

Sandia National Laboratories Energy Newsletter July 2022



1. Sandia National Laboratories Completes Fiscal Year 2022 Building Energy Audits

The Sandia Energy Team completed the Building Energy Audits process for Fiscal Year 2022 (FY22). Twenty high energy intensity buildings at the Sandia National Laboratories campuses in New Mexico and California were selected to be audited. A site walk-through, a performance checklist for different disciplines (mechanical, electrical, etc.), and review of operational data were conducted to identify energy and water conservation measures for each building.

Energy audits are an important tool for managing Sandia’s energy usage and are required by the Energy Independence Security Act (EISA) of 2017, section 432. Energy audits will also help Sandia meet aggressive goals set out in Executive Order (E.O.) 14057, Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability, which sets government-wide goals with regards to pollution-free electricity, climate resilient infrastructure and operations, and net-zero emissions federal buildings. E.O. 13834 also requires energy-intensity reduction measured in BTU/SF/year by 1% year-over-year below 2015 levels through 2025¹. Five main disciplines are evaluated during the energy audits: architecture, facilities control systems, water conservation, mechanical, and electrical engineering. A report is created indicating the findings throughout the process. Figure 1 presents the energy audit timeline.

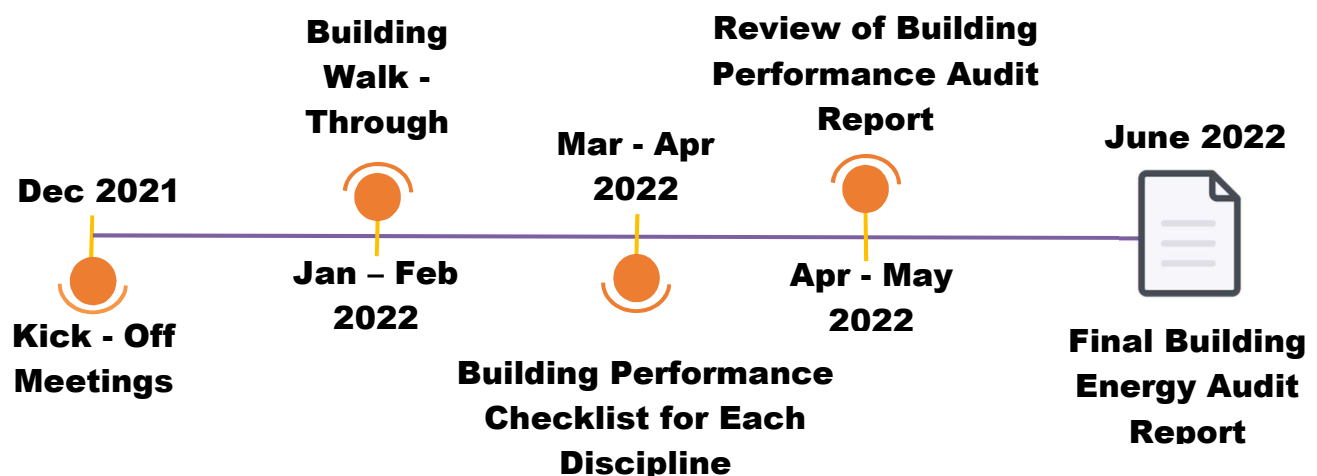


Figure 1. Timeline for FY22 Energy Audits

The Energy audit report lists all the energy conservation measures (ECM) identified for a facility and will guide the efforts towards the implementation of such measures. The ECM list may include, for example, recommendations for the replacement of high-intensity fluorescent lights fixtures with LED bulbs; operational changes, such as modifying temperature set points; or larger capital projects, such as roofing replacement.

The FY22 energy audits will help building managers, operators, and users work together to reduce energy waste and improve building performance. The expected outcomes from the audits not only include improving energy efficiency but also safety and reliable operations at Sandia buildings. The energy audits are an example of how collaborative efforts can advance sustainability practices at the Sandia National Laboratories.

¹Executive Order 13834: Efficient Federal Operations was revoked by **Executive Order 13990: Protecting Public Health and the Environment and Restoring Science To Tackle the Climate Crisis**. This new order is pending updated instructions and is not yet officially published.

