SUSTAINABLE BERKELEY LAB

Energy and Water Management System Manual

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1 INTRODUCTION

This manual defines the Berkeley Lab energy and water management system (EWMS) in accordance with ISO 50001, an international energy management standard. ISO 50001 is organized as a continual improvement Plan-Do-Check-Act cycle. Alignment with ISO 50001 is a key effort to ensure that the Lab's energy and water management activities are strategic, effective, and persistent. The Lab is currently certified to ISO 50001 under underline certificate # 162278.00. The Lab is also recognized as 50001-Ready by the US Department of Energy.

The intended outcomes of the EWMS are:

- Continual improvement in energy and water performance
- Continual improvement of the energy and water management system
- Supporting the mission of Berkeley Lab and adding business value

This manual is shared publicly, via iso50001.lbl.gov to help other organizations align with ISO 50001 and improve their energy and water performance. Please note:

- This manual and the included links represent working documents subject to ongoing updates.
- Most documents linked from this manual are restricted-access.
- Any comments, questions, or suggestions on this document can be sent to Sustainable Berkeley Lab (SBL) at sbl@lbl.gov.
- Team members should make major changes in Suggesting mode, to be resolved by another member. Small edits and corrections may be made directly. To snapshot a major version, a Named Version may be created.

2 SCOPE AND BOUNDARIES

The **Scope and Boundaries** of the Berkeley Lab energy and water management system are defined below.

Scope: Research and operations in support of the mission of the Department of Energy in a wide range of fields including high-performance computing, physical sciences, accelerator technologies, materials sciences, biological and environmental sciences, and energy technologies.

Boundaries: The fenceline of the Lab's main campus at 1 Cyclotron Road, Berkeley, CA 94720, plus a satellite location at 2100 Atlas Road, Richmond, CA 94806.[1]

The Lab operates as one site and maintains one ISO 50001 system across both locations.

- A list of included locations and buildings, with exclusions, is available in the EWMS Portfolio.
- Relevant Issues and Requirements are considered in setting the EWMS scope and boundaries.

The scope, defined according to operational control (the ability to introduce and implement operating policies that impact energy and water performance), includes:

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[1] Energy consumption at the Richmond facility is very small compared to consumption at the Lab's main location on the hill. See energy consumption by location.

- All energy and water uses and consumption, including greenhouse gas emissions associated with energy uses
- Support functions such as design and procurement that can affect energy and water performance
- Fuel use by fleet

The scope does NOT include:

- Commute transportation (fuel use by shuttles and personal transport)
- Greenhouse gas emissions not associated with energy uses, such as refrigerants[2]
- Energy and water uses and consumption for off-site leases where the Lab does not have operational control. This includes the Office of the Chief Financial Officer, Potter Street, the Joint Bioenergy Institute, and Advanced Biofuels Process Demonstration Unit, as well as smaller facilities as detailed in EWMS Portfolio.

Climate change is a relevant issue to the Lab, which is subject to several climate-related requirements.

3 ROLES AND RESPONSIBILITIES

EWMS Roles and Responsibilities provides a guide to who and how people are involved in the EWMS.

- The Roles and Responsibilities Tab describes key **EWMS Roles** and **EWMS Responsibilities**, including those defined by ISO 50001.
- The Area Owners Tab identifies which role is responsible for each area of the EWMS.
- The Individuals Tab identifies the individuals involved in the EWMS and their particular EWMS Role.
- The Stakeholders List (Interested Parties) comprises those who have been deemed relevant to energy and water performance and the EWMS, in particular those who set requirements and to whom the Lab reports on its sustainability performance.

The EWMS Roles and Responsibilities also defines a process for the ongoing implementation of the EWMS. The Area Owners Tab describes:

- Who: The owner is identified by role (the "Owner"). The Individuals Tab indicates the specific people filling each role.
- What: Sections of the ISO 50001 standard are mapped to an owner ("ISO Standard Section for Which Owner is Responsible"). The Area Owners Tab also identifies:
    - "EWMS Manual Sections Maintained by Owner"
    - "Documents Maintained by Owner"
    - "Other Required Activities" of the Owner

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[2] Since scope 1 and 2 emissions are dominated by emissions from electricity and natural gas consumption - and to be consistent with Labwide greenhouse gas reporting - the EWMS references performance metrics for all reported scope 1 and 2 emissions, even though these metrics include some emissions sources outside the scope of the EWMS. The EWMS includes scope 1 emissions from the consumption of natural gas, equipment fuel, and fleet fuel. The EWMS does not include scope 1 emissions from the fugitive release of gases. The EWMS includes all reported scope 2 emissions (emissions from electricity consumption). See Berkeley Lab Greenhouse Gas Inventory Details for more information.

- <u>When</u>: Minimum frequencies for reviewing / updating EWMS Manual sections and documents, as well as conducting other required activities.

