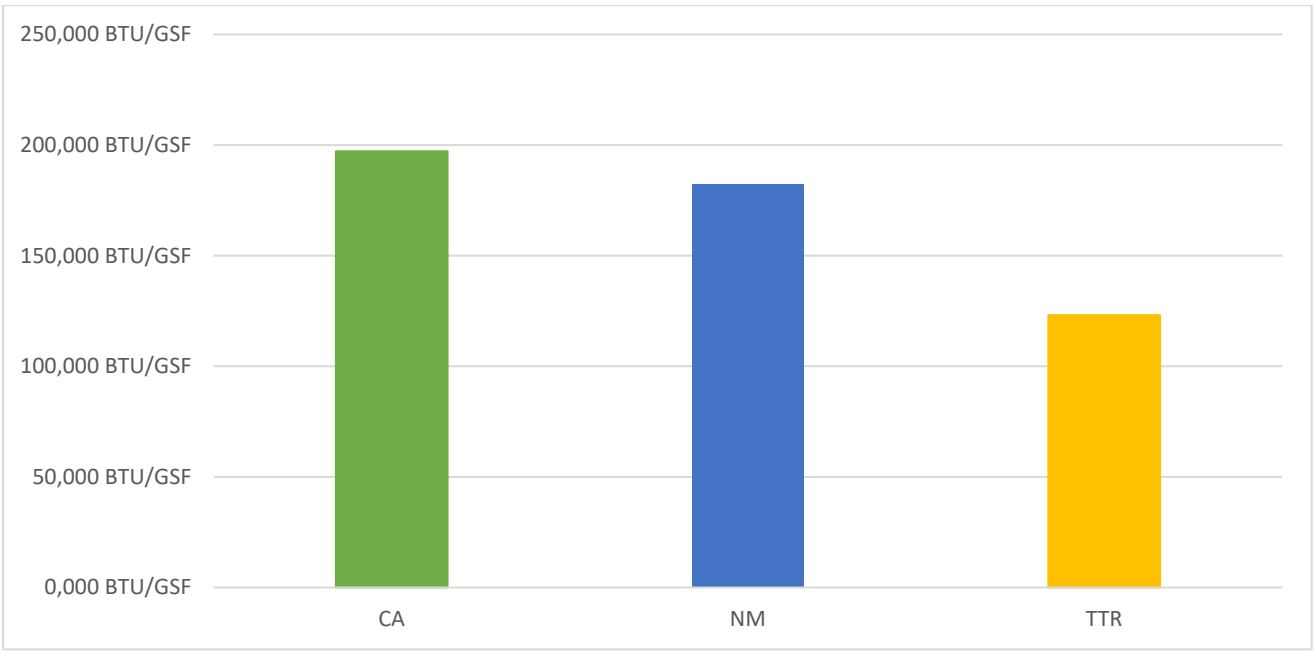


Figure 1-2. Energy intensity for SNL/CA, SNL/NM, and SNL/TTR (Btu/GSF), FY 2021

An initiative in FY 2021 for goal subject buildings was to develop Smart Labs pilot projects for one lab building at SNL/NM and a second lab building at SNL/CA. Smart Labs projects use a risk-based approach for managing ventilation air flow rates, improving ventilation effectiveness, increasing safety, and improving energy efficiency in labs. A lab ventilation risk assessment and a demand ventilation assessment were completed for the project at SNL/NM, identifying performance improvement measures. At SNL/CA, the lab ventilation risk assessment was completed, and the demand ventilation assessment will continue in FY 2022 in order to identify improvement measures. Smart Labs projects have the potential to save a significant amount of energy.

An energy savings plan was developed to achieve federal energy goals in FY 2021 by evaluating 200 energy conservation measures (ECMs) across SNL/NM and SNL/CA sites from condition assessments, building life cycle asset management plans, and energy audits. This energy savings plan will be used to get ECMs into budget cycles for potential funding. Co-benefits of this plan include reducing deferred maintenance, implementing proactive maintenance, increasing safety, increasing reliability, increasing thermal comfort, increasing indoor air quality, increasing support of the mission, and providing the capability to measure and manage energy use. This plan was used to support an energy savings performance contract (ESPC) that is being pursued in FY 2022 and to provide an independent government cost estimate needed to advance this initiative.

A building energy modeling project was conducted in FY 2021 to evaluate ECMs in more than 90 SNL/NM and SNL/CA buildings to provide additional analysis for the energy savings plan. This project calibrated building energy models through an automated calibration process, which resulted in cost and time savings. The results will be presented at the winter American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) conference and will be used to support the energy savings plan and ESPC initiative.

In FY 2021, SNL personnel evaluated utility savings from a reduced electricity rate that was established and championed through a utility contract. A white paper that outlined the cost savings due to the lower utility rates was used to justify reinvestment of utility savings for energy projects. Energy projects were identified, and a commitment was made to invest in the areas of energy efficiency, energy tools, and energy metering for FY 2022.

It will be challenging to achieve the energy intensity reduction goal through FY 2025. The goal to reduce energy intensity 30 percent from an FY 2003 baseline was achieved in FY 2015, in part by implementing many large-energy conservation measures with short payback periods. Going forward, low utility rates and uncertain project funding will impact implementation of future energy conservation measures with longer paybacks. SNL personnel will continue to pursue opportunities such as an ESPC, reinvestment of utility savings, and requests in budget cycles to seek funding to reduce energy intensity.

A significant initiative for an excluded building took place at the Building 725 Data Center. Energy efficiency efforts included improving power use effectiveness (PUE) by installing high-performance cooling systems, warm water cooling for IT systems, thermosiphon chillers that use energy and water saving technology, and establishing a monitoring-based commissioning (MBCx) team to monitor and sustain performance of building systems that provide cooling to the data center. The Building 725 Data Center is projected to have the highest impact on energy use at SNL/NM; therefore, making this data center energy efficient will save a significant amount of energy and water.

The Building 725 Data Center establishes innovative design, technology, and a unique MBCx team to sustain energy and water savings.

SNL personnel participated in DOE ISO 50001 Ready Program training and evaluated the 25 tasks in the ISO 50001 Ready Navigator to determine their status at SNL. A high-level gap analysis was performed to identify areas where the existing energy management program needs improvement to close these gaps and meet the DOE ISO 50001 Ready Program goals.

In FY 2021, a draft net zero emissions goal was developed for SNL/CA. In order to develop this goal, a workshop was held to engage stakeholders, including NNSA team members, where a high-level conceptual design was created to provide renewable energy, energy storage, and a microgrid. Strategies to meet the goal are to electrify heating systems, electrify fleet services vehicles, provide on-site renewable energy, provide on-site energy storage, install a microgrid, replace inefficient buildings, purchase renewable energy, and encourage telecommuting.

In FY 2021, capabilities continued to be built within the SkySpark energy analytics software tool to measure and manage energy. A focused effort for FY 2021 established a customized front end metering dashboard within SkySpark to leverage the tool's capabilities, such as visualizing energy data, performing benchmarking, and performing automated fault detection and diagnostics to identify opportunities for operational improvements. The tool can also identify key performance indicators, allocate energy use to buildings served from chilled water plants, perform weather normalization in order to analyze energy use, and serve as a tool for MBCx. The analytics tool automatically collects 15-minute interval data from weather stations and building energy meters for buildings at SNL/NM and SNL/CA. It also automatically collects additional 15-minute interval data from the building automation system for eight buildings at SNL/NM and four buildings at SNL/CA to support MBCx. Some existing building energy meters cannot provide automated collection to SkySpark, and monthly data is collected manually by a field visit to each of these meters. The *Utility Meters Life Cycle Asset Management Plan* addresses the needs for automated collection of metering data, and identifies locations where meters do not exist and are needed.

Setbacks are an important tool for achieving energy savings in goal subject buildings. A temperature policy at SNL/NM and SNL/CA is intended to save energy in office spaces; the policy includes a temperature setback strategy. Office temperature is maintained between 70°F and 76°F during occupied hours, which is defined as Monday through Friday from 6 a.m. to 6 p.m. Offices with occupancy sensors that are connected to a building automation system have a setback temperature range between 68.5°F and 78.5°F that activates during occupied hours when a space is unoccupied. These occupancy sensors also turn off lighting and airflow in spaces that are unoccupied during occupied hours as a setback strategy. During unoccupied hours, offices have a temperature setback range between 55°F and 90°F, and heating, ventilation, and air conditioning (HVAC) systems are turned off.

Projects are funded to replace energy systems that have met the end of their useful life to reduce deferred maintenance. Deferred maintenance projects are prioritized using a scoring system for selection. Many scoring criteria are used for project selection, one of them being energy reduction. Projects that reduce energy use may receive a higher score than projects that do not save energy.

There were no significant facility dispositions or acquisitions that impacted energy intensity on goal subject buildings.

1.1.2 Plans and Projected Performance

In FY 2022, SNL personnel plan to continue the Smart Labs initiatives and will work with various architectural engineering partners to develop a scope of work, cost estimates for construction, and a phased project approach for executing projects at SNL/NM and SNL/CA. A Smart Labs qualitative study will also be performed across all major lab buildings at both SNL/NM and SNL/CA to identify a prioritized list of candidates. This will be used to develop a strategic approach for implementing a Smart Labs program.

In FY 2022, a pilot MBCx team will implement automated fault detection and diagnostics to identify opportunities to improve energy efficiency and identify co-benefits, such as improving thermal comfort and indoor air quality, increasing energy system reliability, and supporting proactive maintenance. The MBCx team will also support projects with energy conservation measures to sustain proper operations and perform measurement and verification (M&V) of energy savings.

In FY 2022, the factors that contributed to energy intensity reduction for goal subject buildings will be analyzed. An initial analysis identified that weather could be one of the contributors to reduced energy intensity in FY 2021, due to fewer heating degree days than in FY 2020, which can correlate with lower natural gas use due to less heating demand. There were also fewer cooling degree days in FY 2021 than in FY 2020, which can correlate with lower electricity use due to less cooling demand. Another factor that could have contributed to reduced energy intensity was the reduced on-site workforce due to increased telecommuting because of the Coronavirus Disease 2019 (COVID-19) pandemic.

An analysis will be performed in FY 2022 to better understand the energy reduction causes. The analysis will also look at other factors that can impact energy intensity, such as ECM implementation, a change in mission, a change in operations, and the quality of energy data.

In FY 2022, the MBCx team will perform MBCx for the Building 725 Data Center to implement automated fault detection and diagnostics, identify energy efficiency improvements, and gain the co-benefits of maintaining indoor thermal requirements, energy system reliability, and proactive maintenance. The MBCx team will also perform measurement and verification of energy and water savings. This is an important initiative because the data center load is projected to grow significantly through FY 2040, which will impact energy costs. Figure 1-3 shows projected electrical growth for SNL/NM through FY 2040. Figure 1-4 and Figure 1-5 show projected energy cost and consumption through FY 2030 at SNL/NM and SNL/CA, respectively.

In FY 2022, a plan will be developed to close ISO 50001 Ready Program gaps and develop a timeline to meet requirements. This will improve the current energy management program and advance it to meet best energy management practices. SNL personnel will also leverage the existing ISO 14001 Certified Program and its resources to help achieve ISO 50001 Ready Program status.

In FY 2022, funding is being considered for a specialty consultant to build on the net zero emissions work that has been performed in FY 2021 and put together a detailed study and strategy for meeting net zero emissions at SNL/CA.

In the future, the plan is to scale the application of the SkySpark energy analytics software tool to integrate additional 15-minute interval data with buildings that have a building automation system. The building automation system is currently being upgraded to pass data over Ethernet technology

and then integrate with SkySpark through a new front-end capability. This will increase the throughput of data needed to support automated fault detection and diagnostics. This technological and integrated systems approach will also support Smart Labs and an MBCx program. Future plans include upgrading meters and architecture to support automated collection of 15-minute interval data by SkySpark to measure and manage energy use.

Additional energy management tools 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, SNL policy FAC002, *Space Management Policy*, directs management and optimization of building space and plans.