2. Re-Investment of Utility Savings (ROUS) To Help Sandia Finance Projects that Improve Energy Efficiency

The total electricity needed to power all operations and facilities at Sandia National Laboratories (SNL) – New Mexico and California was over 307,772 MWh in fiscal year 2021. To put into perspective, this is equivalent to the electricity usage of about 40,000 homes¹ in the US for one year. Due to this high energy consumption, SNL’s Energy Management Team works to help reduce energy use and operate as efficiently as possible.

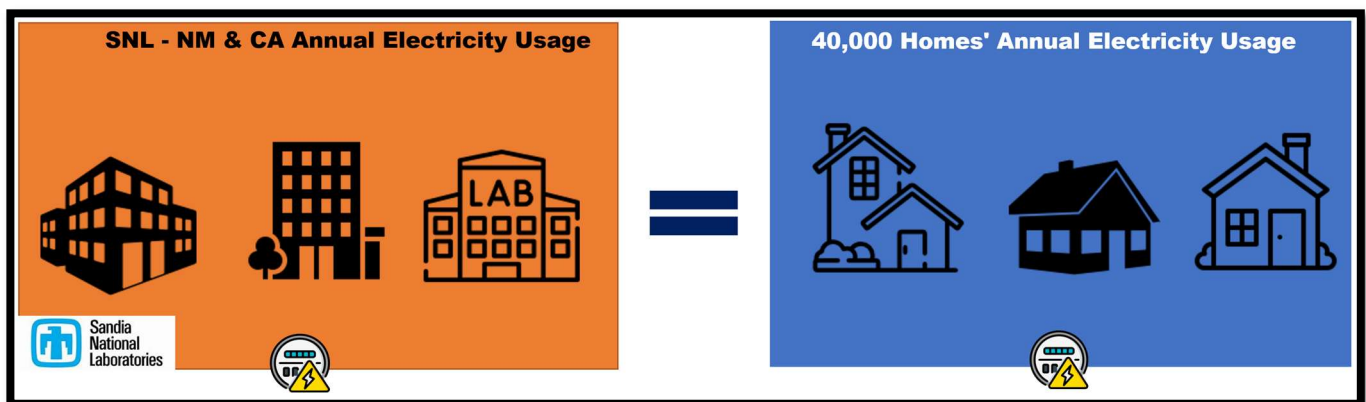


Figure 1. Sandia National Labs - New Mexico and California Annual Electricity Equivalent

The National Nuclear Security Administration (NNSA) re-negotiated Sandia’s utility contracts resulting in an anticipated savings of \$2.3 million/year through 2023. The new contract started in 2020, and at the encouragement of the NNSA, Sandia chose to re-invest this \$2.3 million in energy efficiency projects at SNL New Mexico and California sites. The savings will be invested in two ways:



1. Use a portion of the savings to fund ongoing energy improvement projects
2. Establish a savings re-investment fund in which the annual calculated savings can be used each year to fund projects

Some projects that will be financed through the Re-investment of Utility Savings (ROUS) include Energy efficient upgrades for buildings 877 and 879 in New Mexico. Funds will be utilized to:

- Convert Facilities Controls System (FCS) from pneumatic to Direct Digital Controls (DDC)
- Replace Variable Air Volume (VAV) and any other pneumatic or outdated terminal units
- Install Energy Valves
- Replace existing fluorescent lighting with LED and install occupancy sensors
- Upgrade the chilled water system
- Upgrade energy meters

Each individual item listed above has the potential for energy savings. Lawrence Berkley Lab in California², for example, estimated that DDC systems can yield operational energy savings of 15% and greater when compared to the conventional pneumatic system Berkley Lab³ also indicated that LED retrofit can result in lighting energy savings of 63% or greater. Although the overall impact over the usage for these buildings are still to be determined, the energy savings will be quantified through measurement and verification once the projects are implemented.

In addition, the ROUS will be utilized to finance ongoing commissioning of buildings with approximately \$600,000 designated to create a dedicated team to identify, fix, and measure energy savings, thermal comfort and reliability for existing buildings. Another \$200,000 from the program will also be allocated to finance energy modeling studies that can identify opportunities for energy efficient projects and operational changes that may result in energy waste reductions.

With the ROUS, the Energy Management Team will help SNL operate its facilities efficiently and reliably. The projects financed through these funds will contribute not only to reducing energy consumption, but also to improving resiliency while implementing sustainable practices across SNL's campuses.