3.1 Core Team

The core team plays a key role in implementing and maintaining energy and water performance and the effectiveness of the EWMS. Detailed responsibilities of the core team are listed on the <u>Roles and Responsibilities Tab</u> and the individuals included in the core team are listed on the <u>Individuals Tab</u>. Names and faces of the core team are maintained on an <u>EWMS Team slide</u> used for communications about the EWMS. The team plays a support and review role for many aspects of the management system, as indicated in the Support/Review column of the <u>Area Owners</u> tab. The high-level schedule and content of core team reviews is included in <u>EWMS Annual Review Cycle</u>.

3.2 Top Management

Top management provides leadership and commitment to the EWMS and therefore plays a special role in establishing and maintaining the EWMS. Detailed responsibilities of top management are listed on the <u>Roles and Responsibilities Tab</u> and the individuals included in top management for the EWMS are listed on the <u>Individuals Tab</u>.

- An **EWMS Executive Sponsor**, currently the Lab's Deputy Director for Operations, serves as a point of contact responsible for ensuring support among the Laboratory Director, the Laboratory Deputy Director for Research, and key operations staff related to the EWMS.
- A **<u>Management Review</u>** meeting, conducted with participation by the Lab's Environmental Management System, is held at least annually to coordinate top management information-sharing and responsibilities. Among many areas of requested feedback, top management are asked how the EWMS can best meet its third outcome: "supporting the mission of Berkeley Lab and adding business value."
- The **EWMS Sponsor**, currently the Lab's Chief Sustainability Officer, works closely with the EWMS Executive Sponsor and the Management review team to sustain the function of the EWMS.

4 ENERGY AND WATER POLICY

An energy and water policy statement is included in policy on <u>Sustainability Standards for Operations</u> in the Berkeley Lab Requirements and Policies Manual, and summarized on the <u>ISO 50001 website</u>. The policy is communicated to the Lab Community on an annual basis, concurrent with communicating annual sustainability performance. See the <u>Annual Cycle</u>. The policy is approved via the Lab's Policy Approval Form, and documented in the <u>Policy Approval Folder</u>.

5 ENERGY AND WATER PLANNING

5.1 Strategic Planning

5.1.1 Relevant Issues, Stakeholders (Interested Parties), and Legal and Other Requirements

Relevant issues and legal and other requirements are considered as inputs to the strategic planning process and for setting the scope and boundaries of the EWMS.

- Relevant issues that have the potential to affect the intended outcomes of the EWMS are identified, and then associated with risks or opportunities in the EWMS Risk and Opportunities Register. Risks are evaluated using a probability/impact/velocity framework established in Lawrence Berkeley National Laboratory Risk Management Description for Institutional Risks. Top risks (with their associated opportunities) are identified in the EWMS Risk and Opportunities Register and shared during Management Review.[3]
- Interested parties may express needs or expectations that present relevant issues or that affect the EWMS or its energy and water performance. For the Lab, these interested parties are identified in a Stakeholders list, and include topmost Lab leadership, the federal government and the University of California (UC).
    - The topmost Lab leadership meets quarterly with the EWMS sponsor, providing a forum to identify needs or expectations to be fulfilled by the EWMS. Also, the EWMS sponsor proactively asks the Executive Sponsor annually about their needs and expectations.
    - Federal (DOE Sustainability Performance Office and the Berkeley Site Office) and UC stakeholders manage a process of periodically publishing requirements and an annual process in which reporting against those requirements is communicated to the Lab. Therefore, the Lab understands the needs and expectations of these stakeholders to be that the Lab follow applicable federal and UC requirements. The requirements from these sources within the scope of the EWMS are identified and discussed in the bullet below. The federal or UC stakeholders could identify additional needs or expectations to be fulfilled by the EWMS, but this has not occurred previously, so the Lab relies on the published requirements to express needs and expectations.
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- Requirements and Quantitative Targets in the EWMS identifies requirements and quantitative metrics that track performance within the scope of the EWMS, a subset of legal and other requirements identified in the Berkeley Lab Sustainability Targets and Requirements. Some requirements have the force of law and others are administrative requirements. Management review includes an assessment of performance against, rather than formal compliance with, Requirements and Quantitative Targets in the EWMS. The Lab does not assess formal compliance

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[3] Risks and opportunities are communicated to top management, rather than issues alone, to be consistent with a Labwide approach to discuss issues within a risk management framework. Note that the term "issue" in the ISO 50001 standard is broad, meaning "an important topic or problem for debate or discussion." At the Lab, an "issue" has a more specific definition: "any event, incident, condition, or circumstance that has resulted in an adverse outcome, conformance, or noncompliance; and/or adversely affects the laboratory's reputation, achievement of mission, or strategic or business objectives." See Pub 5519 for more information.

because its requirements in the EWMS are not enforced within a regulatory framework. The Lab has only one EWMS requirement based in Law (related to Procurement), but the Lab is not required to demonstrate compliance with the Law. Instead the Lab reports progress annually to the federal government in meeting the requirement.