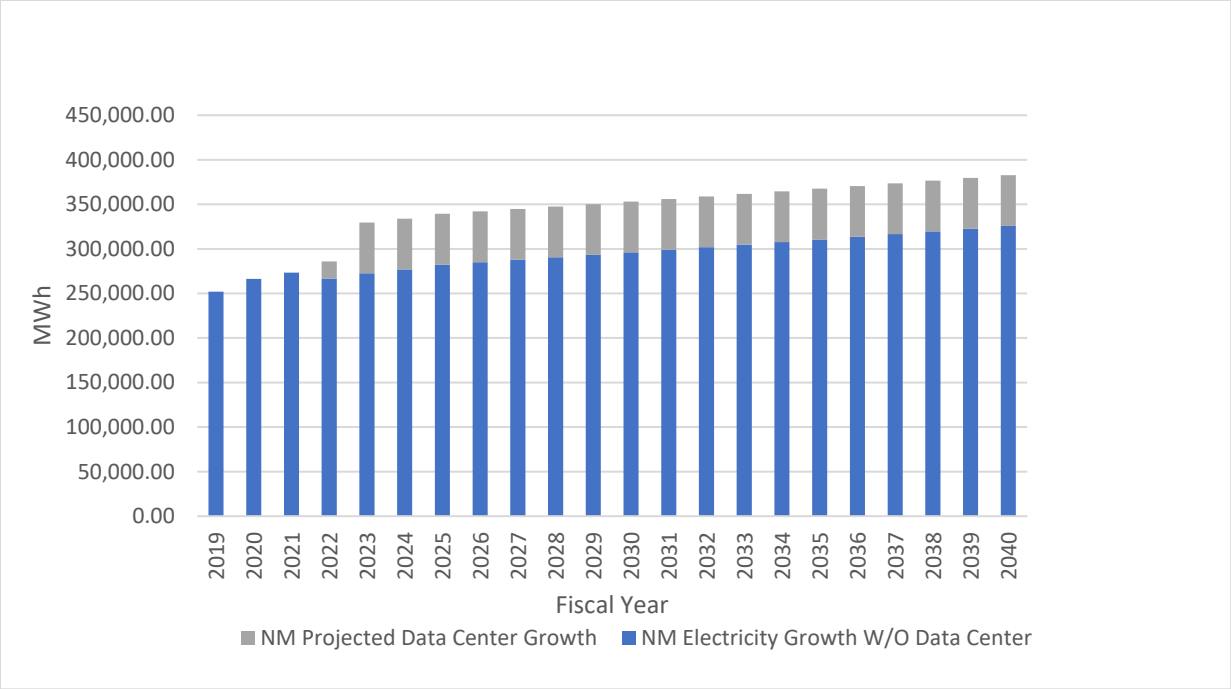


Figure 1-3. Projected electricity growth for SNL/NM, FY 2019–FY 2040

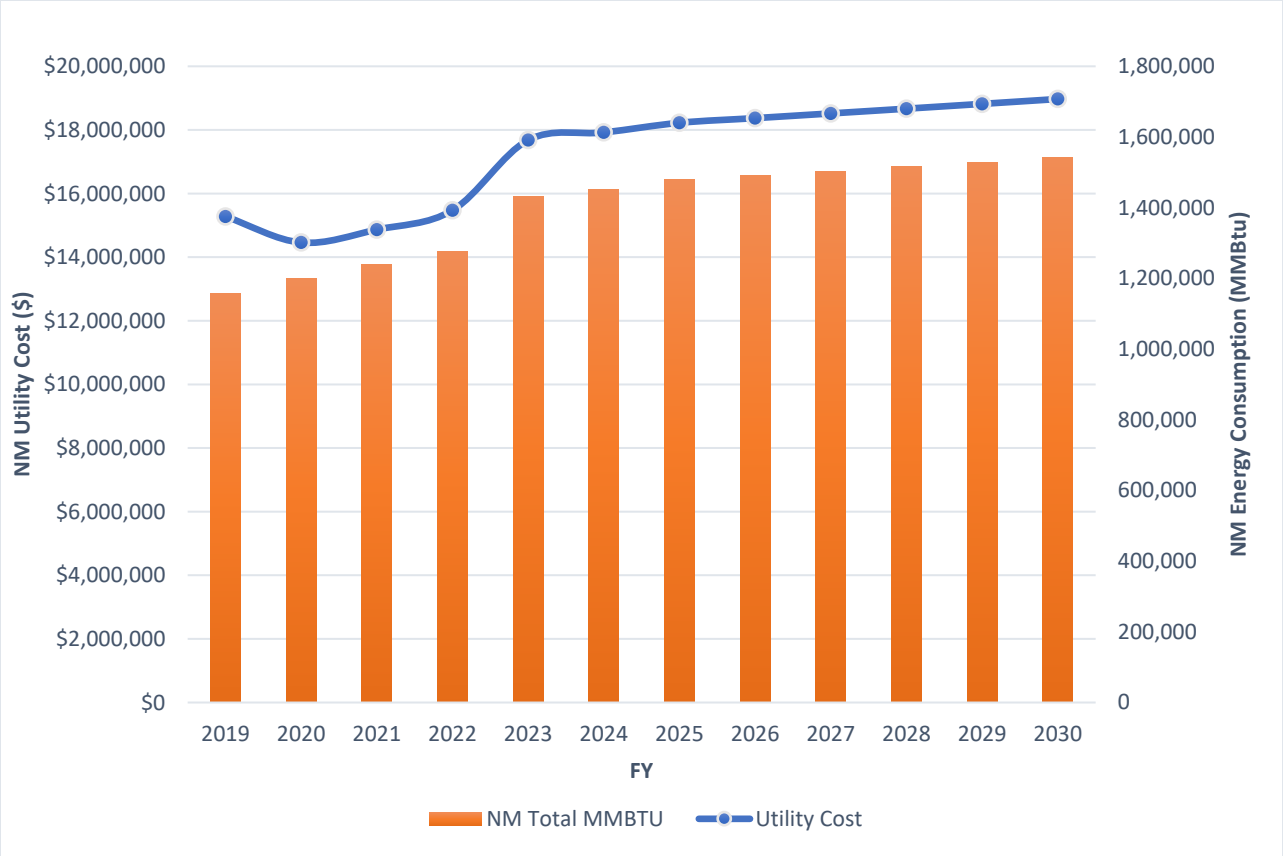


Figure 1-4. Projected energy consumption and cost for SNL/NM, FY 2019–FY 2030

Figure 1-5. Projected energy consumption and cost for SNL/CA, FY 2017–FY 2030

There are no significant planned facility dispositions or acquisitions that would impact energy intensity on goal subject buildings. Some new buildings are being added, which will increase energy use, but this will have a small impact on energy intensity for goal subject buildings since energy is normalized by square footage. There is projected data center growth, which will increase total site energy use and energy intensity for excluded buildings.

Future plans include continuing to implement the setback strategy to manage energy use and using the energy analytics software tool to verify that setbacks are working properly.

SNL personnel plan to continue funding projects to reduce deferred maintenance and will use energy reduction as one of the scoring criteria for selecting projects.

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. FY 2021 was the beginning of a new four-year cycle, and 18 energy and water audits were completed.

SNL personnel developed a comprehensive process for performing building-level energy and water audits. This process is equivalent to the ASHRAE Level 2 energy audit. The process includes completing individual discipline checklists, developing energy load profiles, evaluating historical energy performance, preparing a summary report, and identifying energy conservation measures. The energy and water audits are also used to support *Guiding Principles for Sustainable Federal Buildings and Associated Instructions* (*Guiding Principles*) requirements.

The energy and water audits are not combined with condition assessments, but the projects identified in condition assessments are used and reviewed for energy conservation measures. 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, also known as monitoring-based commissioning (MBCx), is not performed at this time on EISA audits, but a plan is in place to stand up an MBCx team to perform this task. The building automation system is in the process of being upgraded and integrated with the analytics system to support this initiative.

The results from EISA evaluations include the identification of two types of energy conservation measures. The first type is called operational fixes and includes lower-cost fixes. These fixes are submitted as service requests through a computerized maintenance management system to be addressed by operations and maintenance personnel. The second type is called a project and is submitted as an inspection unit in the DOE system and evaluated through the project scoring process to receive funding.

EISA requires benchmarking for energy and water usage. SNL personnel use the U.S. Environmental Protection Agency (EPA) Portfolio Manager system to benchmark monthly data on building energy and water usage. In addition, SkySpark analytics software is being integrated with Portfolio Manager to import data and will be used to perform additional benchmarking, building performance analyses, and weather normalization of energy use.

Energy conservation measures identified in energy and water audits are prioritized based on a project scoring system that includes scoring criteria for categories and are not based on life-cycle cost. The categories for scoring include energy reduction, simple payback, federal energy drivers support, *Guiding Principles* implementation, metering, and water reduction. A score is established for each project using this scoring system and then prioritized based on highest to lowest scores. The cutoff for project selection is based on available funding for sustainability projects.

Energy conservation projects do not use a measurement and verification plan to verify energy savings. Measurement and verification will be used in the future when the MBCx team is established and when an ESPC is in place to implement energy conservation measures.

1.2.2 Plans and Projected Performance

The next four-year cycle of the required EISA Section 432 energy audits for covered facilities will be completed by September 2024. SNL personnel have identified the facilities that consume 75 percent of the energy. and will be audited in the next four-year cycle. All audits will evaluate retro-commissioning and MBCx opportunities.

In the future, the SkySpark analytics platform will be used to perform measurement and verification on projects. In order to implement a measurement and verification plan, an investment is needed to modernize the metering systems at SNL/NM and SNL/CA. If an ESPC is implemented in the future, measurement and verification will be a requirement for all energy conservation measures, including the establishment of necessary metering.

Additional benchmarking plans include expanding the use of SkySpark to collect energy use data for new buildings, *Guiding Principles* candidates, and non-EISA buildings, and to connect the data with Portfolio Manager to perform benchmarking, energy analysis, weather normalization, and ongoing building performance analysis.

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 SNL location. The *Utility Meters Life Cycle Asset Management Plan* (provided as a separate attachment on the DOE Sustainability Dashboard) provides more detailed information.

The energy management team continues to pursue robust funding sources for the metering system such as the Overhead Management Budget Office and G2. Obtaining a metering system has been deemed one of the highest priorities for the energy management team. In FY 2021, a personalized energy metering dashboard was developed and personalized in SkySpark (Figure 1-6). This dashboard will help track energy consumption and meter functionality.

A metering system implementation plan was developed in FY 2020. This plan evaluated the metering priority and developed a risk buy down methodology that SNL personnel have already begun to implement. In FY 2021, the following meters were updated:

- Electric meters: 753, 831, 832, 875, 6580, 9920, 9926, 9972, 9981, 9982F, MO250, MO251, MO290, MO293, WT1, and WT2
- Water meters: 701, 809, 810, 840, 848, 861, 880, 885, 891, 892, 895, 905, 960, 962, 963, 6585, MO290, MO853B, and T33
- Gas meters: 954

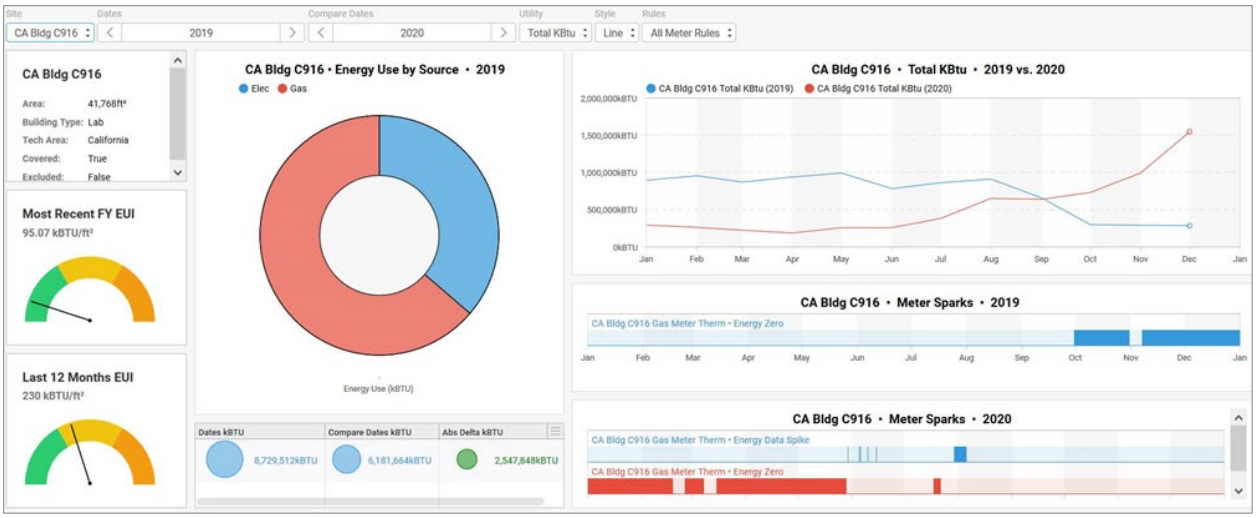


Figure 1-6. Personalized energy metering dashboard in SkySpark

A metering security plan is under development. This plan will help define network and cybersecurity requirements for the future system configuration.

In FY 2021, SNL personnel worked with NNSA to fund a metering study at SNL/CA. This study inventoried the site level meters and high energy-consuming buildings to identify metering gaps and develop a Class 3 cost estimate for replacing and installing meters. This study will support the development of a more detailed investment plan for SNL/CA. The SNL/CA meters also have been connected to the new metering front end.

1.3.2 Plans and Projected Performance

SNL personnel plan to continue installing new meters; however, metering funding remains minimal. The priority is the site level meters, which capture the highest level of energy consumption for the whole SNL/NM site. These meters are used to generate utility bills; therefore, their accuracy directly impacts the budget. Smaller metering projects will continue to be funded until larger scale funding is received.

The gaps identified by the NNSA metering study will be inventoried. This data will be used to develop an investment strategy to enable the modernization and maintenance of the SNL/CA metering program.

See Figure 1-7 for the risk buy down strategy.

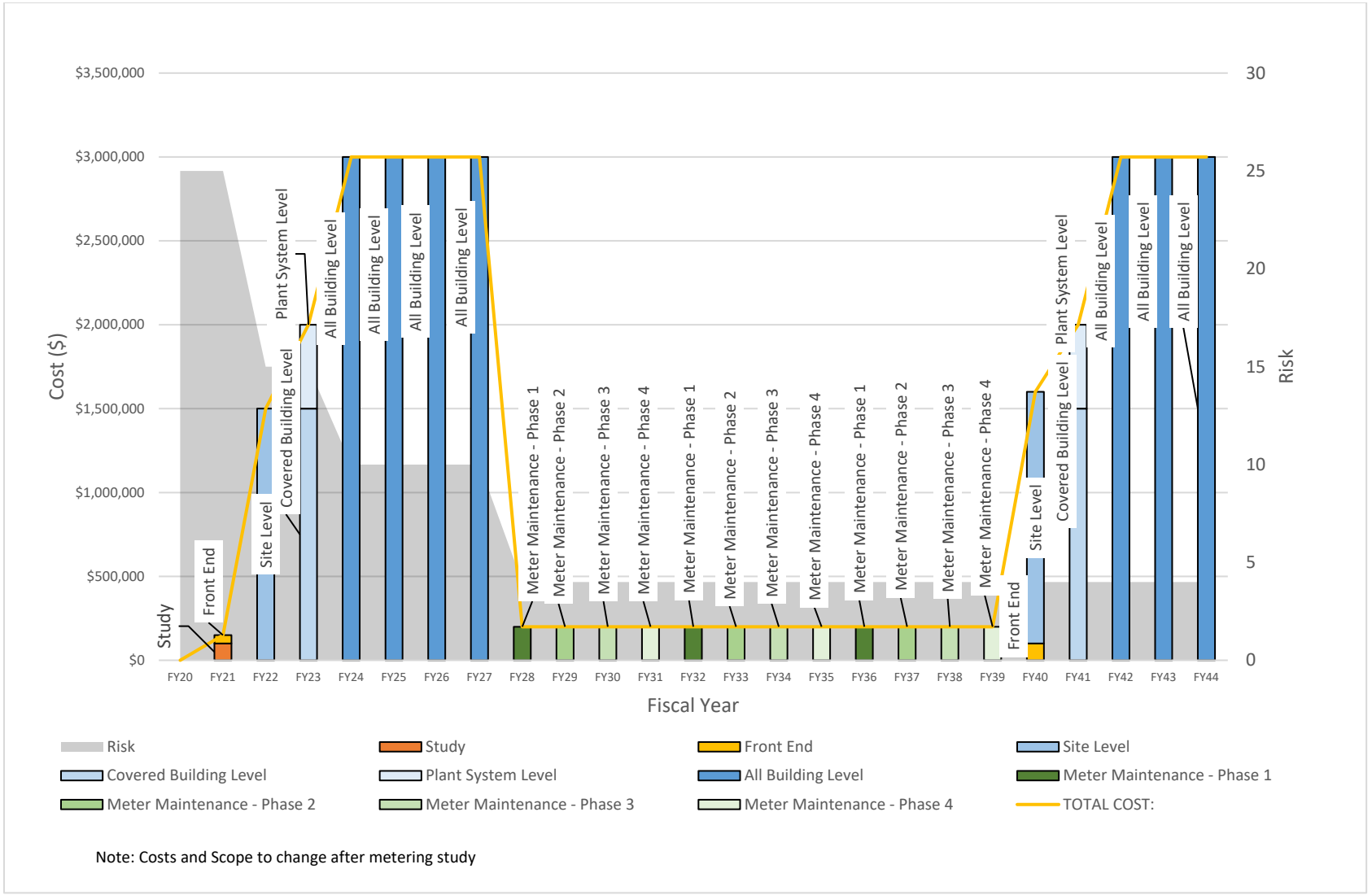


Figure 1-7. Risk buy down strategy

1.4 Non-Fleet Vehicle and Equipment Usage

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 SNL 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 nature of SNL 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 SNL site.

