




# Sandia National Laboratories Energy Newsletter Winter 2022/2023

Sandia National Laboratories’ facilities support critical mission work, and we are always looking for ways to make our infrastructure more resilient, efficient, and productive. Our commitment to [modeling the way forward in site sustainability](#) is just one of the ways Sandia strives to advance climate security through science, technology, and action. The Sandia Energy Management Team, which works to improve the energy efficiency of our operations, invites you to learn more about their efforts to manage energy use throughout our facilities through their quarterly newsletter. Read the previous newsletter [here](#).

## Monitoring-based commissioning team helps save more than \$200,000 in energy costs

 **New process to identify and fix building issues saves money, improves safety, and reduces emissions**

Monitoring-based commissioning (MBCx) is a process that maintains and continuously improves building performance over time. It is an ongoing commissioning process with a focus on monitoring and analyzing large amounts of energy data on a continuous basis. Sandia uses monitoring-based commissioning to increase energy efficiency, occupant comfort, and energy savings. Since the program’s kickoff in October 2021, MBCx has realized over \$150,000 in savings, increased equipment lifespan, improved safety, and supported occupant comfort.

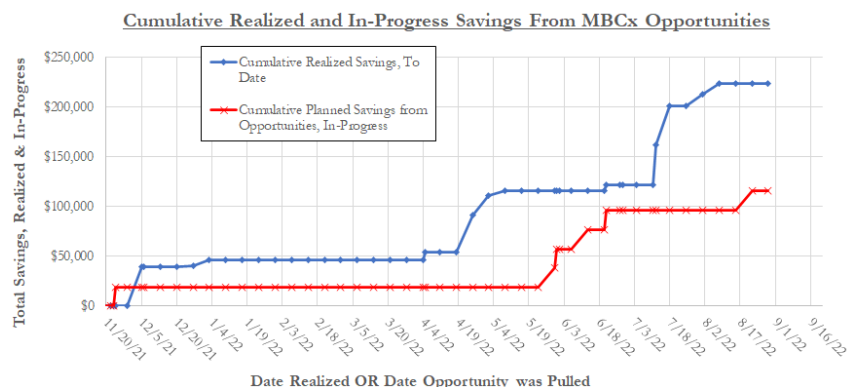
Using the MBCx process to identify and fix issues, Sandia has generated savings and improved thermal comfort by:

- eliminating short cycling on boilers;
- eliminating the imminent danger of a catastrophic failure of a compressor;
- identifying high static pressure (i.e., staying at a constant maximum) in the ducts of an air handler unit;
- fixing a leak in a gas meter;
- improving thermal comfort by addressing heating, ventilating, and air conditioning (HVAC) issues; and
- identifying occupancy sensors that were constantly on or off.

As of December 2022, the MBCx team estimates that the total savings from the program equates to:

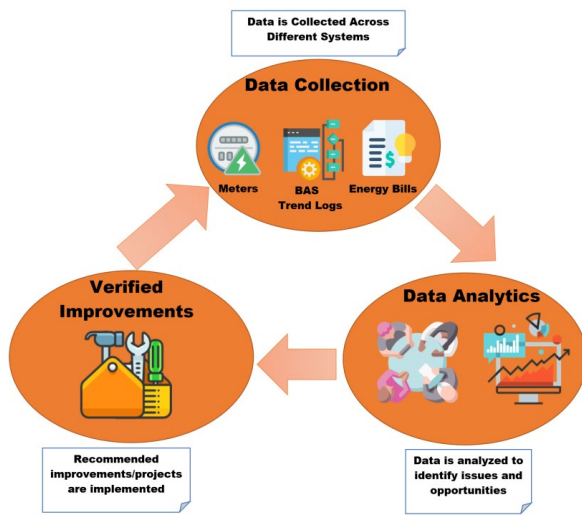
- 715 MWh of electricity,
- 3,300 MMBTU of natural gas,
- 125,000 gallons of water, and
- ~690 tons of carbon dioxide.

In addition to these savings, the MBCx team estimates proposed operational changes would yield an additional \$100,000 in savings through the end of 2022. Figure 1 shows the realized and the potential additional savings from the MBCx program.



**Figure 1. Realized and potential savings from the MBCx program**

The MBCx team consists of Facilities staff from the Energy Management, Facilities Control System, and Mechanical and Electrical Maintenance teams, with other team members collaborating as necessary.



**Figure 2. MBCx process steps**

Figure 2 illustrates how the MBCx process is conducted. The first step of the MBCx process consists of collecting information from trend logs created using building automation systems and other operational data. Then, a thorough analysis of the data is conducted to identify issues and opportunities. The final step involves investigating the root causes of the issues and implementing improvements.

