

BERKELEY LAB SUSTAINABILITY SUMMARY FOR FY 2020

Berkeley Lab pursues three broad initiatives to build institutional capacity and reach sustainability goals. These initiatives are listed below, and described in greater detail at sbl.lbl.gov.

- **Climate:** Improving buildings, greening the energy grid, and low-carbon commutes
- **Waste:** Rethinking waste through composting, recycling, and smart purchasing
- **Water:** Upgrading fixtures, stopping leaks, and encouraging conservation

Sustainability goals and requirements are driven by:

- Federal sustainability requirements ([Executive Order 13834](#), DOE Orders, Secretary Memos, Federal Acquisition Regulations)
- Legal requirements (California State or federal law)
- Applicable provisions of the [University of California Policy on Sustainable Practices](#)

A summary of these goals is available here: sbl.lbl.gov/goals.

For more detail:

- The Lab's Annual Site Sustainability Plans are available at sbl.lbl.gov/reports. These reports to the federal government include greater detail on performance against more than 25 sustainability goals.
- [A Plan for a Sustainable Berkeley Lab](#) describes the full range of sustainability activities at Berkeley Lab. We invite your review of the plan and feedback using this [google form](#). And always feel free to contact us by e-mail at sbl@lbl.gov.

PERFORMANCE SUMMARY

Key sustainability performance metrics for the Lab, as of the end of fiscal year 2020, include:

- **Total reported greenhouse gas emissions** are 54% below 2008 levels and 46% below 2015 levels (see [chart](#)).
- **Lab-wide energy use intensity** (weather-corrected energy consumption divided by square footage) has decreased 25% since FY 2015. Lab-wide weather-corrected energy use intensity excluding major process loads is the same: 25% lower than in FY 2015.
 - While energy efficiency in FY 2020 is lower due to the COVID shelter-in-place, the Lab was seeing a significant reduction in energy use intensity prior to COVID-related changes in operations: Lab-wide weather-corrected energy use intensity excluding major process loads as of April 1, 2020 was 19% lower than in FY 2015. See [Change in Energy Use Intensity and Consumption from Baseline](#) at sbl.lbl.gov/data for more detail.
- **Energy savings:** As of fall 2020, Berkeley Lab is maintaining annual energy savings of 12.3 million kWh (up from 7.8 million kWh reported last year) of electricity and gas savings and annual water savings of 19.9 million gallons. [Maintained Efficiency Savings](#) are updated monthly at sbl.lbl.gov/data.
- **Renewables:** 27% of electricity use (and 21% of all energy use) is procured or generated from renewable sources (beyond the renewables included in the grid power mix). The renewable

portion using federal metrics that include bonuses are 46% of electricity use and 36% of energy use.

- **Waste diversion** is at 74% (see [chart](#)), and diversion from construction and demolition projects is at 72%.
- **Water use intensity** is 28% below 2007 levels (see [chart](#)).

For more detail:

- The Lab's Annual Site Sustainability Plans are available at sbl.lbl.gov/reports. These reports to the federal government include greater detail on performance against 20 sustainability goals.

ACCOMPLISHMENTS

The Lab's sustainability efforts were **recognized by four awards in the last year**.

- Berkeley Lab's Integrative Genomics Building (IGB) received the UC's highest recognition for sustainability in new construction, a [2020 Best Practice Award for Overall Sustainable Design](#).
- The Integrative Genomics Building was awarded a [2020 Department of Energy \(DOE\) Sustainability Award](#) Honorable Mention for the Outstanding Sustainability Program/Project category.
- The NERSC Efficiency Optimization Team was presented a [2020 Department of Energy \(DOE\) Sustainability Award](#) for the Sustainable HPC/Data Center category.
- In November 2019, the Lab received an "Accelerating Smart Labs" Project Award from the Department of Energy, on behalf of the Better Buildings Smart Lab Accelerator. The award recognizes the Lab's innovative approach to generate energy and water savings through continual improvement in building operations, what the Lab calls an ongoing commissioning (OCx) process.

Additional detail on these award-winning activities is provided below along with other accomplishments in fiscal year 2020.


The Lab was also certified to an international standard for energy management, ISO 50001. See more information below.