At SNL/NM, non-fleet vehicle and equipment greenhouse gas (GHG) emissions decreased from 398.06 $mtCO_2e$ in FY 2020 to 132.31 $mtCO_2e$ in FY 2021.

At SNL/CA, non-fleet vehicle and equipment GHG emissions decreased from 55.53 $mtCO_2e$ GHGs in FY 2020 to 38.72 $mtCO_2e$ in FY 2021.

At SNL/TTR, non-fleet vehicle and equipment GHG emissions increased from 119.87 $mtCO_2e$ in FY 2020 to 126.28 $mtCO_2e$ in FY 2021.

At SNL/KTF, non-fleet vehicle and equipment GHG emissions increased from 2.83 $mtCO_2e$ in FY 2020 to 19.25 $mtCO_2e$ in FY 2021.

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. No non-potable water sources are used. The Albuquerque Bernalillo County Water Utility Authority, which is the secondary water supplier, is currently pursuing aquifer recharge activities; SNL/NM 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, water uses consist of process, comfort cooling, irrigation, domestic, construction, and laboratory operations. Accurately measuring water use is an ongoing process, as some water uses are not currently metered individually. Figure 2-1 shows a breakdown of water usage at SNL/NM for FY 2021.

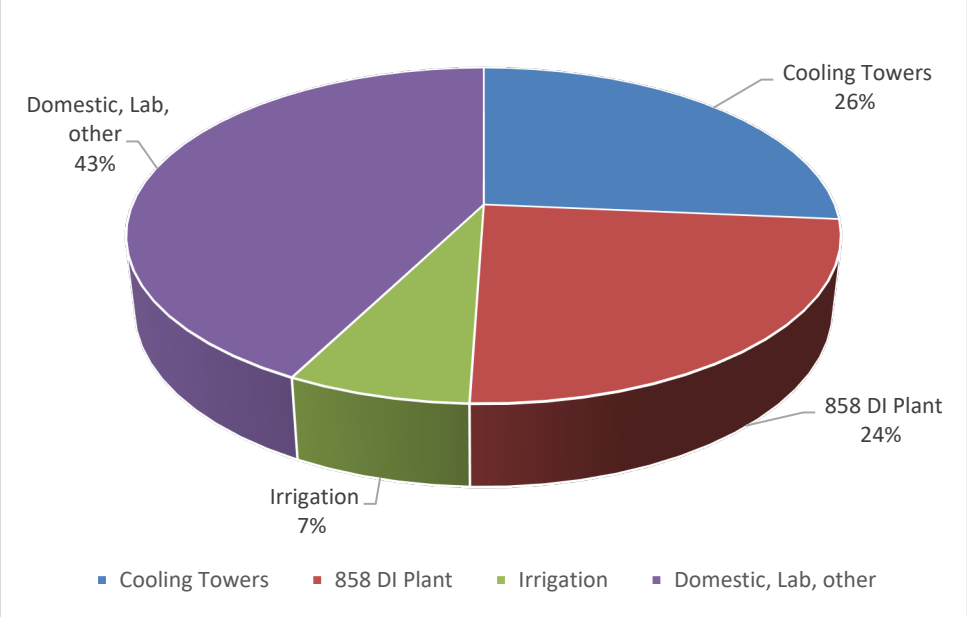


Figure 2-1. Water use at SNL/NM, FY 2021

Water used at SNL/NM is monitored at the site, building, and system levels. When the capability is available, the meters are connected to the Facility Control System. This allows for real-time monitoring and historical data logging. At the building and system level, a current effort is underway to upgrade any outdated meters to types that will connect to the Facility Control System. Due to

their remoteness, site meters are not connected to the Facility Control System but instead communicate with an on-site server via radio. Water use at the site level is recorded and analyzed monthly by technical area.

As of FY 2021, water intensity is down approximately 39.5 percent at SNL/NM when compared to the 2007 baseline. The FY 2021 intensity was 46 gal/GSF, as compared to 49.83 gal/GSF in FY 2020.

Two major factors helped to drive down water consumption in FY 2021. The first factor was the large portion of the workforce that worked remotely due to the COVID-19 pandemic. The second was the reimplementation of the Microsystems and Engineering Sciences Application (858 Complex) reclaim system. Currently, the reclaim water is being used in the acid scrubbing equipment at the 858 Complex, estimated to have saved 5 to 10 million gallons in FY 2021. This system could potentially save up to 20 million gallons of water annually. A challenge in the coming years will be to continue to meet year-over-year water reduction goals as more of the workforce is brought on-site as the pandemic comes to an end.

In FY 2021, high water use and high-water intensity buildings continued to operate at SNL/NM. The 858 Complex accounts for nearly 30 percent of overall water use sitewide. The Building 858 deionized water system alone accounted for 24 percent of overall water usage sitewide (see Figure 2-1). Cooling towers accounted for 26 percent of overall water usage sitewide. The other portion of water consumption is domestic, various labs, irrigation, and unmetered flow. At this time, there is no water balance at SNL/NM.

Currently there is no water management plan based on a conservation perspective, though water conservation goals continue to be managed by maintaining and operating water-conserving systems. Any plan would include KAFB.

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. In FY 2021, work began on adding four additional meters to the sitewide metering network. This will lead to more accurate totals and will include buildings that are outside the metering network in the site totals. In addition, 18 building level meters were either added or upgraded to smart meters with Facility Control System connectivity in FY 2021. Work on adding meters at the building level will continue into the future.

Other water conservation efforts include building audits. The audits are conducted to estimate domestic use based on the water fixtures installed in a building. When an audit deems it necessary, the fixtures in a building 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, EISA requirements and Leadership in Energy and Environmental Design (LEED) standards are incorporated into design and construction documents.

2.1.2 Water Use at SNL/CA

Many facilities at SNL/CA rely on cooling towers as the primary cooling mechanism. Another major water usage is landscape irrigation. For FY 2021, water use at SNL/CA was 33 percent for cooling and domestic uses, 6 percent for irrigation, and 60 percent for unknown losses. Fire system testing accounted for 1 percent of water use. SNL/CA does not have any non-potable water sources.

Water usage for the site (Figure 2-2) is updated based on available meter data. The unknown losses consist of system leaks and construction activities. Personnel continue to better analyze the Unknown category so that more water use in this category will be accounted for in future years.

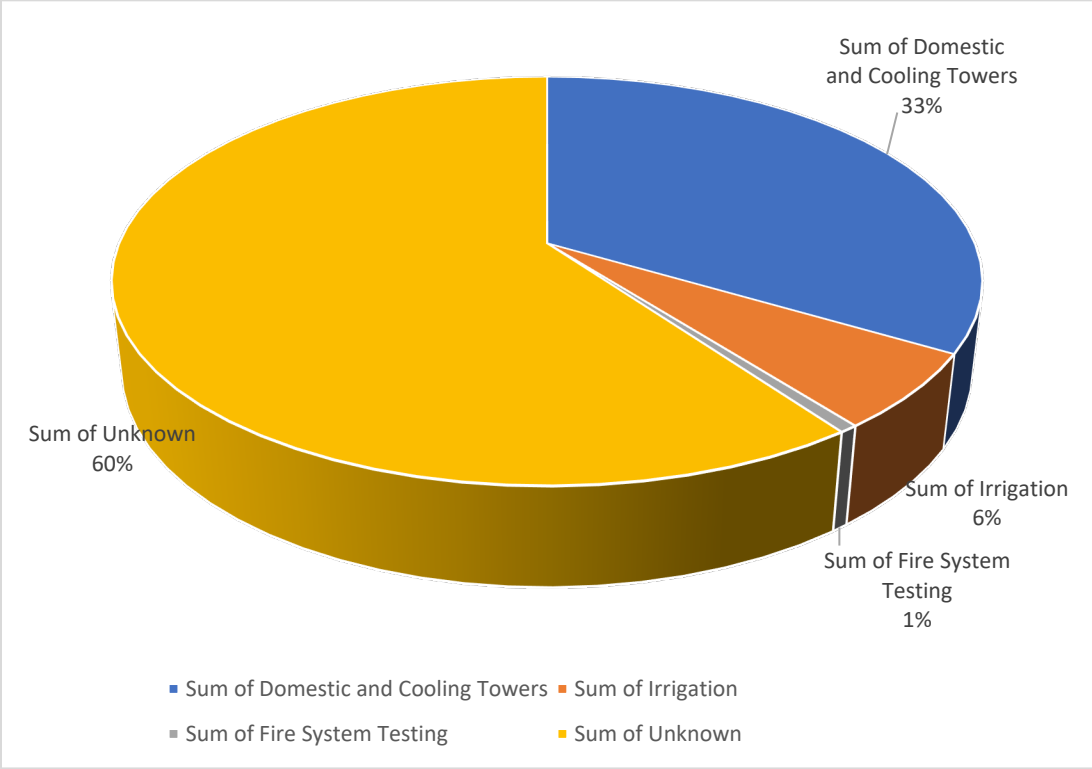


Figure 2-2. Water use at SNL/CA, FY 2021

Factors likely to impact water consumption are new building construction, water main breaks and repairs, and unpredictable rainfall and weather patterns.

SNL/CA water usage for FY 2021 was 40,114,099 gallons. The FY 2021 intensity was 45 gal/GSF as compared to 47.7 gal/GSF in FY 2020. Figure 2-3 shows potable water consumption at SNL/CA from FY 2007 to FY 2021.

Though there is no water management plan based on a conservation perspective, water conservation goals continue to be maintained. Such a plan would need to be a coordinated effort between SNL Facilities, SNL environmental management, and LLNL personnel.

The metering system at SNL/CA has been modernized and is currently operating in an easily maintainable state. However, this only covers most of the large buildings on-site. Overall water

consumption decreased 3.8 percent in FY 2021 from FY 2020. See SNL/CA Water Consumption chart (Figure 2-3).

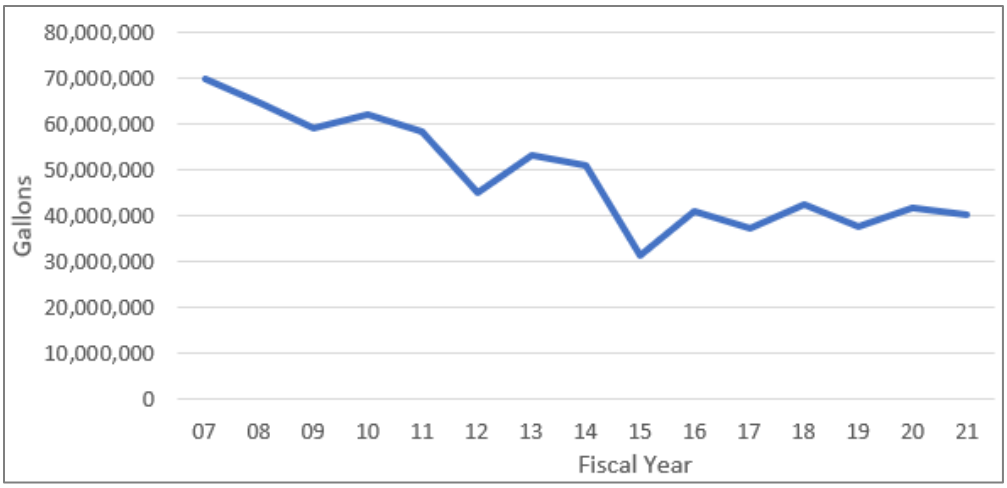


Figure 2-3. Water consumption at SNL/CA, FY 2007–FY 2021

There have been some replacements and additions in best management practices for stormwater management. Stormwater data is now being entered into a spreadsheet for better data management. Previously it was solely entered into the California State Waterboard's database. As new facilities are built or facilities are renovated, water meters will be added. New cooling equipment uses closed-loop systems to minimize water demand. New potable water lines are being installed and replaced as part of the Water Line Project, which will help reduce and replace old leak points.

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.

The *Landscape Master Plan* has been developed for SNL/CA, and stormwater is managed in compliance with federal and state regulations. Retention and infiltration basins that are being installed currently are non-vegetative, and thus do not have an irrigation need. Stormwater captured in these ponds evaporates into the air and infiltrates into the ground.

2.2 Plans and Projected Performance

SNL personnel will continue to explore water conservation opportunities.

2.2.1 Water Use at SNL/NM

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. 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.
- Old meters will be updated to connect to the Facility Control System.
- Water lines will be replaced to help reduce the frequency of flushing due to line and/or valve repairs or replacements.
- Reclaim water will continue to be used in the acid scrubbers into the future. Other ways to utilize any unused reclaim water will also be investigated.
- Water audits will continue to identify opportunities for water use reduction.

SNL 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 goals for high-performance sustainable buildings through implementation of the *Guiding Principles*.

2.2.2 Water Use at SNL/CA

At SNL/CA, water conservation efforts will be continued in FY 2022, including the following:

- As new facilities are built or facilities are renovated, water meters will be added.
- New cooling equipment will use closed-loop systems to minimize water demand.
- New potable water lines are being installed as part of the Water Line Project, which can help reduce and replace old leak points.
- Existing landscaping will be converted to low water-use landscaping, as funding allows.