Legal and other requirements are kept up-to-date through a variety of activities and communicated at a minimum through Core Team and Management Review Meetings. Of note:

- **Requirements Management**: Berkeley Lab has a formal "requirements management" process and governance structure oriented toward ensuring that the Lab fulfills the terms of its operating contract to the Department of Energy, including compliance with applicable regulations. This process is a "feeder system" that can help identify legal or other requirements that might apply to the EWMS.
- **Management Meetings**: The Berkeley Lab Chief Sustainability Officer or designee attends several regular management meetings in which new Laboratory commitments would be discussed that could lead to new legal and other requirements, including:
  - Monthly Division Directors Meeting
  - Annual Director's Strategic Planning meeting
  - Regular Operations Leadership meetings
- **UC Sustainability Coordination**: For requirements arising from the University of California system, the EWMS Executive Sponsor serves on the UC Sustainability Steering Committee, which meets at least annually and is responsible for approving all updates to the UC Policy on Sustainable Practices. The Chief Sustainability Officer often attends the steering committee meetings on behalf of EWMS Executive Sponsor, and also represents the Lab on the UC Global Climate Leadership Council, which is closely involved with the setting of climate policy within the UC.
- **Annual [Management Review](#) meetings** also provide an opportunity to capture new legal or other requirements that might apply to the EWMS.
- **One quarterly ISO 50001 Core Team meeting** each year includes review of legal and other requirements.
- **Annual Requirement Coordinator Review** - [Requirement Area Coordinators](#) are responsible for reviewing and updating requirements annually. Requirements are organized into Requirement Areas, each with an assigned coordinator. The Requirement Area Coordinator reviews the corresponding requirements (using filter views in [Berkeley Lab Sustainability Targets and Requirements](#)) on an annual basis (per the [Review Cycle](#)) to verify validity and applicability, and suggest changes to Berkeley Lab Sustainability Targets and Requirements. The annual review includes review of requirements on a [Requirements Watch List](#), as well as designation of new requirements for that list. This list identifies requirements known to be in flux, requirements that may not be applicable to the Lab but may be considered to be adopted as policy, or requirements in development that will likely apply to the Lab at a future date. The coordinators should follow the Guidance set forth in the [Annual Requirements Review](#). Also, a mid-cycle review would be held as needed in response to a major change in requirements, such as a new Executive Order.
- **Coordination with Environmental Management:** The EWMS is coordinated with the Lab's Environmental Management System (EMS). This coordination provides an opportunity to identify applicable legal and other requirements. Division of responsibilities between the two

management systems is detailed in this matrix of EMS & EWMS topics. Coordination activities between EWMS and EMS include:

- ○ Mutual participation in respective program core teams
- ○ Review of annual reporting
- ○ Regular discussions on requirements and program integration

5.1.2 Organization Context, Risks and Opportunities

Strategic planning involves:

- Evaluating the Organizational Context
- Identifying risks and opportunities associated with relevant issues and requirements**.**

Organization Context comprises the external and internal issues relevant to the Lab's purpose and that affect the ability to achieve EWMS outcomes:

- Continual improvement in energy and water performance
- Continual improvement in management system, and maintenance of savings
- Support mission and add business value

Organizational Context Changes that may impact the EWMS and performance include:

- **Leadership**: top Lab leadership, White House administration
- **Infrastructure**: significant new construction / demolition, catastrophic event
- **Mission**: significant change in scientific / DOE direction
- **Budget**: significant impact to funding, utility costs
- **Technology & Materials**: significant changes in technology and/or availability
- **Partnerships & Staffing**: strength of partnerships across the Lab, availability of skilled staff

The EWMS Risk and Opportunities Register identifies the top risks (with associated opportunities) to be addressed by the EWMS to ensure that it achieves its intended outcomes. These top risks are addressed through Action Plans. The register also includes an archive of Risks Previously Addressed. Other actions that improve the EWMS are tracked in Issue & Improvement Tracking.

Risks are evaluated using the Risk Severity Guidelines found in the Issues Management Program Manual PUB 5519 from the Lab's Office of Institutional Assurance & Integrity.

5.2 Tactical Planning

5.2.1 Energy and Water Review

An energy and water review is conducted annually, and involves an evaluation of energy and water management processes and systems, including data collection and metrics, trends and major changes. In addition, the need for an updated, mid-cycle energy review is evaluated in response to a major change in facilities, equipment, systems, or energy- (or water-) using processes. See records of energy and water review.