ENERGY and CLIMATE

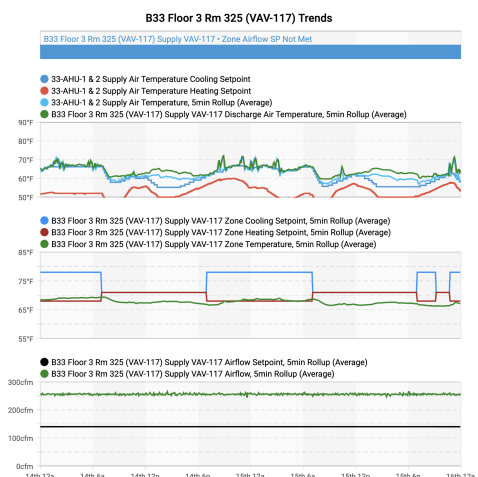
Energy Information and Management

- **Maintained Energy Savings:** As of fall 2020, Berkeley Lab is maintaining annual energy savings of 12.3 million kWh (up from 7.8 million kWh reported last year) and annual water savings of 19.9 million gallons. These savings have been generated since 2015 and are actively maintained going forward. The energy savings are equivalent to the generation from a 7.9 MW photovoltaic array, which would occupy 24 football fields or 31 acres. These energy and water savings are being generated primarily through improvements in facility operations, delivered by the Ongoing Commissioning Team and a focused team at NERSC. The Lab has paid particular attention to reducing its natural gas use. At-the-meter, weather-corrected natural gas consumption

decreased sitewide 20% since fiscal year 2015 as of the start of the COVID shelter-in-place. Maintained Efficiency Savings are updated monthly at sbl.lbl.gov/data.

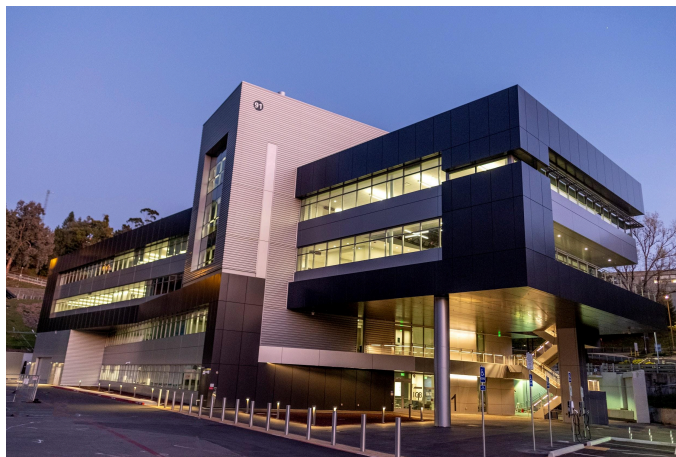
- **ISO 50001 Certification:** Berkeley Lab became officially certified to [ISO 50001](https://www.iso.org/standard/68291.html), an international standard for managing and improving energy performance, in September 2020, after a multi-year effort to strengthen its energy and water management practices. The Lab was also recognized by DOE as ISO 50001 Ready in June 2020, through a program jointly developed by DOE and Berkeley Lab's Energy Technologies Area. The Lab's Energy and Water Management System Manual and more information is available iso50001.lbl.gov. The Lab has made its manual publicly available to help and encourage other organizations to adopt ISO 50001.
- **Ongoing Commissioning:** The Lab continues to operate a dedicated cross-functional team of controls engineers and technicians from the Facilities Management division and Sustainable Berkeley Lab who work continuously to identify, prioritize, and resolve operational problems in buildings in order to generate energy savings and improve operations. Ongoing Commissioning savings are identified as "OCx" savings on the chart of Maintained Efficiency Savings that are updated monthly at sbl.lbl.gov/data. The OCx approach was recognized by a fall 2019 "Accelerating Smart Labs" Project Award given by the Department of Energy on behalf of the Better Buildings Smart Lab Accelerator. The team is described further in the Ongoing Commissioning project profile at sbl.lbl.gov/progress and in a more detailed conference paper available at [tinyURL.com/y3lyghc2](https://tinyurl.com/y3lyghc2).
- **Energy and Water Savings in High Performance Computing:** The Lab has continued work with NERSC (meeting approximately monthly) to protect savings and strengthen monitoring capabilities. In FY 2017 and FY 2018, the Lab verified annual maintained savings of over 1.8 million kWh at NERSC - approximately 37% of the baseline "non-compute" electricity use - and over 500,000 gallons of water. See details on the NERSC Efficiency Optimization at sbl.lbl.gov/progress. The NERSC Efficiency Optimization Team was presented a [2020 Department of Energy \(DOE\) Sustainability Award](#) in the Sustainable HPC/Data Center category for their ongoing performance improvements.