SNL/CA has no plans at this time to develop alternative water sources. Aquifer replenishing activities are not performed at SNL/CA.

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 (commercial landfills) are used for off-site solid waste disposal.

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

The diversion rate for construction and demolition (C&D) waste in FY 2021 was 87 percent. Of 13,853 metric tons generated, 12,075 tons were recycled or reused, and 1,778 metric tons were disposed of at the KAFB C&D Landfill.

Personnel at SNL/NM have been working with construction contractors to divert concrete and asphalt from the KAFB C&D Landfill to the Concrete and Asphalt Recycle Area (CARA). Credit for diversion cannot be taken until the concrete and asphalt stored at CARA is processed and removed to a recycle vendor. A conscious effort to have the material at CARA processed and recycled will be made in FY 2022. Construction contractors are encouraged to use the on-site truck scale to document their recycle efforts. The truck scale tickets were revised to support collection of data.

In FY 2021, SNL/NM operations generated 1,168 metric tons of solid waste. Of this amount, 320 metric tons (27 percent) were sent to the Cerro Colorado Landfill. SNL/NM personnel diverted 848 metric tons (73 percent) of solid waste from this commercial landfill by recycling (611 metric tons), composting (156 metric tons), and reusing material (81 metric tons). This is illustrated in Figure 3-1.

The amount of waste generated in FY 2021 (1,168 metric tons) was less than that generated in FY 2020, which was 1,653 metric tons, a difference of 485 metric tons. This is due to personnel working from home in response to the COVID-19 pandemic. The diversion rate increased by 11 percent. SNL/NM personnel continue to expand the composting of paper towels throughout non-limited area buildings (29 buildings) in Technical Area I, Technical Area II, and Technical Area IV. Expanding to buildings in the limited areas over the course of the next year will be considered. The focus on communicating the importance of recycling and providing recycling training will increase, and new personnel will be familiarized with the effort to reach Zero Waste by 2025.

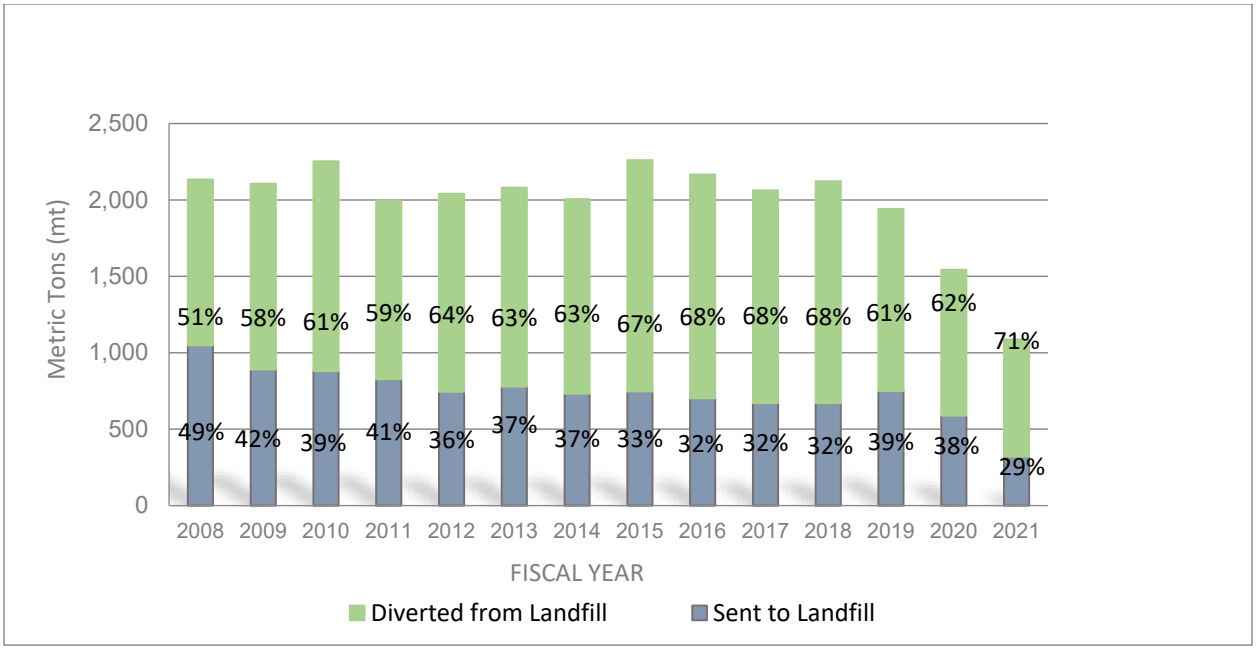


Figure 3-1. SNL/NM municipal solid waste and diversion, FY 2008–FY 2021

SNL/NM personnel divert a significant amount of electronic waste and metal for recycling. The revenue from electronic waste and metal recycling largely supports the recycle program. Revenue also comes from recycling aluminum cans and cardboard. White paper is shredded on-site under witness, and the shredded material is recycled at a cost. Paper that contains information that is Official Use Only or a higher classification is pulverized, and the powder is delivered to a composting facility at a cost. There are also several reuse programs at SNL/NM, including a lead bank, a toner exchange program, and pallet reuse.

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 the Environmental Management System objectives.

3.1.1.2 Waste Diversion at SNL/CA

At SNL/CA, the Facilities Management organization owns and manages solid waste disposal contracts and works in conjunction with SNL/CA Pollution Prevention Program personnel 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, SNL/CA personnel continue to evaluate and improve solid waste management activities. Facilities Management personnel haul mixed recycle waste and solid waste directly from the SNL/CA site to the Republic Services Vasco Road Landfill in Livermore, California. The mixed recycle waste is transferred to and managed at Republic Services Newby Island Resource Recovery Park in Milpitas, California. The solid waste is disposed of at the Republic Services Vasco Road Landfill.

Livermore Sanitation picks up SNL/CA compostable wastes and transports the waste to Recology Blossom Valley in Vernalis, California, for composting. Livermore Sanitation also picks up cardboard, carpeting, concrete, C&D debris, green waste, wood, and solid waste on an as-needed basis. The recyclable waste streams are managed at Alameda County Industries in Alameda, California.

In FY 2021, commercial solid waste increased by 33 percent. The amount of solid waste generated in FY 2021, 431.39 metric tons, increased from 323.76 metric tons in FY 2020. There was an increase in landfill waste, due to a change in the recycling facility's practices. Diversion rates were 74.1 percent of nonhazardous solid waste, excluding construction and demolition debris, and 96.8 percent of construction and demolition debris.

Removing asphalt from a large parking lot to build a new facility and replacing pavement generated 858 metric tons of asphalt in FY 2021. The asphalt was recycled off-site.

Impact from changes in California's recycling fees in FY 2021 were as follows:

- Electronic waste recycling revenues were steady.
- Scrap metal recycling revenues improved due to constrained supply chains and rising prices.
- Mixed recycling (e.g., cardboard, aluminum, glass, or plastic) and mixed paper recycling is not a revenue generator; both streams incur fees, which were steady.

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.

3.1.2 Plans and Projected Performance

The SNL mission and population grew over the past year and likely will continue to grow through FY 2022, not only from new hires, but from personnel returning on-site following the COVID-19 pandemic. This will directly impact the volume of waste generated.

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 2022. This is expected to increase the use of acceptable nontoxic or less-toxic alternative chemicals and processes while minimizing acquisition of hazardous materials.

3.1.2.1 Waste Diversion at SNL/NM

SNL/NM personnel are expanding the composting of paper towels throughout non-limited area buildings (29 buildings) in Technical Area I, Technical Area II, and Technical Area IV, and will consider expanding to buildings in the limited areas over the course of the next year.

The focus on communicating the importance of recycling and providing recycling training will increase, and new personnel will be familiarized with the effort to reach Zero Waste by 2025.

Construction activities are expected to continue at SNL/NM, which will generate significant amounts of dirt, rock, and grub (stumps and roots) to be delivered to the KAFB Landfill. Large amounts of green waste from landscaping projects, which are always ongoing, continue to be delivered to the KAFB Landfill.

Construction contractors will continue to be encouraged to recycle and to report their recycle achievements. In the past this was not done effectively.

3.1.2.2 Waste Diversion at SNL/CA

At SNL/CA, the *Solid Waste Management Improvement Plan* was implemented in FY 2021. The plan addresses solid waste management challenges and provides a pathway to ensure that solid waste is managed as required by local regulations. Information is being provided to Members of the Workforce and contractors through education and signage regarding recyclable or compostable materials.

3.2 Wastewater Treatment

3.2.1 Performance Status

Wastewater discharge permits with the local publicly owned treatment works are in place for SNL/NM and SNL/CA. The number of personnel served by the wastewater treatment system every workday at SNL/NM was estimated as 5,906 for FY 2021. This number was calculated by taking the total number of SNL/NM Members of the Workforce (13,124) and multiplying it by 45 percent, which was the percentage of Members of the Workforce estimated to be reporting on-site during FY 2021. This resulted in 28.1 metric tons of wastewater treatment-related GHG emissions.

At SNL/CA, an estimated 804 personnel were served by the Livermore Water Reclamation Plant every weekday in FY 2021. There are 1,786 Members of the Workforce at SNL/CA, with an estimated 45 percent reporting on-site daily. This resulted in 4.9 metric tons of wastewater treatment-related GHG emissions in FY 2021.

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

4.0 Fleet Management

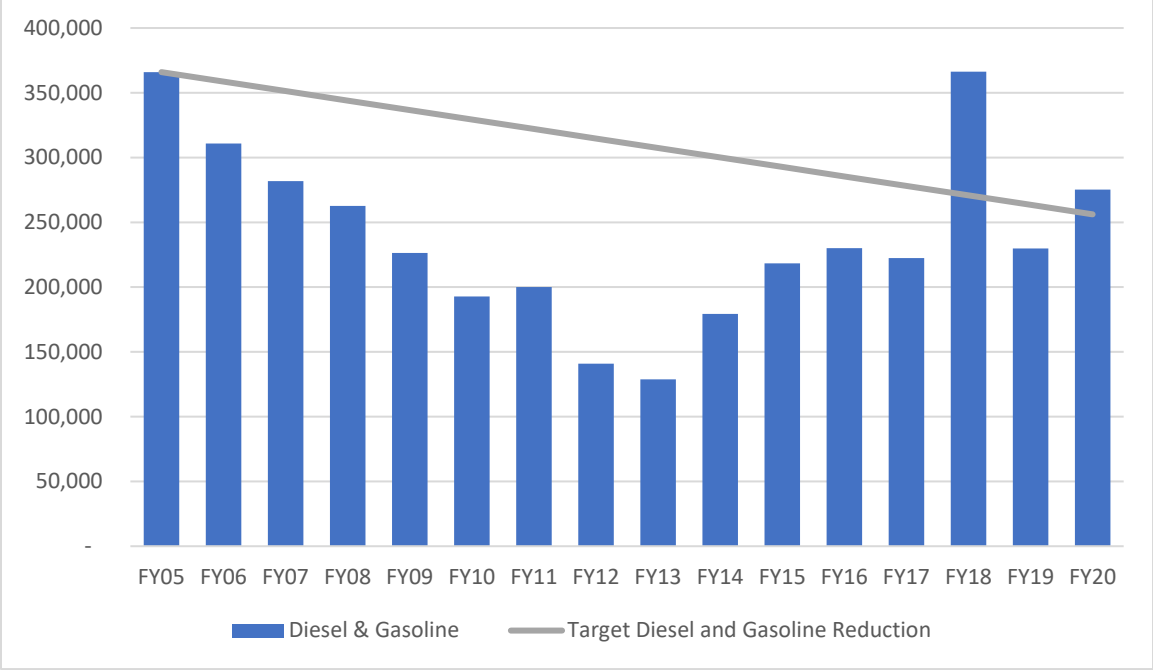
Fleet management focuses on all fleet-related topics, such as GHG emissions and fleet inventory, mileage, and fuels, including petroleum reduction and alternative fuel use. The FY 2021 Federal Automotive Statistical Tool data is not yet available on the DOE Sustainability Dashboard. The data discussed in this section is through FY 2020.

4.1 Performance Status

Figure 4-1 and Figure 4-2 depict fleet petroleum and alternative fuel use through FY 2020.

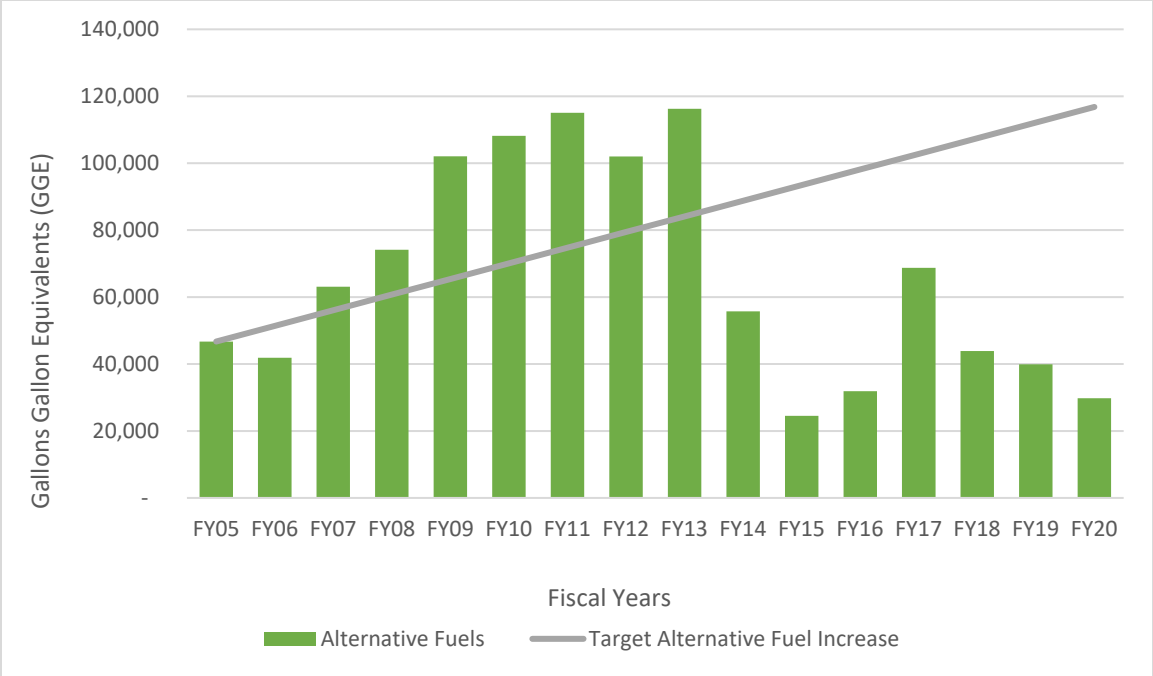
An increase in petroleum fuel use correlated to a decrease in alternative fuel use in FY 2020. In previous years, security patrol vehicles at SNL/NM and SNL/CA developed performance issues when using E85 (ethanol-based fuel that is 85 percent ethanol and 15 percent unleaded); these issues were resolved by using gasoline. As a result, E85 was not used for SNL/NM and SNL/CA security patrol vehicles for several years. Although security patrol vehicles are exempt from using alternative fuels, in FY 2021 SNL/NM and SNL/CA personnel requested security patrol vehicles to be fueled with E85 once again.