¹Based on EPA - Greenhouse Gas Equivalencies Calculator (<https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>)

²A Design Guide for Energy-Efficient Research Laboratories, 1996

³Energy Cost Savings of Systems-Based Building Retrofits: A Study of Three Integrated Lighting Systems in comparison with Component Based Retrofits, 2018

3. Advancing Energy Efficiency with Service Elevator Upgrades

Six service elevators were upgraded at the beginning of calendar year 2021. The upgrades comprised the replacement of old drive systems with a new Variable Voltage Variable Frequency (VVVF) system. In the old configuration, a generator used energy even when the car was not in motion. The new VVVF drive draws

much less current during acceleration and deceleration resulting in reduced energy consumption and emissions associated with the elevator operations as well as improved ride quality.

Six buildings were upgraded with the new VVVF elevator technology. For each individual elevator with the new drive system installed, an annual energy savings of 19,700 kWh and an annual cost savings of \$900 are estimated. Altogether, the six elevators will reduce energy usage a total of almost 120,000 kWh and save up to \$5,400 in annual electricity costs. Figure 1 shows the electricity use before and after the upgrades as well as the energy savings as result of these renovations.

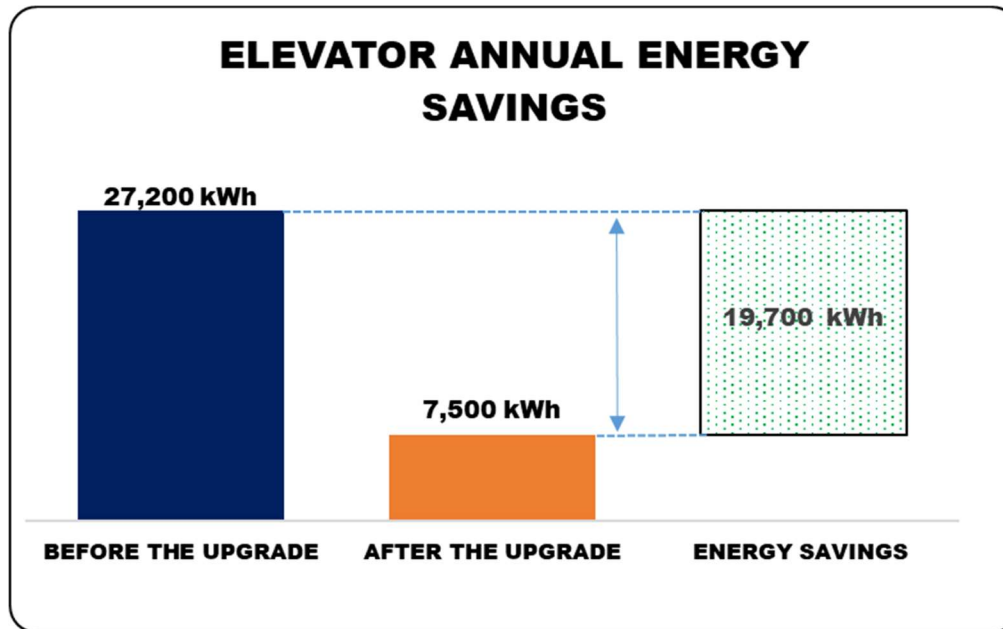


Figure 2. Estimated Energy Savings for Each Elevator

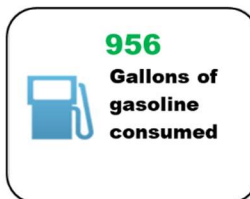
These upgrades will also avoid an estimated 8.5 Metric Tons of CO₂ equivalent per elevator of annual emissions¹. Figure 2 presents the equivalent ways to express these emissions for each individual elevator. To put into perspective, the avoided emissions of one single elevator that was renovated is equivalent to the CO₂ emissions of one average house energy use in the US, or the emissions associated with the electricity use in 1.5 houses in one year. Therefore, the avoided emissions from renovating the six elevators are equivalent to reducing the electricity use of nine US households, or eliminating the fuel consumption of approximately 12 passenger vehicles driven for one year.

Avoided Emissions Equivalent From One Elevator:

Greenhouse gas emissions from



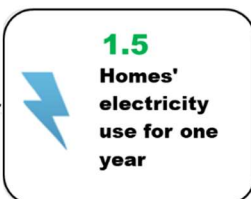
CO₂ emissions from



Or



Or



Or



Figure 3. Emissions equivalent comparison

Source: EPA - Greenhouse Gas Equivalencies Calculator (<https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>)

Besides the energy and environmental benefits associated with renovations, the upgrades simplified commissioning and increased system efficiency and safety of the service elevators. This shows the commitment of Sandia's Facilities Organization to sustainability and reliability of facilities operations.