- Efficiency Improvements in Berkeley Lab's Computing Center:** The power utilization effectiveness (or PUE, a measure of the non-compute load as a percentage of the total data center load) at the Berkeley Research Computing Center (located in 50B-1275) has been reduced from an average of 1.37 to 1.28 in the last year. This means that the “overhead” energy use of the facility was reduced by 24%. These savings have been generated by deploying a number of additional [rear-door heat exchanger units](#) at the rack-level, shutting down three additional cooling room air conditioning (CRAC) units, and replacing equipment (pumps and heat exchanger) with more efficiency units.
- Site-Wide Exterior Lighting:** The Lab continues efforts to modernize exterior lighting on its main campus. See a Lighting Modernization project overview at sbl.lbl.gov/progress. While COVID-19 posed significant challenges to accomplishing lighting work in FY 2020, the Lab took the opportunity to gear up for work in FY 2021. In addition, the Lab leveraged knowledge gained from current construction design efforts to update the Lab's lighting guidance and documentation.
- Integrated Laboratory Airflow Management:** Sustainable Berkeley Lab is working with the Lab's EHS Division to closely coordinate efforts in laboratory safety, building operations, and energy efficiency. The Lab has been piloting an enhanced ventilation management program at buildings 74 and 91 (the new Integrative Genomics Building).
- Tools for Scaling Energy Management:** The Lab has significantly expanded implementation of an integrated development environment called Skyspark. With this tool, the Lab is able to integrate to a wide range of legacy facility operations data sources and tag all of the data using a consistent metadata schema. This allows for energy management at scale. For example, instead of monitoring operation for one piece of equipment such as an HVAC air handler, the tool allows for custom analytics across more than 300 air handlers across the Lab.
- Cutting-Edge Control Strategies:** Sustainable Berkeley Lab, NERSC, and the Energy Technologies Area (ETA) of Berkeley Lab are completing a three-year research project funded by the DOE to deploy advanced mechanical system controls in a large office space (greater than 100,000 square feet). Sustainable Berkeley Lab is also working with ETA on a DOE project related to automated fault detection in building control systems. Several automated fault detection algorithms have been implemented in Berkeley Lab buildings.
- New Sustainable Operations Policy:** The Lab published a new campus-level policy on Sustainability Standards for Operations that clarifies roles and responsibilities related to achieving zero waste, advances management of energy and water, and reduces use of toxic substances. The Lab also updated its Sustainability Standards for New Construction, first implemented in 2013, adding electrification requirements among other improvements.



Green Building

- **Updated Sustainability Standards for New Construction:** The Lab updated its policy on [Sustainability Standards for New Construction](#) in December 2019. This policy was recognized with a 2019 Department of Energy Sustainability Award - Outstanding Sustainability Program or Project.
- **High Performance New Construction:** The Lab opened its Integrative Genomics Building (IGB) laboratory in November 2019. This building, which won the UC Best Practice Award for Overall Sustainable Design and an a 2020 Department of Energy (DOE) Sustainability Award Honorable Mention in the Outstanding Sustainability Program/Project category, is designed to meet deep energy efficiency targets (consuming less than 36% of the energy used by the facility it replaced) and use no natural gas for space or water heating. See details about the IGB at sbl.lbl.gov/progress. Through considerable attention by the Lab's Ongoing Commissioning Team, the building is meeting its performance targets after the first year of operation. Photovoltaic panels are planned for future installation.
- **Continued Leadership in Sustainable New Construction:** As of the end of FY 2020, the Lab is finishing up construction drawings for a 78,000 square foot laboratory (BioEPIC) and working on the design of a 47,000 square foot multi-use welcome center (Seismic Safety & Modernization Project). The Lab's policy on Sustainability Standards for New Construction continues to drive many high-performance and sustainable aspects of these designs.



Transportation

- **Increased Electric Vehicle Charging:** The Lab increased the size of its charging community by about 12% in FY 2020 to (from 171 to 191). Prior to the COVID shelter-in-place, approximately 110 EV drivers were charging regularly each month at the Lab's main site. Details about the Staff EV Charging Program are available at sbl.lbl.gov/progress.
- **Transportation Advisory Committee:** The Lab continued an advisory group with diverse representation by scientific and operational staff. The Committee is responsible for addressing transportation policy, operational and safety matters, as well as developing recommendations for clean and sustainable commute options.