A significant increase in mission work activities has resulted in an increase in the fleet vehicle inventory and associated fleet vehicle fuel use. Additionally, alternative fuel vehicle options from the U.S. General Services Administration are limited as manufacturers offer fewer alternative fuel vehicle models than in previous years.



Notes: Includes all sites. Petroleum fuels include gasoline, diesel, and the diesel portion of B20 (biodiesel that is 20 percent biobased and 80 percent petroleum). Data is presented in gasoline gallon equivalents.

Figure 4-1. Petroleum fuel use, FY 2005–FY 2020



Notes: Includes all sites. Alternative fuels include the non-diesel portion of B20, E85, compressed natural gas, and electricity; electrical use includes only SNL/NM data. Data is presented in gasoline gallon equivalents.

Figure 4-2. Alternative fuel use, FY 2005–FY 2002

Table 4-1 illustrates the fleet light-duty alternative fuel vehicle acquisition status through FY 2020. In FY 2021, 82 percent of the fleet vehicle inventory (not acquisitions) was comprised of alternative fuel vehicles (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 alternative fuel vehicle acquisitions, FY 2005–FY 2013

Year	Replacement with Alternate Fuel Vehicles (percent)	Year	Replacement with Alternate Fuel Vehicles (percent)
FY 2005	60	FY 2014	98
FY 2006	60	FY 2015	80
FY 2007	68	FY 2016	93
FY 2008	95	FY 2017	61
FY 2009	100	FY 2018	74
FY 2010	96	FY 2019	58
FY 2011	100	FY 2020	100
FY 2012	96	FY 2021	To be determined
FY 2013	100		

Note: Includes all sites.

All 43 light-duty alternative fuel vehicles acquired in FY 2020 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, B20, and compressed natural gas are available for SNL/NM fleet vehicles at KAFB. Additionally, E85 fueling stations are available for use at SNL/CA. Fleet 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.

To increase the use of E85 in FY 2021, several reminders were placed in the *Sandia Daily News*, designated vehicle owners were contacted, and reminder stickers were placed on the dashboards of newly acquired fleet vehicles. Facilities and Protective Force team leads at SNL/NM were also reminded of the requirement to use E85. Any proposed increase in all-electric vehicles in the fleet vehicle inventory could potentially have a negative impact on future increases in E85 usage.

In 2018, NNSA approved an 80 vehicle increase to the fleet vehicle inventory. Acquisition of additional all-electric vehicles in FY 2021 was not approved by NNSA due to incremental cost restraints. As a result, 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 plug-in hybrid electric vehicles.

- Two solar-powered Level 2 charging stations with capacity for two vehicles each were installed at SNL/NM in FY 2021. SNL/NM now has five stations, and SNL/CA has five stations.
- SNL/CA maintains four Level 2 electric vehicle charging stations in two separate parking lots (eight total), with two charging ports per charger and 16 designated parking spaces for charging vehicles. Two permanent Level 2 electric vehicle charging stations with two charging ports each are maintained at SNL/NM.
- Eighteen solar-powered electric carts were acquired in FY 2021, 17 of which are located at SNL/NM with one at SNL/CA.

4.2 Plans and Projected Performance

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

Petroleum fuel consumption for fleet vehicles will be reduced by doing the following:

- If available, specify alternative fuel (E85 and B20) vehicles when ordering replacements to reduce reliance on petroleum fuels.
- 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 or solar-powered carts. In FY 2020, 37 gas-powered carts were replaced. There are 29 gas-powered carts left in the fleet.

- Convert existing Club Cars with a solar photovoltaic-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 fleet vehicle operators at SNL/NM to use E85 fuel at the KAFB fueling station as well as other locally available E85-dispensing stations. This will include reminders in the *Sandia Daily News*, emails to the designated vehicle owners, stickers on the dashboards, and informational card inserts for every E85 compatible vehicle.
- Continue to encourage fleet vehicle operators to use B20 fuel at the KAFB fueling station.
- Continue to evaluate opportunities to accommodate and encourage the use of personally owned electric and hybrid gas-electric vehicles for Members of the Workforce 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 renewable energy credits and developing on-site and existing R&D renewable energy projects. Renewable energy credits are primarily purchased through an existing contract with an energy service provider.

Procurement documentation for the next renewable energy credit contract for SNL/NM has added the following language in the requirements section: "If available, Offeror shall provide documentation of ability to provide renewable energy credits generated on Indian Land." NTESS is committed to incorporating DOE Procurement Policy Guidance, *Purchase of Electricity, Energy Products and Energy By-Products from Indian Tribes*.

In addition, a power purchase agreement for SNL/CA electricity generation is associated with a photovoltaic farm located at LLNL.

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

In FY 2021 at SNL/NM, the Distributed Energy Technologies Laboratory in Building 833 generated approximately 61.9 MWh of electric power from systems, totaling 98 kW. New systems were brought online at the Photovoltaic Systems Evaluation Laboratory in Building 848 to replace an older array that required decommissioning; at the end of the year, the new systems generated approximately 574 MWh of electric power, totaling 286 kW. The total capacity of photovoltaic electric power generation at SNL/NM increased slightly compared to the capacity reported in FY 2020.

Figure 5-1 shows renewable electric generation through FY 2021.

On-site renewable electricity generation represents less than 1 percent of total energy consumption. Since on-site renewable energy generation capacity is limited, clean and renewable energy goals are satisfied by purchasing renewable energy credits (to cover both site electric consumption and total energy use). Therefore, the purchase of renewable energy credits will be increased to meet future renewable electric energy goals.

SNL personnel are currently working with NNSA on an ESPC Notice of Opportunity. This document identifies renewable energy and microgrids as an energy conservation measure that SNL personnel are interested in pursuing. In FY 2021, an R&D team at SNL/NM evaluated the possibility of using a microgrid with energy storage to meet the resiliency requirements for several key facilities. This study used the SNL Microgrid Design Toolkit to model several different

microgrid configurations that could serve a group of buildings for a 30-day period. Simulations with varying amounts of diesel generation, photovoltaic generation, and battery storage were evaluated based on implementation cost and energy availability for the facilities. SNL/CA personnel are also working to define the benefits and implications of installing a microgrid at their site. A microgrid may also be considered as part of a larger net zero goal for the SNL/CA site.

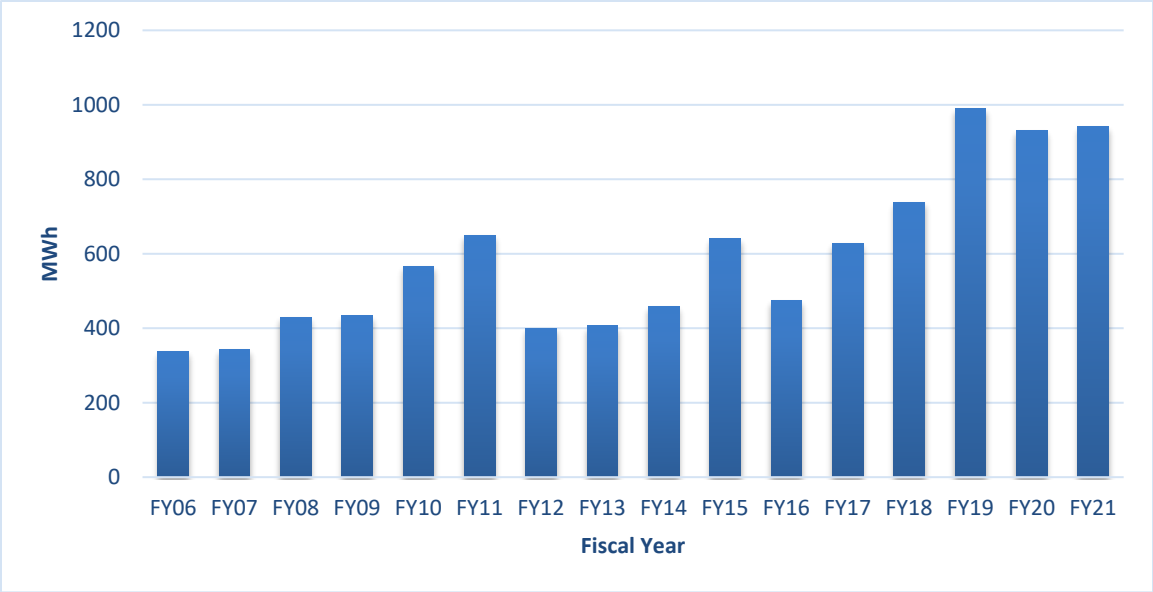


Figure 5-1. Renewable electric generation at SNL/NM and SNL/CA, FY 2006–FY 2021

Installation of renewable energy systems in new buildings is being considered. Each new building over 5,000 square feet requires certification as a high-performance sustainable building. As part of this certification, renewable energy systems must be evaluated for energy modeling, renewable energy credits, and life cycle cost analysis. Thus far, no renewable system has been found that is cost-effective for a building's life cycle. Generally, renewable energy credits must be used to meet high-performance sustainable building renewable energy credits.

5.2 Plans and Projected Performance

Sources of clean and renewable energy that are effective throughout their life cycle are sought continuously. Planned and projected efforts to add clean and renewable energy capacity include the following:

- Purchase renewable energy credits to meet the goals for FY 2022 and beyond.
- Continue to leverage renewable energy R&D activities to reduce and offset energy consumption.
- Continue the planning and evaluation phase for microgrid and energy storage-related projects. As these projects become more defined, acquire support for implementing projects.
- Continue to develop a renewable energy design philosophy to enable the implementation of future renewable energy systems. This philosophy will include the development of a section in *Sandia National Laboratories/New Mexico Design Standards Manual* and project specifications. The goal of this effort is to enable the development of future photovoltaic projects.

Table 5-1 presents on-site renewable electric energy generation and consumption, purchased green electric energy, renewable energy credits, and total electricity consumption through FY 2026. All on-site renewable electric energy generation is consumed on-site.

Table 5-1. Renewable electric energy generation and consumption, FY 2021–FY 2026

Renewable Electric Energy (MMBtu)	Actual FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026
On-site renewable electric energy generation[1]	3,215	3,215	3,215	3,215	3,215	3,215
On-site renewable electric energy consumption	3,215	3,215	3,215	3,215	3,215	3,215
Purchased green electric energy[2]	1,488	1,488	1,488	1,488	1,488	1,488
Renewable energy credits[3]	307,080	307,080	310,492	313,904	317,316	320,728
Total electricity consumption[4]	1,050,163	1,127,738	1,208,490	1,365,954	1,375,670	1,385,482

Notes:
[1]Renewable electric energy generation in FY 2021 is for projects installed. No contracted, funded, or otherwise specific renewable energy generation systems can be projected beyond FY 2021.
[2]Purchased green electric energy is based on the approximate 7 percent provided from the LLNL photovoltaic system.
[3]Renewable energy credit purchases are based on goal requirements and not on an increase in total site energy use from FY 2021.
[4]Total electricity consumption is based on SNL/NM and SNL/CA numbers for FY 2021.

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

Table 5-2. Total renewable energy generation and consumption (electric and thermal), FY 2021–FY 2026

Renewable Thermal and Electric Energy (MMBtu)	Actual FY 2021	Planned FY 2022	FY 2023	FY 2024	FY 2025	FY 2026
On-site renewable electric energy generation[1]	3,215	3,215	3,215	3,215	3,215	3,215
On-site thermal energy generation[2]	445	445	445	445	445	445
Purchased green electric energy[3]	1,488	1,488	1,488	1,488	1,488	1,488
Renewable energy credits[4]	307,080	307,080	310,492	313,904	317,316	320,728
Total energy consumption[5]	1,431,790	1,458,348	1,622,712	1,646,187	1,673,061	1,683,191

Notes:
[1]Renewable electric energy generation for FY 2021 is for projects installed. No contracted, funded, or otherwise specific renewable energy generation systems can be projected beyond FY 2021.
[2]Thermal energy generation for FY 2021 is for the Building 848 geothermal energy system.
[3]Purchased green electric energy is based on the approximate 7 percent provided from the LLNL photovoltaic system.
[4]Renewable energy credit purchases are based on goal requirements and not on an increase in total site energy use from FY 2020.
[5]Total energy consumption is based on SNL/NM and SNL/CA numbers in FY 2021.

6.0 Sustainable Buildings

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

6.1 Guiding Principles

6.1.1 Performance Status

In FY 2021, 34 buildings, or 18.4 percent of buildings at SNL met goals with implementation of the 2008/2016 or 2020 *Guiding Principles*. Table 6-1 provides more detail.

Table 6-1. Meeting Goals through Implementation of the *Guiding Principles*

Building Size	Building Count	Square Footage
Total buildings > 5,000 GSF	184	6,407,545
Compliant buildings	34	1,139,591

All buildings constructed at SNL sites are required to conform to a simple box energy model that shows the building design is projected to perform 30 percent better than an ASHRAE 90.1-2013, *Energy Standard for Buildings Except Low-Rise Residential Buildings*, baseline case. This ensures that designers consider the most efficient approaches in their designs and then buildings operate in an efficient manner. An energy management team reviews design documents for all new buildings to ensure that this requirement is met. This fiscal year, the energy management team developed a sustainable building checklist for ensuring that all new designs meet 42 USC 6834, *Federal Building Energy Efficiency Standards*.