¹Estimated based on eGRID 2019 emission factor for the New Mexico Region = 0.43 Metric Tons of CO₂e/MWh

4. Lighting Upgrades at Buildings 954 and 890 Help Improve Energy Efficiency at SNL - New Mexico

As part of the efforts to reduce energy use, one of the most effective approaches is the replacement of old lighting fixtures with Light-Emitting Diode (LED) bulbs. At SNL New Mexico and California, building energy audits have helped identify opportunities for lighting improvements with the installation of LED fixtures.

LED light use up to 90% less energy and lasts up to 25 times longer than incandescent bulbs, and their costs have continued to decline¹. Therefore, energy savings are instantaneously observed at the completion of the installation of the LED lights and payback for such projects have become faster in recent years. When coupled with occupancy and daylight sensors, the LED fixtures allow ever greater energy and cost savings since these features allow dimming lighting output when no motion is detected.

Several facilities underwent lighting improvements in 2021. This includes LED installations on main hallways on all floors, basements, offices and meeting rooms. To illustrate some of the benefits attained, Figure 1 shows the energy savings for two lighting upgrades projects that happened in buildings 954 and 890. Combined, the electricity reduction due to the replacement of high intensity fluorescent fixtures with more efficient LED

lights bulbs are over 56,000 kWh annually and the costs savings are \$2,809. The electricity savings from these projects would be enough to supply electricity to seven US homes for an entire year².

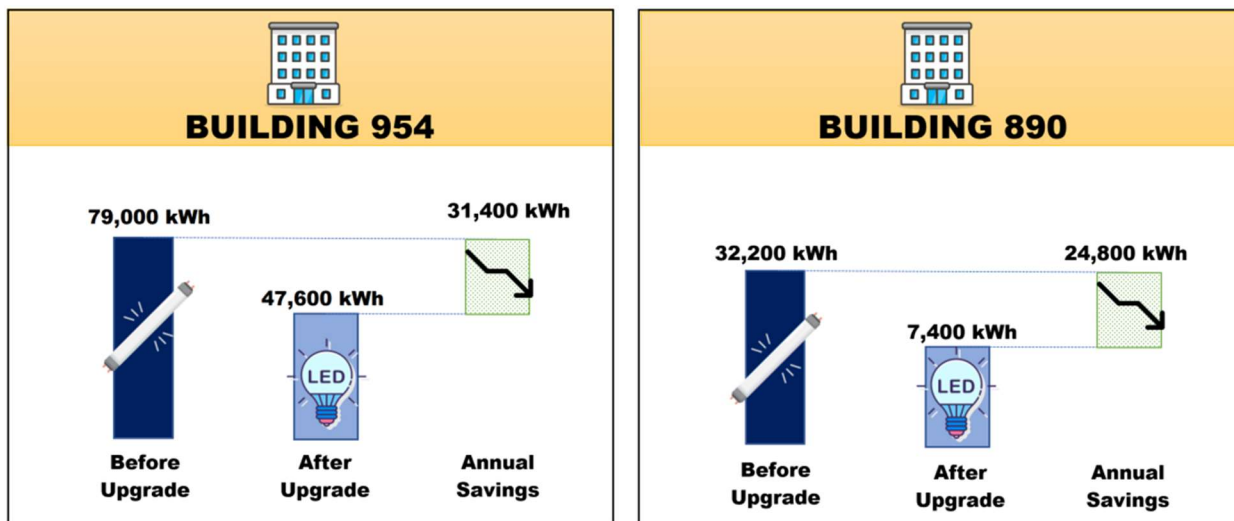


Figure 4. Energy Savings as result of lighting upgrades with LED

Lighting improvement is conducted by a team of facilities experts that include electrical engineers, project managers, technicians, and operational and maintenance staff. The Energy Management Team supports the projects with funding and identifying potential lighting improvements that will result in energy and costs savings.