Direct Release of Greenhouse Gases

- **Continued Reductions in Sulfur Hexafluoride Emissions:** Berkeley Lab has continued a program to reduce releases of sulfur hexafluoride (SF₆), with current emissions 93% less than baseline emissions in FY 2008. Berkeley Lab switched to using N₂O gas instead of SF₆ as a tracer gas when performing fume hood acceptance testing. Also, the Lab has used a recycling unit to recapture and reuse SF₆ from major uses. The Lab now typically recaptures all SF₆ emissions from

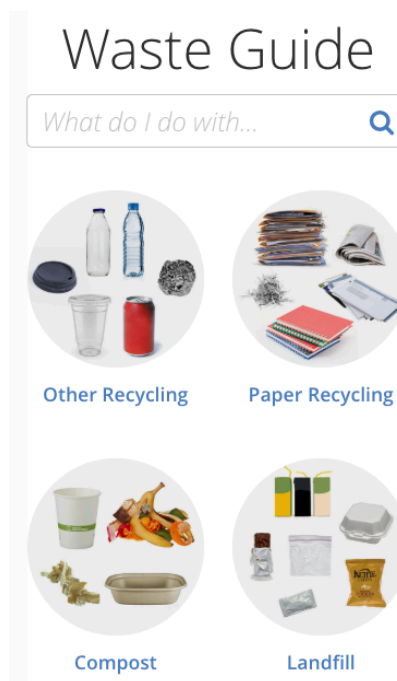
maintenance activities at the Advanced Light Source and periodic maintenance of high voltage power supplies of electron microscopes at the National Center for Electron Microscopy. The remaining releases of SF₆ are from other electron microscope work. All users of SF₆ are aware of the environmental impacts associated with this chemical and are strongly encouraged to use recovery equipment when maintaining their systems.

Renewable Energy

- **Decarbonizing Energy Supply:** The Lab is participating in two requests for proposals for renewable electricity and is actively working on opportunities to make long-term purchases of renewable electricity. Berkeley Lab continues to purchase 20% of the output of a 3.3-MW, 10-acre solar photovoltaic array in Livermore, developed in collaboration with Lawrence Livermore National Laboratory, and completed in February 2016.

WASTE

- **Online Waste Guide:** The Lab has continued hosting an online Waste Guide (wasteguide.lbl.gov) to educate the Lab community on how to reduce, reuse, and recycle more than 250 items. The Guide has been very useful and popular. It indicates how to dispose of items and provides additional details about what happens after items are put in the bin.
- **Site-Wide Waste Audits:** The Lab has maintained its site-wide waste audit system to track building-level diversion and identify the composition of waste streams in order to better target diversion efforts. Explore Waste Diversion by Building at sbl.lbl.gov/data and read about the Lab's data-driven waste diversion efforts at sbl.lbl.gov/progress.
- **IGB Pioneers as the Lab's First Zero Waste Building:** IGB has demonstrated leadership by committing to be the Lab's first building to go "zero waste," with updated infrastructure to reach and sustain greater than 90% waste diversion. SBL Waste Audits had found that single bins under desks were the primary source of contamination, bringing down the total diversion rate in the building, and that eliminating them could help increase diversion rates. Approximately 65% of the contents in those bins could have been recycled or composted, but ended up going to landfill, compared to 14% at central waste stations. In response, the JGI Sustainability and Wellness Group (SWELL) formed a Zero Waste Team and got commitment from senior leadership to forgo all under desk bins and instead increase the four-bin central waste stations throughout the building. Coupled with increased education and awareness initiatives, the JGI team has blazed the path towards zero waste.
- **New Policies for Zero Waste and Waste Reduction:** New policies were finalized in the Lab's Requirements and Policy Manual in February 2020 ([Sustainability Standards for Operations](#)) to clarify roles and responsibilities related to achieving zero waste (greater than 90% diversion).



WATER

- **New Water Policies:** Three policies were officially adopted within the Lab's Requirements and Policy Manual intended to reduce water consumption (see Sustainability Standards for operations, adopted February 2020). These include policies defining limitations for landscape watering, for water-conserving restroom fixtures, and to eliminate water waste associated with single-pass cooling. Single-pass cooling refers to the use of a cold water supply as a source of cooling in which water is run through a piece of laboratory or building cooling system equipment to a drain.