Implementing the *Guiding Principles* in existing SNL buildings is challenging because of the aging building stock. SNL personnel recently reevaluated all eligible facilities for the new 2020 *Guiding Principles*. During that evaluation it was found that the most challenging credit is energy reduction. This credit requires baseline and current year energy data, which is not always available or reliable.

The Sandia National Laboratories/New Mexico Design Standards Manual has been updated to incorporate the latest sustainability requirements to be met through implementation of the latest *Guiding Principles*. The energy management team has been providing training to architectural engineering partners, project managers, and other subject matter experts. During the design process, the energy team is able to review all phases of work to ensure that all items on the SNL sustainable building checklist have been incorporated into the design.

6.1.2 Plans and Projected Performance

The Building Systems Engineering group is working to incorporate sustainable building practices into the *Sandia National Laboratories/New Mexico Design Standards Manual*. Special attention is being paid to future net zero requirements, Smart Labs design requirements, and other design requirements and approaches that will impact fossil fuel reductions.

Programs are being developed to increase the energy efficiency in existing buildings. Facility metering and benchmarking is gradually being improved, which will support the energy reduction credit's accuracy. All projects that are funded through sustainability funding are prioritized based on their ability to support implementation of the *Guiding Principles*.

SNL personnel will continue to develop relationships among the sustainability project teams. Once it is determined exactly what institutional documents, procedures, and processes would be most beneficial to implementing the *Guiding Principles*, these documents will be created (Table 6-2).

Table 6-2. *Guiding Principles* recapitalization and maintenance plan, FY 2020–FY 2031

Building	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	FY 2031
518	$ -	$ -	$ 468,821.69	$ -	$ -	$ -	$ -	$ -	$ -	$ -
700	$ -	$ -	$ -	$ -	$ -	$ -	$ 165,149.15	$ -	$ -	$ -
701	$ -	$ -	$ 572,765.50	$ -	$ -	$ -	$ -	$ -	$ -	$ -
702	$ -	$ -	$ 183,447.46	$ -	$ -	$ -	$ -	$ -	$ -	$ -
703	$ -	$ -	$ 142,928.76	$ -	$ -	$ -	$ -	$ -	$ -	$ -
704	$ 236,607.94	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
705	$ -	$ -	$ -	$ 266,031.58	$ -	$ -	$ -	$ -	$ -	$ -
720	$ -	$ -	$ -	$ 198,384.36	$ -	$ -	$ -	$ -	$ -	$ -
725	$ -	$ -	$ -	$ 252,104.66	$ -	$ -	$ -	$ -	$ -	$ -
727	$ 108,985.72	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
729	$ -	$ -	$ -	$ -	$ -	$ -	$ 162,017.26	$ -	$ -	$ -
730	$ -	$ -	$ -	$ -	$ 257,869.79	$ -	$ -	$ -	$ -	$ -
750	$ -	$ -	$ -	$ -	$ 121,807.62	$ -	$ -	$ -	$ -	$ -
751	$ -	$ 130,993.16	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
752	$ -	$ -	$ -	$ -	$ 158,842.46	$ -	$ -	$ -	$ -	$ -
753	$ -	$ -	$ -	$ 80,288.11	$ -	$ -	$ -	$ -	$ -	$ -
755	$ -	$ -	$ -	$ 164,392.46	$ -	$ -	$ -	$ -	$ -	$ -
756	$ -	$ -	$ -	$ -	$ -	$ -	$ 192,416.26	$ -	$ -	$ -
758	$ -	$ -	$ -	$ -	$ -	$ 168,018.46	$ -	$ -	$ -	$ -
770	$ -	$ 153,410.86	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
800	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 167,221.62	$ -	$ -
802	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 783,463.19	$ -	$ -
803	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 83,932.25	$ -	$ -
809	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 110,384.17	$ -
810	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 635,575.87	$ -
811	$ -	$ -	$ -	$ -	$ -	$ 134,396.56	$ -	$ -	$ -	$ -
821	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 418,595.49
825	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 119,069.82
826	$ -	$ 70,180.39	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

Building	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	FY 2030	FY 2031
831	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 126,129.09
836	$ 288,656.63	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
851	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 85,503.05	$ -	$ -
855	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 116,801.09
856	$ -	$ -	$ -	$ -	$ 130,198.06	$ -	$ -	$ -	$ -	$ -
857	$ -	$ -	$ -	$ -	$ 303,659.91	$ -	$ -	$ -	$ -	$ -
870	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 360,575.03
885	$ -	$ -	$ -	$ -	$ -	$ -	$ 52,716.94	$ -	$ -	$ -
895	$ -	$ -	$ -	$ -	$ -	$ -	$ 360,934.10	$ -	$ -	$ -
898	$ -	$ 792,210.26	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
899	$ -	$ -	$ -	$ 273,622.44	$ -	$ -	$ -	$ -	$ -	$ -
954	$ -	$ -	$ -	$ 68,857.04	$ -	$ -	$ -	$ -	$ -	$ -
957	$ -	$ -	$ -	$ -	$ -	$ 157,741.67	$ -	$ -	$ -	$ -
960	$ -	$ -	$ -	$ -	$ -	$ 274,158.61	$ -	$ -	$ -	$ -
969	$ -	$ -	$ -	$ -	$ -	$ 134,386.75	$ -	$ -	$ -	$ -
971	$ 106,176.32	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
983	$ -	$ -	$ -	$ -	$ -	$ 220,167.48	$ -	$ -	$ -	$ -
1090	$ -	$ -	$ -	$ -	$ 126,532.52	$ -	$ -	$ -	$ -	$ -
6539	$ -	$ -	$ -	$ -	$ 136,781.33	$ -	$ -	$ -	$ -	$ -
6584	$ -	$ 118,887.38	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
6585	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 268,930.24	$ -
6586	$ -	$ -	$ -	$ -	$ -	$ 76,536.78	$ -	$ -	$ -	$ -
6587	$ -	$ 134,384.85	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
MO294	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 87,076.72	$ -
MO295	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 95,127.92	$ -
MO307	$ -	$ -	$ -	$ -	$ -	$ -	$ 111,734.90	$ -	$ -	$ -
MO324	$ -	$ -	$ -	$ -	$ -	$ -	$ 87,028.12	$ -	$ -	$ -
Maintenance cost	$ -	$ -	$ -	$ -	$ 386,204.20	$ 507,193.40	$ 603,638.80	$ 382,993.80	$ 710,934.60	$ 958,050.80
Total cost	**$ 740,426.61**	**$ 1,400,066.90**	**$ 1,367,963.41**	**$ 1,303,680.65**	**$ 1,621,895.89**	**$ 1,672,599.71**	**$ 1,735,635.53**	**$ 1,503,113.91**	**$ 1,908,029.52**	**$ 2,099,221.32**

6.2 New Building Design

6.2.1 Performance Status

Many new SNL buildings are in various design and construction phases. Although design and construction may be completed for some of these buildings in FY 2021, green building certifications may not happen that same fiscal year depending on how fast paperwork can be processed by the third-party certifier. In the future, this will be taken into consideration when forecasting dates. Several different certification approaches are also being piloted, and depending on the outcome of these pilots, a certification strategy may need to be updated and standardized.

This fiscal year, the *Guiding Principles* continued to be incorporated into new building design. No new buildings completed *Guiding Principles* certification this fiscal year, but these new buildings are expected to achieve certification in FY 2022. The existing building stock has been evaluated in comparison with implementation of the 2020 *Guiding Principles* and an investment strategy was created.

There are no net zero buildings at SNL currently. However, Building 6035 is actively being designed as an all-electric building in an effort to support a carbon-free approach.

SNL personnel have a very detailed planning process for all new buildings. This process involves a cross-functional team that evaluates sites for environmental impact, utility interconnections, fit with long-range planning efforts, and many other topics.

6.2.2 Plans and Projected Performance

The following building design practices will be accomplished:

- Building design and construction requirements related to sustainability and resilience will continue to be improved. Current leadership is supportive of the sustainability program. As new requirements emerge, the mandates will be incorporated in new building designs.
- A project manager is working with the energy management team to complete the work scope presented in Table 6-3 in FY 2022. Once completed, these buildings should be able to meet goals based on implementation of the 2020 *Guiding Principles*.

Table 6-3. FY 2022 funded work to support the implementation of *Guiding Principles* in existing buildings

Building	Ventilation and Thermal Comfort Analysis	Recommissioning	Radon Testing	Utility Metering
Building 704	✓	✓	✓	✓
Building 727	✓	✓	✓	✓
Building 971	✓	✓	✓	✓
Building 836	✓	✓	✓	✓

The SNL investment plan for the *Guiding Principles* has defined similar scopes to bring all previously certified and uncertified buildings to meet goals based on implementation of the 2020 version of the *Guiding Principles*.

- A great deal of work went into developing stretch goals that would enable the SNL/CA site to become net zero. An additional study will define this possibility in more resolution. In the future, all new buildings ideally would be programmed as carbon-neutral; however, this depends on forthcoming sustainability guidance.
- The building planning process is currently working very well. A cross-disciplinary team ensures that all buildings plans are well-thought-out and align with the long-range strategic plan. This planning process will be improved as needed.

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 at SNL/NM and SNL/CA adhere to DOE Acquisition Regulation Clause 970.5223-7, "Sustainable Acquisition Program," which is part of the NTESS Prime Contract.

In FY 2021, efforts to increase acquisitions of designated product environmental specifications for SNL/NM included the following:

- Existing acquisition workflows and processes were further evaluated to identify opportunities for improving compliance through collaboration among departments that owned each portion of the processes. The interdepartmental team consisted of personnel from Procurement, Facilities Management and Engineering, Prime Contract, ES&H, Integrated Supply Chain Management, Information Engineering, and SFO.
- A contract was established with Ecomedes to modify the Sustainable Facilities Tool used by the U.S. General Services Administration, creating an application that more accurately tracks and reports data from subcontractors who have sustainable acquisition requirements in their contracts.
- The interdepartmental team identified Facilities as the sustainable acquisitions process owner; Facilities personnel will be responsible for enhancing the sustainable acquisition program to improve compliance with the NTESS Prime Contract clauses related to sustainable acquisition. The sustainable acquisition program is being established to be all-inclusive of the various environmental specification requirements.
- Interdepartmental team members prepared drafts of communications, trainings, a contract clause, and policies that will be presented to affected parties (e.g., Sandia Designated Representatives, buyers, and subcontractors) as appropriate in FY 2022. The drafts will be finalized and implemented once the Ecomedes application is moved from demo to production.
- ES&H personnel engaged with Facilities Materials Sustainability Program personnel to develop Environmental Management Systems objectives that focus on sustainable acquisitions for FY 2022.
- The Facilities Materials Sustainability Program lead aggregates data received from subcontractors and filters it accordingly for submittal into required reports; partners with Procurement personnel to obtain data on applicable contracts for the inclusion of sustainable acquisition language and the monetary value of applicable contracts; and enters the data into the DOE Sustainability Dashboard.

SNL personnel complete a National Environmental Policy Act (NEPA) checklist for proposed construction activities. The NEPA Program lead evaluates each project for utilization of products that fall under various environmental specifications. If it is determined that a project will include use of designated products, a requirement is added to the checklist. The added requirement informs the

NEPA checklist owner that the subcontractor hired to complete the construction project must submit a report that includes the designated products.

Oracle software is used to identify applicable contracts using North American Industry Classification System codes and contract terms and conditions. The applicable terms and conditions include the Federal Acquisition Regulation and DOE Acquisition Regulation sustainable acquisition clauses. The Oracle database is queried to extract a list of contracts with terms and conditions that have sustainable acquisition information. The extracted list is captured in an Excel spreadsheet that is provided to the Materials Sustainability Program lead. The lead evaluates the spreadsheet to distill which contracts should be included in reporting. The process is subjective and manual.

At this time, supply chain vulnerabilities are unknown.

7.2 Plans and Projected Performance

The Ecomedes application was designed in a manner that will standardize the reports received from all subcontractors that have sustainable acquisition requirements in their contracts with SNL. Subcontractors have been identified to participate in user experience testing of the application. Their input will be valuable to ensure that the application is user-friendly, intuitive, and viewed as a valuable resource to assist with reporting requirements.

The application includes a catalog of products that meet various environmental specifications. For example, subcontractors can add compliant products found outside the application and upload products that are noncompliant. Noncompliant products will require a justification for being selected (e.g., cost, availability, or performance). A checks and balances feature is being evaluated to ensure that subcontractors are submitting a sustainable acquisitions report at the end of each quarter. It is anticipated that the application will drastically increase the amount of data that is submitted in FY 2022 reports.

The interdepartmental team for sustainable acquisitions is identifying ways to include information regarding sustainable acquisition requirements in the request for information and request for quote bidding process. Procurement policy personnel are devising a way to identify existing, awarded contracts that require the addition of sustainable acquisition language. Once identified, the revised sustainable acquisition clause (350APR) will be added. The 350APR clause outlines the designated products, reporting structure, link to the Ecomedes application, and available resources. IT personnel are drafting a communication that will be sent to the point of contact listed on the contract; it will include instructions and a user guide for the Ecomedes application.

Interdepartmental team members are evaluating a way to improve the accuracy of reported subcontract information. Once the process of identifying applicable contracts is established, the foundation of that method can be elaborated upon to extract contract information. The new process should make it possible to query the Oracle database more thoroughly and make it easier to identify which contracts were applicable for adding the 350APR clause, which contracts were applicable but exempt for adding the clause (e.g., weapons or less than $250 K), and the monetary value of all applicable contracts.

Once all the initiatives described for SNL/NM are completed, SNL/CA personnel will incorporate the processes.

8.0 Efficiency and Conservation Measure Investments

Efficiency and conservation measure investments 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 to select projects for SNL/NM and SNL/CA. Energy conservation measures are not identified or funded for SNL/TTR and SNL/KTF. 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.

8.1.2 Plans and Projected Performance

In FY 2022, SNL personnel plan to use the DOE Sustainability Dashboard to enter ECMs identified in EISA energy and water audits. The DOE Sustainability Dashboard can be used to calculate life cycle costs for each ECM and track the status of each ECM from an identified measure to completion. These new capabilities in the DOE Sustainability Dashboard can be leveraged to manage, update, and maintain an accurate ECMs list. The DOE Sustainability Dashboard can also track funding sources for each ECM, and this capability will be leveraged to track ECMs that receive funding from sources that are indirect, direct, ESPCs, purchase power agreements, utility energy service contracts, or any other funding source.