¹EIA - By 2018, LEDs had become the second-most common lighting in U.S. commercial buildings

²EPA -Greenhouse Gas Equivalencies Calculator

5. Sandia SkySpark Metering Dashboard to Improve Energy Management and Data Quality

As part of the efforts to improve the acquisition and quality of energy data, SNL contracted Group14 Engineering to develop a Metering Front End Dashboard in SkySpark. The Metering Front End Dashboard will enable more automation of the energy management and reporting processes enabling faster identification and fixing of operational issues to avoid energy waste. Once all meters are connected directly to SkySpark, it will be possible to:

- Monitor real-time energy data
- Identify issues with meters
- Evaluate metering infrastructure needs

The dashboard will help SNL track progress towards meeting the Department of Energy’s Energy Use Intensity (EUI) reduction goals. Another outcome from this effort is the automation of calculations including allocations of chilled and hot water plant energy consumption, which will minimize manual estimation errors.

Figure 1 illustrates the user features available in the SkySpark Dashboard. Gaps and spikes in data that may result in skewed energy consumption can be analyzed by using the “Spark” feature on the dashboard. Another



important feature available on the dashboard – the “Metering front End” – allows users to evaluate individual building’s current and historical energy usage and key performance indicators.

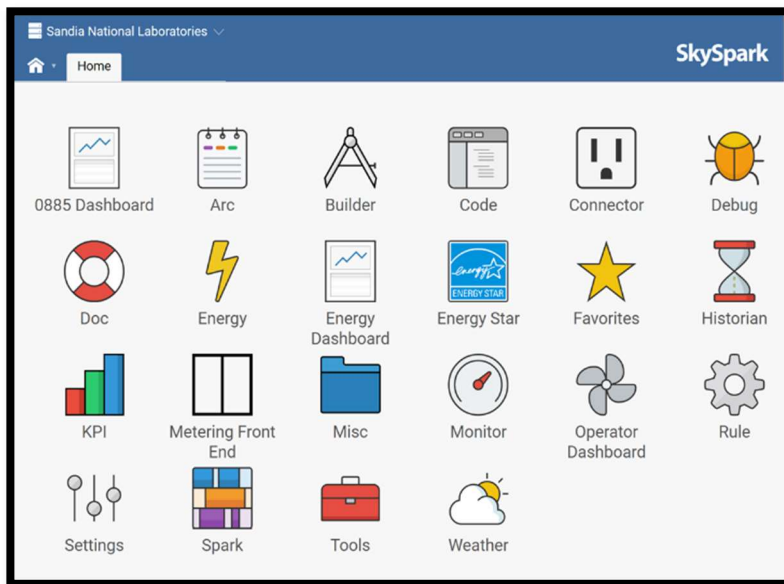


Figure 5. SkySpark Dashboard User Features

Figure 2 shows how the data is displayed for a specific building at the New Mexico campus when the Metering front End is selected.

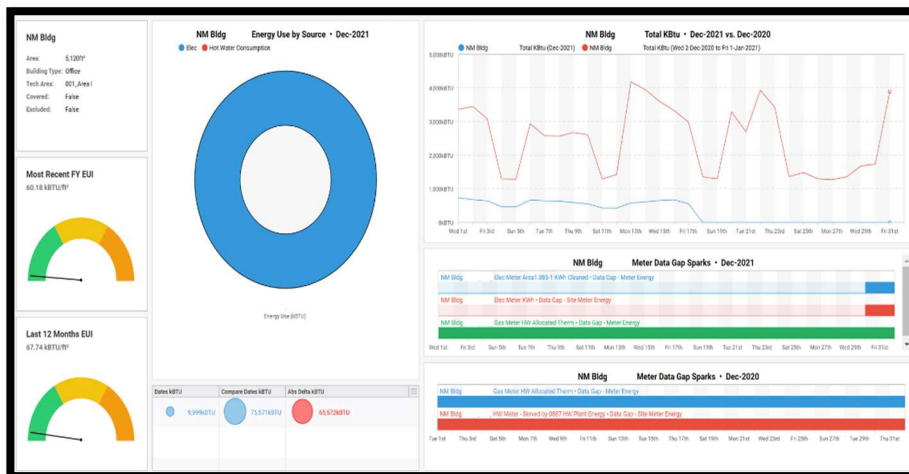


Figure 6. Individual Building Energy Dashboard

Once fully implemented, the SkySpark Energy Dashboard will be a powerful tool. It will allow compilation of all energy data into a single platform assisting energy management of Sandia’s facilities. With better quality energy data and access to real time and historical electricity and natural gas consumption for all buildings, the Energy Management Team will be able to better assess energy performance, work with operational staff to fix issues in a timely manner, and improve energy efficiency.