In addition to energy and cost savings, the MBCx program also has a positive impact on facility occupants' comfort and safety. For example, with the help of MBCx findings, operators can identify deviations from target temperatures and fix them to avoid thermal discomfort or impacts on the health and well-being of Sandia's staff and visitors. MBCx is therefore not only an effective way for Sandia to save costs but also to create a more comfortable workplace for employees.

For fiscal year 2022, funding from the Reinvestment of Utility Savings (ROUS) project was set apart to maintain a dedicated MBCx team for existing buildings at the New Mexico and California campuses. ROUS is a \$2.3 million fund that was made available due to the renegotiation of Sandia's utility contracts and will be used to finance energy efficiency projects. Implementing MBCx at Sandia's buildings has been a powerful way to identify energy savings opportunities and reduce costs.

## Net-zero efforts highlight Sandia's commitment to improve sustainability and energy resilience



### *Sandia commits to achieving net-zero emissions ahead of federal guidelines*

Sandia is developing a pathway to becoming carbon neutral with commitments to achieve net-zero emissions at the Livermore, California site by 2040 and the Albuquerque, New Mexico site by 2045. These efforts would meet or exceed the 2021 Executive Order 140571 that sets federal guidelines for achieving net-zero greenhouse gas (GHG) emissions and net-zero energy consumption by 2050, while also improving energy resilience and demonstrating new technologies. Net-zero emissions mean cutting GHG emissions to as close to zero as possible, with any remaining emissions re-absorbed from the atmosphere by oceans, forests, or carbon-capture technologies. Relatedly, net-zero energy means that energy needs are met with energy produced from renewable, zero-emission sources.

Sandia produced 307,000 MtCO<sub>2</sub>e of emissions at the New Mexico site in 2020 and 15,967 MtCO<sub>2</sub>e of emissions at the California site in 2019, as shown in Figure 3. Considering only Sandia/NM in fiscal year 2020, these emissions are equivalent to the electricity usage of almost 60,000 U.S. houses, according to the EPA GHG Equivalencies Calculator.

The Sandia California site already has a plan that defines strategies and goals to achieve net-zero emissions by 2040. The plan outlines a pathway to net zero that involves onsite solar and wind generation, energy storage, as well as electrification and energy efficiency improvements of buildings. This high-level roadmap will allow Sandia California to meet mission needs while also achieving the following:

- Net-zero GHG emissions
- Net-zero energy consumption
- Improved energy resilience
- Demonstration of new technologies

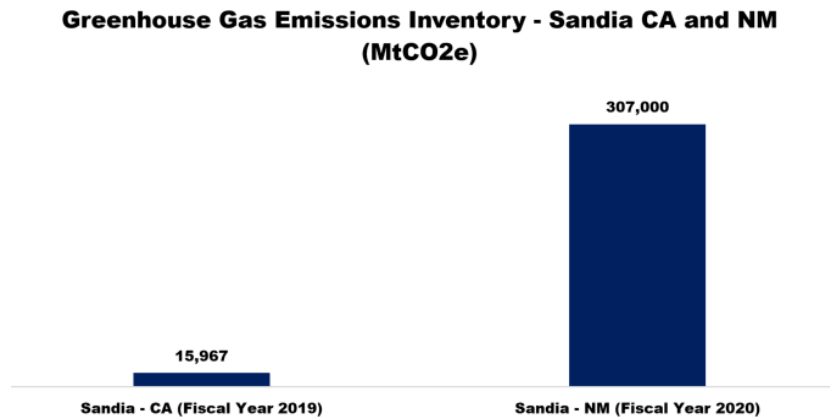


Figure 3. GHG emissions for Sandia sites

At the New Mexico site, a pilot program is evaluating the feasibility of having one or more facilities converted to net-zero or net-negative emissions and electricity. This pilot program will serve as a model for future building projects aimed at ensuring net-zero and resiliency goals across Sandia campuses. Strategies that could be adopted to reach net zero for individual buildings include, among other measures, on-site solar generation, use of heat pumps (electrification), battery storage, and LED lighting upgrades.

Funding to support these efforts is crucial to achieving Sandia’s net-zero goals. Sandia has already received support from the NNSA Energy Resilient Infrastructure and Climate Adaptation (ERICA) fund to finance some of this work.

Pivoting to net zero is an ambitious goal with important implications; Sandia is paving the way for more sustainable use of resources. The roadmap to net zero will be a call to action, requiring staff and community engagement and education, as well as development of new clean technologies. Ultimately, all these efforts show that Sandia is committed to decarbonizing, increasing transparency, and building a framework that supports the clean energy transition.

## Sandia’s New Mexico and California sites: Efforts to become ISO 50001 Ready



### *Program enhances Sandia’s energy management efforts*

Sandia’s Energy team is currently working to implement the U.S. Department of Energy (DOE)’s [50001 Ready program](#) at the New Mexico and California sites. DOE describes this program as a “self-paced, no-cost way for organizations to build a culture of structured energy improvement that leads to deeper and sustained savings that does not require any external audits or certifications.” The team will use this program to improve Sandia’s energy management system (EnMS) and to investigate how to integrate energy management into Sandia’s culture.