8.2 Performance Contracts

8.2.1 Performance Status

SNL operations do not have an ESPC. However, a Notice of Opportunity has been developed to pursue an ESPC at SNL/NM and SNL/CA. SNL personnel are actively working with the Federal Energy Management Program to provide support for a successful ESPC. In FY 2021, a rough order of magnitude independent government cost estimate was created for the costs and savings for potential ECMs that can be implemented with an ESPC. The types of ECMs include HVAC, building automation systems, Smart Labs, MBCx, LED lighting, advanced metering, renewable energy, and resiliency. The independent government cost estimate also supports the procurement process for initiating the ESPC and was submitted to NNSA.

A barrier to implementing performance contracting is low utility rates and the high cost to complete projects in high-security areas at SNL/NM and SNL/CA.

No other alternative financing vehicles are being considered at this time.

8.2.2 Plans and Projected Performance

In FY 2022, SNL/NM and SNL/CA personnel will work with NNSA and Federal Energy Management Program personnel to release the Notice of Opportunity to energy service contractors. Interested energy service contractors will respond to the Notice of Opportunity and will be evaluated for selection to implement an ESPC. The selected energy service contractor will develop a preliminary assessment based on ECMs in the Notice of Opportunity and additional ECMs identified by the energy service contractor. The preliminary assessment is a high-level economic analysis to determine whether an ESPC is viable and which projects are recommended for an ESPC.

SNL personnel plan on using an ESPC to meet the requirements in the Energy Act of 2020 to implement ECMs identified in EISA energy and water audits.

8.3 Appropriations/Direct Obligations

8.3.1 Performance Status

In FY 2021, only internal indirect funding was used to fund energy management program support and ECMs. There were no appropriations or direct funding for ECMs.

In FY 2021, SNL personnel evaluated the opportunity to reinvest utility savings in energy projects due to lower electricity rates. NNSA personnel wrote a white paper that outlined the utility savings and areas where reinvestment could be applied. This white paper was evaluated, and a determination was made to reinvest utility savings in FY 2022.

8.3.2 Plans and Projected Performance

In FY 2022, SNL personnel plan to use indirect funding for energy management program support and ECMs. There is no plan to receive appropriations or direct funding for energy management program support and ECMs. In FY 2022, the plan is to reinvest utility savings to fund energy management initiatives and ECMs. ECMs include building automation system upgrades from pneumatic to direct digital controls, LED lighting upgrades, occupancy sensor to control lighting and ventilation upgrades, air handler upgrades, MBCx activities, ASHRAE 55 indoor thermal comfort assessments, ASHRAE 62 indoor air quality assessments, *Guiding Principles* implementation, air compressor system upgrades, Smart Labs assessments, direct evaporative cooling, metering, and building energy modeling.

8.4 Training and Education

8.4.1 Performance Status

Training is being provided to energy managers so they can maintain Certified Energy Manager credentials through the Association of Energy Engineers. This furnishes 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 training and online training that are offered at no cost will be pursued.

9.0 Travel and Commute

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

9.1 Personnel Commuting

9.1.1 Performance Status

SNL personnel use an internally designed web application called the Commuter Profile in lieu of surveys to capture all commuting data. This application shows personnel their estimated Scope 3 GHG emissions footprint by analyzing their work schedule, driving distance, and commuting habits. This data is aggregated via the application and processed through a reporting dashboard to estimate the total SNL commuter Scope 3 GHG emissions footprint quarterly. Replacing surveys with the Commuter Profile has increased participation, data accuracy, and the ability to use the data dynamically.

The Commuter Assistance website gives Members of the Workforce an opportunity to connect with the following emissions-reducing resources:

- Rideshare. There are several rideshare options at both SNL/NM and SNL/CA. Personnel can set up carpooling through the Commuter Profile or designate a personal vehicle as a vanpool if the vehicle has seats for at least seven people and is used 80 percent of the time for the vanpool. Both of these commute methods are incentivized via priority parking. 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. Additional vanpool options are available through numerous cities in the region.
- Biking commuter SharePoint site. This web page provides information about biking gear, routes, on-site shower and locker facilities, safety, traffic, and the "Bike Buddy" bike commuter connector. Bike commuting is supported by bike commuter groups at both SNL/NM and SNL/CA and by the Virgin Pulse health points system. The points accumulate and translate into money in the employee's Health Reimbursement Account or Health Savings Account and help them cover medical costs.
- Mass transit at SNL/NM. 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 (train) 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.
- Mass transit SNL/CA. There are two intercity rail systems, a local bus system, and multiple shuttles from transit stations to SNL/CA. These commuting options, as well as biking and vanpooling, are supported by the option of a Travel Spending Account or a tax advantaged reimbursed account to help Members of the Workforce offset costs of alternative commuting.

- Personal electric vehicles. Members of the Workforce are allowed to use designated fleet vehicle charging stations to charge personal electric vehicles at SNL/NM and SNL/CA, when available. This is done by joining the Personal Electric Vehicle Program and paying a monthly fee to cover all charging expenses, as well as by reserving preferred parking spaces near charging stations. This program incentivizes personal electric vehicle use by offering charging in priority parking locations.

Alternative work schedules also encourage the workforce to drive less and thus reduce commuter emissions. SNL offers a 9/80 work schedule and a 4/10 work schedule as well as a standard workweek, and both full-time and part-time telecommuting options are available.

In FY 2021, telecommuting, remote work, and hybrid work options were expanded. On average during FY 2021, nearly 45 percent of Members of the Workforce were telecommuting full-time.

During FY 2021, a major reconstruction and roadway modification took place at KAFB to enhance the security of entry points. This required significant coordination with Albuquerque's public transit official so that bus routes could continue service onto KAFB. This initially reduced the number of bus routes that came on-site; however, it is anticipated that these routes will be resumed in FY 2022.

9.1.2 Plans and Projected Performance

Full-time telecommuting for at least 30 percent of Members of the Workforce will be maintained into the future.

The potential future options for personal electric vehicle charging is currently being assessed for all sites through coordination with SFO.

In FY 2022, SNL personnel will investigate the use of badge swipe data to enhance the accuracy of the data accumulated by the Commuter Profile. Options for simplifying data entry into the Commuter Profile are also being explored.

In response to the COVID-19 pandemic, many public transit options were reduced or removed entirely. It is anticipated that these options will resume in the future.

9.2 Business Ground and Air Travel

9.2.1 Performance Status

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

9.2.2 Plans and Projected Performance

The following efficiency measures to reduce vehicle miles traveled will be undertaken:

- Encourage trip consolidation through carpooling and vanpooling.
- Increase the use of teleconferencing, videoconferencing, web conferencing, and web-based collaboration tools.
- Encourage electric vehicle use; install on-site charging stations.

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 2021 has been reported in the DOE Sustainability Dashboard.

10.1 Fugitives

10.1.1 Performance Status

The primary source of Scope 1 GHG emissions at SNL/NM is fugitive emissions, which are defined as any emissions that cannot reasonably pass through a stack, chimney, vent, or other functionally equivalent opening. At SNL/NM, 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. The programs and the buildings that house them use large quantities of SF6 as a necessary dielectric gas. These programs use leak detection and repair processes and SF6 reclamation units when feasible. Various other activities conducted throughout SNL 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. A portable micro-reclaimer was purchased in FY 2021, and Z Facility personnel coordinated four separate recoveries, which prevented the release of 6.4 pounds of SF6 to atmosphere.

Since FY 2012, SF6 additions to systems have been tracked 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], Sandia Lightning Simulator, and Electro-Magnetic Environment Simulator). This method of tracking provides better information about SF6 emissions at the equipment level than tracking purchases alone. Emissions from all other operations continue to be estimated based on purchases. GHG purchases and estimated use are reported in the DOE Sustainability Dashboard.

The department that operates Saturn, HERMES III, and SPHINX decreased SF6 usage from FY 2020 to FY 2021 by more than 650 pounds (approximately an 11 percent decrease). This decrease was attributed to a 12 percent reduction in total shots at the HERMES III and Saturn accelerators and the following SF6 emission reduction strategies:

- A new compressor was installed on the Saturn reclaimer unit to reduce SF6 gas leakage.
- The Saturn accelerator switch pressure leak test was converted from SF6 to nitrogen gas.
- The Saturn SF6 gas system was inspected, and any potential leaky tubing, faulty materials, and fittings were replaced or repaired.
- New SF6 gas regulators were installed at HERMES III to improve pressure accuracy and control, resulting in a reduction of total gas usage.
- A new departmental DILO SF6 gas analyzer was purchased to determine SF6 quality and to help identify any potential contamination or leak sources.

- New handheld SF6 leak detectors were purchased to quickly identify potential SF6 leak sources and prevent release.

Pulsed Power Sciences Center personnel continue to strive for SF6 reductions throughout their operations. In FY 2021, these reductions were pursued in a variety of ways as follows:

- Improved documentation tools for recording SF6 usage to reduce potential for human error were deployed successfully.
- An SF6 system failure modes and effects analysis was performed for conduct of operations. This effort was intended to discover all events that can cause personnel injury or an unintentional SF6 fugitive release, and the results will drive projects intended to mitigate both.
- To improve SF6 quality, the desiccant (moisture) filter system was regenerated. The system has two desiccant filter systems designed for continual operations while performing this regeneration process, and an upgraded desiccant filter system with pre-oil filters is being pursued. Improved quality will help to identify any potential contamination or leak sources.
- Z Facility provided a subject matter expert to coordinate the purchase of a portable SF6 micro-reclaimer that will be available throughout SNL/NM, as needed, to recover small quantities of gas that previously would have been released to the atmosphere. Z Facility personnel will continue to assist this new effort by providing storage for the micro-reclaimer and a dedicated subject matter expert to support operational use.

Based on the equipment and processes involved, currently there is no suitable alternative to SF6 for previously discussed applications.

COVID-19 did not impact the use or consumption of fugitives or refrigerants.

Usage and emissions of SF6 from research activities and gas-insulated switchgear at SNL/CA is relatively minor compared to other DOE sites. California Air Resources Board regulates a maximum allowable leak rate in the California Code of Regulations (CCR) Sections 95350–95359, *Regulation for Reducing Sulfur Hexafluoride Emissions from Gas Insulated Switchgear*. The regulation sets a maximum allowable leak rate of 10 percent for 2011. 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 California Air Resources Board's increasingly strict emissions limit for SF6, SNL/CA personnel implemented a five-year project to refurbish or replace all switchgear. The project was completed in 2018. The success of the switchgear refurbishment and replacement project is evidenced by the steady decrease in SF6 emissions from 17 pounds in 2012 to zero pounds in 2020 and again in 2021.

The monthly preventive maintenance program captures early leaks from the switchgears. SNL personnel will continue to pursue strategies to reduce or replace SF6.

10.1.2 Plans and Projected Performance

The department that operates Saturn, HERMES III and SPHINX will be improving the SF6 supply system for HERMES III during FY 2022. The new SF6 mechanical design is currently in review and is intended to minimize SF6 leaks stemming from original 30-year-old equipment.

Personnel at the Sandia Lightning Simulator and the Electro-Magnetic Environment Simulator will be replacing Marx trigger systems and components that currently use SF6 to components that use dry air.

Several organizations have teamed up to create an SF6 Fugitive Emissions Workgroup and a subsequent management plan. The plan will be finalized in FY 2022 and will target on-site use and establish methods and opportunities to mitigate releases.

The portable micro-reclaimer operated by Z Facility personnel will continue to be used to recover gas from smaller activities that are otherwise unable recover it. These recoveries are expected to increase as additional micro-reclaimer operators are trained and the recovery efforts are more widely known and available.

Recent climate legislative amendments may result in revision of the California Air Resources Board's SF6 gas-insulated switchgear regulation, as California Senate Bill 32, *California Global Warming Solutions Act of 2006: Emissions Limit*, requires the state to assess the potential for reducing GHG emissions to 40 percent below the 1990 level by 2030. SNL/CA personnel will comply with any revised requirements when they become effective.

10.2 Refrigerants

10.2.1 Performance Status

MN471022, *ES&H Manual*, "Refrigerants/Ozone-Depleting Substances in Equipment or 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 Management and Engineering organization maintains 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 use and emit relatively minor quantities 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.

Refrigerant usage and emissions at SNL/CA 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. Additionally, in FY 2021, SNL/CA personnel continued to develop and implement a process for ensuring that 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. In FY 2021, SNL/CA personnel developed a Refrigerant Management Compliance Plan that describes the California Air Resources Board's requirements for HVAC and refrigeration appliances and the SNL/CA approach to comply with these requirements.

10.2.2 Plans and Projected Performance

SNL personnel will continue to manage refrigerants in accordance with applicable regulations and policies described in this plan.

11.0 Electronic Stewardship and Data Centers

Electronic stewardship and data center section 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

Procurement personnel continue to incorporate a green product purchasing section in contracts, which requires the just-in-time providers of electronic products to submit a quarterly report of furnished products and to give preference to those registered 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. An exemption request can be submitted, reviewed for justification, and approved for purchase.

At SNL/NM, desktop computer and monitor purchases in FY 2021 were 95 percent compliant with EPEAT requirements. Applicable imaging equipment purchases (e.g., printers, scanners, and multifunction devices) in FY 2021 were 98 percent compliant. One hundred percent of mobile phone purchases were EPEAT gold-registered products.

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

- Two standardized models of fleet copiers are used, both of which are EPEAT gold-registered.
- At SNL/NM, 611 fleet copiers were added to operations in FY 2021; this provides printing, copying, and scanning functions for multiple personnel at each machine. Assuming on average 12 personnel are served per machine, then approximately 7,332 personnel are served by these fleet copiers.
- At SNL/CA, 81 fleet copiers were added in FY 2021. Assuming on average 12 personnel are served per machine, then approximately 960 personnel are served by these fleet copiers.

It is a continuing struggle to achieve the overall 95 percent goal for EPEAT-registered electronic products due to the updates made to the Institute of Electrical and Electronics Engineers standards that govern EPEAT criteria for achieving the various ratings. The updates drastically decreased the availability of gold- and silver-rated products. The request that SNL personnel made to DOE to have the EPEAT clauses in the NTESS Prime Contract amended to remove the Alternate 1 verbiage was denied. 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.

11.1.2 Plans and Projected Performance

Acquisitions and Procurement efforts (Section 7.0) will eventually include the just-in-time electronics providers, which will standardize the format and requirements for aggregating and evaluating data that subcontractors are required to provide to meet reporting requirements.

It is uncertain how supply stream complications related to COVID-19 will impact the production of electronic equipment and the ability of such equipment to attain EPEAT standards.

11.2 Operations

11.2.1 Performance Status

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

Of the eligible machines—approximately 30,800 Windows computers at SNL/NM and 6,973 at SNL/CA—100 percent are managed with default power management capabilities.

Just-in-time imaging equipment contracts require EPEAT-registered duplexing-capable desktop printing equipment. This first became a contractual requirement in FY 2013. 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

There are no anticipated changes to operations for the upcoming year.

11.3 End of Life

11.3.1 Performance Status

All electronic assets and equipment are required to be processed through the Property Management and Reapplication Department at SNL/NM and the Logistics Department at SNL/CA to ensure adherence to applicable federal regulations. At the end of life, all functional electronics are first made available to the workforce.

Representatives from 17 schools visited SNL/NM to pick up used desktop computers, laptops, tablets, keyboards and other equipment as part of the SNL K-12 Computer Donation Program. Over 1,700 items were donated.

Broken or outdated computers and equipment at SNL/CA are sent for recycling to a vendor that is Responsible Recycling, e-Steward, and California state certified. Electronic equipment that can retain information (e.g., removable electronic media) is removed and then securely stored until there is a sufficient quantity to ship to a waste-to-energy incinerator under witnessed destruction.

In FY 2021, SNL/NM personnel recycled 226,172 pounds of electronic waste and transferred or donated 71,496 pounds.

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

11.3.2 Plans and Projected Performance

Existing resources will continue to be reallocated to Members of the Workforce prior to purchasing similar items. The next option is to accumulate items that can be donated to local schools.

11.4 Data Centers

11.4.1 Performance Status

Building 725E is a data center built to house high-performance computing machines. This building was designed for 85 percent water cooling and 15 percent air cooling. This design helps the data center to run efficiently, maintaining a PUE of around 1.07 during the colder months. A PUE of 1.07 means that of the total power draw used to power and run the IT equipment, 7 percent is used for infrastructure support, including cooling, pumps, and fans. Thermosyphons were installed on the roof of Building 725E as a means of cooling the process water loop without water evaporation, saving around 8 million gallons of water per year.

During warmer months, the thermosyphons cannot cool the process water loop because they require the outdoor air to be 4°F cooler than the water. This loss of cooling capability requires use of the chiller plant in Building 726 to maintain the necessary water temperature. While the chiller plant is supporting the Building 725E data center, the PUE raises to 1.13, nearly doubling the infrastructure power use. To combat this, a plan is in place to install a new cooling system adjacent to the data center. This system will utilize hybrid fluid coolers to improve the data center's energy efficiency. These fluid coolers will be able to return PUE back to 1.07, even during summer months.

Another method for improving the data center's PUE is through increased water temperatures. Currently, the process water loop is set to a supply temperature of 75°F. When built, Building 725E had a process water temperature of 69°F. This temperature was required for the first high-performance computing system installed in the building, Astra. A medium temperature water loop was implemented to feed this system directly from the chiller plant in Building 726. This allows Astra to run independently of the process water loop while maintaining nearly the same energy efficiency as before. With the rest of the high-performance computing systems in Building 725E able to operate with warmer water temperatures, the data center's efficiency improved by nearly 20 percent. In addition, the Building 725E water usage was reduced considerably.

11.4.2 Plans and Projected Performance

To further improve the Building 725E data centers' efficiency and ensure future sustainability for data centers at SNL, seven more projects are planned or in progress. The process water loop supply temperature is planned to reach 85°F over the next couple of years, further improving water usage and energy efficiency. New server cooling technologies are being researched and tested, which will allow a supply water temperature to reach 100°F or more, even on extremely high-power processors. Another effort to improve energy usage is the installation of cooling doors on otherwise air-cooled racks. By using cooling doors, the heat from servers is transferred to water immediately upon being exhausted. This is much more efficient than air handlers while also allowing the room to maintain a cooler temperature. These cooling doors must be kept on the medium temperature water loop.

12.0 Adaptation and Resilience

The adaptation and resilience section focuses on activities that impact resiliency at the Laboratories level.

12.1.1 Performance Status

SNL leadership recognizes the need to maintain performance of essential functions and operations during disruptive events.

In FY 2020, SNL personnel completed a climate vulnerability assessment. The assessment addressed anticipated changes in climate by the year 2050 and potential vulnerabilities to these changes in climate at SNL sites. This assessment focused on key resource areas (energy, water, space and infrastructure, and personnel) for each site. In FY 2021, SNL personnel participated in the Technical Resilience Navigator DOE cohort. The Technical Resilience Navigator is a tool that helps users assess risk for a site's critical functions following energy and water utility disruptions and then prioritize solutions that reduce risk. The Technical Resilience Navigator cohort consists of seven DOE sites and was created to provide participating personnel an overview of the tool's key concepts and familiarize them with the tool's features and processes.

In conjunction with safety basis and remote site subject matter experts, Emergency Management personnel instituted the use of a hazard analysis and qualitative risk assessment at multiple remote sites to comprehensively assess vulnerability to threats and hazards, including climate-related threats and hazards.

The SNL climate vulnerability assessment identified existing climate adaptation and resilience efforts to protect critical infrastructure and minimize the impacts of climate-induced disruptions to energy and water supplies, facility operations, information and communication technology capabilities, and transportation. Throughout FY 2021, resources were invested in the development of several cross-disciplinary teams with expertise on climate and resiliency. A Resilient Energy Working Group was established to bring together R&D, ES&H, and Facilities communities in an attempt to make the SNL sites more energy resilient and sustainable while showcasing SNL research. The vision is to identify and pursue opportunities to increase resilience through innovative approaches.

Several R&D teams have been tasked with looking at the feasibility of resiliency solutions, including microgrids and concentrated solar systems. Stretch goals have been developed to enable the SNL/CA site to become net zero. Furthermore, Continuity of Operations Program personnel are actively incorporating resiliency into its risk mitigation measures through the installation of generators at strategic locations to provide emergency backup power. Final installation is scheduled for FY 2022. The sustainment of critical infrastructure during emergencies is addressed at the Emergency Operations Center. The structure and approach for responding to extraordinary incidents that affect SNL sites and facilities is documented in the *Center 4700 and Center 4800 Response Operations Plan for SNL/NM*.

Climate-related assessments and tools are used to identify threats or hazards that could impact the mission, programs, plans, operations, or personnel. For example, consensus results from international and national climate assessments, climate data from the Climate Resilience Toolkit, and the National Oceanic and Atmospheric Administration National Weather Service data were

used to develop the climate vulnerability assessment. Emergency Management personnel conduct an all-hazards survey for SNL sites to address natural, technological, and human-caused hazards in accordance with DOE O 151.1D, *Comprehensive Emergency Management System*. These surveys are revised every three years or upon significant changes. Emergency planning hazards assessments are created for facilities that are 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 involving hazardous materials. Emergency Management personnel have also completed emergency management plans and threat and hazard identification and risk assessments for multiple remote sites, in accordance with the SNL DOE O 151.1D Implementation Plan.

There are ongoing efforts to integrate climate resilience into larger risk-management processes (e.g., emergency management, continuity of operations planning, and cybersecurity). DOE O 151.1D and DOE O 150.1A, *Continuity Programs*, require mitigation of identified risks. To comply with this requirement, Emergency Management and Continuity of Operations Program personnel implement risk-based planning and assurance measures to address a variety of hazards and assist in the prioritization of assets, efforts, and personnel. The impacts of climate change are included in risk mitigation efforts. The Emergency Management Program is an integral part of ES&H, and team members partner with Meteorology Program and other ES&H program subject matter experts to provide decision support services, including on-site and local meteorological data and expertise. Integration spans from emergency planning to Emergency Operations Center coordination and support during and after an emergency.

The COVID-19 pandemic impacted operations, resilience measures, and planning. This prompted the development of resilience policies, plans, and tools to enable proper response to the pandemic. In anticipation of the release of COVID-19 vaccines, Continuity of Operations Program, Legal, and Employee Health Services personnel partnered with SFO to formally identify SNL as a COVID-19 vaccination provider in coordination with the New Mexico Department of Health through an addendum to the existing *Closed Point of Dispensing Plan*. Following New Mexico Department of Health requirements, SNL personnel developed the addendum entitled *Closed Point of Dispensing COVID-19 Vaccination Plan*. The plan addressed distribution and dispensing of the Pfizer and Moderna vaccines and encompassed SNL, SFO, and other DOE/NNSA personnel. Priority for vaccinations aligned with the order established by the Centers for Disease Control and Prevention and the New Mexico Department of Health vaccination phases. SNL/CA personnel partnered with SFO, the DOE/NNSA Livermore Field Office, and LLNL to develop the *Closed Point of Dispensing COVID-19 Distribution Plan*. The plan addressed distribution and dispensing of the Pfizer and Moderna vaccines.

In FY 2021, continuity efforts largely focused on responding to the COVID-19 pandemic, concentrating on minimizing disruption to operations and personnel availability. Members of the Workforce were encouraged to maximize teleworking. Information Technology Services personnel worked diligently to ensure network availability, monitored network traffic, and, when necessary, released In Case of Emergency licenses to stabilize accessibility. IT personnel documented lessons learned and incorporated the information into existing plans. The Disaster Recovery team updated and expanded their planning and testing efforts, thereby increasing IT resiliency.

Emergency Management personnel partnered with Employee Health Services, Facilities, ES&H, and Continuity of Operations Program personnel to develop a process for evaluating and responding to

COVID-19 cases among Members of the Workforce. This effort ensured the engagement of key stakeholders to assess impact to operations and then respond to minimize workforce impacts. Continuity of Operations Program personnel worked with mission essential function leadership and developed planning documents to address the response to and sanitization of mission essential function operational spaces. This activity ensured the continued availability of assigned mission essential functions.

The SNL/NM and SNL/CA Emergency Operations Centers tracked and coordinated COVID-19 pandemic operations. High-level plans were developed or modified to meet current threats and vulnerabilities. Processes, plans, and checklists were tweaked following each positive COVID-19 case that required a response. Tools were developed through this process of continuous improvement that streamlined Emergency Operations Center responses and increased efficiency by a factor of 8. The time it takes to respond to a COVID-19 case went from 10–12 hours (during the first few cases) to 1.5 hours (by the end of FY 2020) to 15–20 minutes (currently).

12.1.2 Plans and Projected Performance

In FY 2022, SNL personnel will continue to participate in the Technical Resilience Navigator DOE cohort. Outputs from the Technical Resilience Navigator will be used to update the climate vulnerability assessment, where appropriate.

ES&H personnel are implementing a multiyear improvement plan to develop one SNL-wide end-to-end work planning and control process, to be executed through an integrated IT platform. As part of this effort, improvements to the hazard analysis and qualitative risk assessment process were proposed in FY 2021 to support identification of vulnerabilities in the Analyze Hazards/Aspects and Identify Controls step. The improvements will be implemented in FY 2022 and integrated into software in FY 2023.

Climate adaptation and resilience efforts will continue to be pursued to protect critical infrastructure and minimize the impacts of climate-induced disruptions to energy and water supplies, facility operations, information and communication technology capabilities, and transportation. First, a new Emergency Operations Center is being constructed at SNL/NM, with an expected opening in FY 2023. The LEED Gold-certified facility aligns with the NNSA Enhanced Minor Construction and Commercial Practices initiative. Second, a fuel storage facility is currently in the design phase and will complement the generators as part of a Continuity of Operations Program short-term goal to ensure mission essential function sustainability for 30 days. This project is expected to be completed between FY 2023 and FY 2024. Additionally, Continuity of Operations Program personnel are evaluating long-term opportunities to enhance emergency power generation capabilities through the integration of a microgrid. The microgrid would include renewable energy sources, mitigate GHG emissions, enhance power resiliency, and defer costly investments in additional power generation. Third, cross-disciplinary teams with expertise in climate and resiliency, including the Resilient Energy Working Group, will be maintained. These teams will continue to identify and pursue opportunities to increase resilience through innovative approaches. SNL personnel will continue to build on current efforts to help the SNL/CA site become net zero and will conduct additional studies to define this possibility in more detail.

The efforts to integrate climate resilience into larger-risk management processes (e.g., emergency management, continuity of operations planning, and cybersecurity) described in this plan will continue into FY 2022.

As the COVID-19 pandemic continues, it is expected that SNL operations, resilience measures, and planning will continue to be impacted. SNL personnel will continue to develop and update policies, plans, and tools to enable proper response to the pandemic.

Resources

Related Laboratory Policies and Processes

EM003, *Mission Critical Personnel Policy*

EM004, *Continuity of Operations Policy*

FAC002, *Space Management Policy*

FIN001, *Travel and Expense Report Policy*

References

42 USC 6834, *Federal Building Energy Efficiency Standards*

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*

Center 4700 and Center 4800 Response Operations Plan for SNL/NM

Closed Point of Dispensing COVID-19 Distribution Plan

Closed Point of Dispensing COVID-19 Vaccination Plan

DOE O 150.1A, *Continuity Programs*

DOE O 151.1D, *Comprehensive Emergency Management System*

DOE O 436.1, *Departmental Sustainability*

DOE Procurement Policy Guidance, *Purchase of Electricity, Energy Products and Energy By-Products from Indian Tribes*

Energy Independence and Security Act (EISA) of 2007

Energy Policy Act of 2005

Federal Buildings Personnel Training Act

Guiding Principles for Sustainable Federal Buildings and Associated Instructions

ISO 14001, *Environmental Management Systems*

ISO 50001, *Energy Management*

Landscape Master Plan

MN471022, *ES&H Manual*

National Energy Conservation Policy Act

Sandia National Laboratories/New Mexico Design Standards Manual

Solid Waste Management Improvement Plan

U.S. EPA, *Federal Leadership in High Performance and Sustainable Buildings Memorandum of Understanding*

Utility Meters Life Cycle Asset Management Plan