The 50001 Ready program will prepare Sandia for ISO 50001 certification. Certification will ensure that all the work put into developing an EnMS will endure through operational, administrative, and other changes. ISO 50001 is a global standard for EnMSs based on the Plan-Do-Check-Act cycle used for other federal standards

and programs. Once certified, Sandia will be recognized for establishing policies and procedures to systematically track, analyze, and continuously improve energy efficiency. When implemented, this certification will also support Sandia's ISO 14001 and ISO 9001 certifications. ISO 14001 specifies requirements for an EnMS to enhance environmental performance and ISO 9001 sets criteria for quality management, which focuses on organizational performance improvement. Combined, these three efforts will assist with existing sustainability goals like achieving net-zero emissions and reducing energy usage.

By implementing the 50001 Ready program, Sandia will be able to:

- advance collaboration across departments to promote best energy practices,
- increase energy efficiency,
- contribute toward cost reductions,
- reduce emissions and pollution, and
- contribute to Sandia's continuous improvement.

This program is a collaborative effort. Members of the Facilities Partnership and Planning Department, IT Infrastructure Services, DOE/NNSA Physical Security System Engineering Department, and the Facilities Area Manager (FAM) assisted with the kick-off process.

## Roof Asset Management Program helps Sandia reduce energy waste



*New roofs reduce electricity usage equal to the annual emissions of nine U.S. homes*

The Roof Asset Management Program (RAMP) was created in 2003 to help reduce the number of roof failures. The program manages roof assets across several DOE sites and is managed by the Kansas City National Security Complex (KCNSC). Some of the participants in the program include Los Alamos National Laboratory, Lawrence Livermore National Laboratory, and Sandia in New Mexico and California.

The main goals of the program are to:

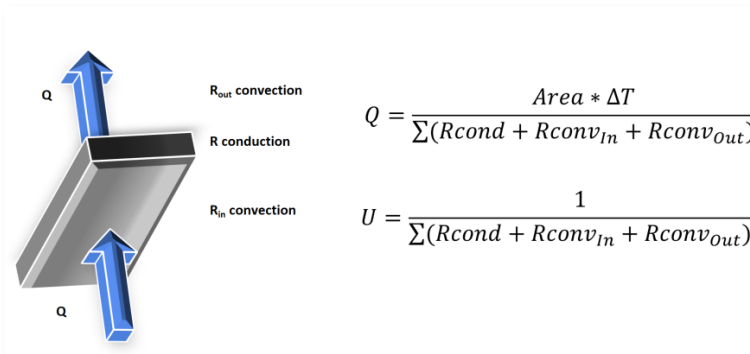
- increase the average remaining roof life in line with industry,
- improve facility reliability, and
- reduce deferred maintenance.

New and more efficient roofing materials have the potential to reduce energy waste because they are better able to resist thermal movement. R-value is a measure of thermal resistance, or the ability to prevent the transfer of heat. The more insulation the new materials provide, the higher the R-value and the lower the losses caused by the airflow between the outside and inside of the building. As building energy standards become more stringent, the R-values for new roofs are higher than previously required.



**Roofing Committee - not pictured, Gail Granot**





**Figure 1. Heat transfers due to convection and conduction through roof surface**

The Building Systems Engineering organization, in conjunction with the Sandia project management team responsible for the program, completed over 80 roof replacement projects since 2016 at Sandia New Mexico.

The Sandia Energy Team carried out an assessment to evaluate and quantify the energy savings resulting from these new, better insulated roofs. The assessment sampled 11 of the buildings that had their roofs and insulation material replaced since 2019 and took into account the R-values of the materials, heating and cooling degree

days, and the buildings' cooling and heating system characteristics. Figure 1 illustrates the heat transfer (Q) due to convection and conduction through the roof surface. Heat transfer was estimated by looking at the R-values prior to and after the roof upgrades and then translated into potential energy savings.

The results indicate a yearly savings of 6,500 therms of natural gas and 6,400 kWh of electricity from the roof replacements across the sampled buildings. The total savings from the roof upgrades equals \$3,000 a year in avoided energy costs, and since the replacements, the total cost savings have been more than \$6,700.

The roof upgrades have resulted in annual electricity and natural gas savings that avoid 47 metric tons of CO<sub>2e</sub> emissions per year. To put this into perspective, this is equivalent to the emissions from the electricity usage of nine U.S. homes or 10 gasoline-powered passenger vehicles driven in one year, according to the EPA emissions equivalent calculator.

The RAMP program illustrates the importance of the asset management efforts that not only save on costs but also have a positive impact on energy efficiency. With less energy waste, facilities become more efficient, putting Sandia on the right path to achieve its ambitious energy goals.