5.2.1.1 Major Change

A major change in facilities, equipment, systems, or energy- (or water-) using processes may be indicated through any of the regularly occurring information-gathering that occurs as described as part of Strategic Planning. Monthly significant deviations in energy or water consumption are also reviewed regularly (within Skyspark see Meters,Monthly/Significant Deviations, login credentials required) for the potential to indicate a major change.

- For energy, a monthly significant deviation is defined as monthly consumption of electricity or natural gas at a facility or sitewide that exceeds 35% of a weather-normalized profile based on the previous 12-months of consumption data.
- For water, a monthly significant deviation is defined as monthly consumption of sitewide water that exceeds 50% of a profile based on the previous 12 months of consumption data.
  - For selected water meters with interval data, sudden changes in water consumption are monitored within SkySpark (see His Alarms). Water meters with interval data are assigned a threshold either in gallons/hour or gallons/day. If change in water consumption is above the threshold for a set period of time, email notifications are sent to the Energy Manager and Energy & Sustainability Analyst.
  - For water meters without interval data, monthly manual reads are used to monitor changes in water consumption within a Tableau report maintained by the Energy & Sustainability Analyst. Abnormal changes in water consumption are reviewed with the Energy Manager on a monthly basis.

If a monthly significant deviation is indicated, the approach identified in Significant Deviation Process is used to determine whether minor follow ups are required to protect the integrity of the EWMS, or whether a major change has occurred, warranting an updated energy and water review.

5.2.1.2 Energy and Water Types, Suppliers, & Uses

Energy and water types within the EWMS are listed below. New types would be identified through energy and water reviews and an annual accuracy review with the Core Team. Energy and water types (with suppliers) are summarized below. See energy consumption related to the energy types listed below.

1. Electricity
   a. Electricity supplied to the main site (1 Cyclotron Road, Berkeley, CA 94720) by the Western Area Power Administration (WAPA) and transmitted by Pacific Gas & Electric
   b. Electricity supplied to offsite facilities by Pacific Gas & Electric or MCE, a community choice aggregator, and distributed by Pacific Gas & Electric
   c. Berkeley Lab Electricity Sources describes the Lab's current and potential sources of electricity in more detail.
2. Natural Gas
   a. Natural gas supplied to the main site by NRG Business Marketing LLC and distributed by Pacific Gas & Electric
   b. Natural gas supplied and distributed to offsite facilities by Pacific Gas & Electric (There is currently no offsite natural gas consumption within the scope and boundaries of the EWMS.)
3. Delivered Fuels (a very small portion of EWMS energy consumption, see energy consumption)
   a. Diesel fuel used for emergency generators and in fleet vehicles

   b. Gasoline and E85 used in fleet vehicles
   c. Propane used for forklifts and research uses
   d. Methane delivered in canisters for research uses
  4. Water
   a. Potable water provided by East Bay Municipal Utility District

Energy and water uses associated with the largest greenhouse-gas emitting facilities are tracked using a Key Facility flag.[4] An additional group, called "UNKNOWN" includes residual natural gas consumption on the Lab's main hill site that is measured by subtraction of meters rather than by submetering. The "UNKNOWN" consumption is not associated directly with any one facility. Based on a thorough survey of the natural gas distribution system conducted in FY 2023, all natural gas flows are submetered. The "UNKNOWN" quantity is thought to be primarily associated with metering error. The [Facility Ranked Consumption](#) identifies Key Facilities and their cumulative percentage of facility greenhouse gas emissions, facility energy consumption, facility electricity consumption, and facility natural gas consumption within the EWMS. The Key Facilities are further categorized by **Space Type**. Space Type categories include:

- **Computing**: Key Facilities with high performance computing and data center loads (50A/B Process, 59 Process)
- **Accelerator**: Key Facilities with accelerator loads (6 Process, 34 Process, 37 Process, 88 Process)
- **Wet Lab**: Key Facilities where laboratory space is greater than office space[5], or hood density >=0.30 hood/ksf
- **Dry Lab**: Key Facilities where laboratory space is greater than office space, and hood density <0.30 hood/ksf; plus vivarium
- **Office**: Key Facilities where office space is greater than laboratory assigned space, and the Key Facility Space Type is not Computing or Accelerator
- **Other:** Consumption not classified as one of the other five space types

Energy or water consumption associated with a Key Facility may be broken down (where it can be reasonably estimated) into end uses:

- Energy
  - **Mechanical**: Uses associated with building mechanical systems
  - **Lighting**: Uses associated with lighting systems
  - **Plug**: Uses associated with equipment that is plugged into an electrical receptacle
  - **Process**: Uses associated with Accelerator, Computing, or other loads that support scientific processes (such as a facility that produces compressed air for multiple laboratory buildings)

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[4] A Key Facility can be a group of buildings, a single building, or a separate and significant end use in one building.
[5] Laboratory space is determined based on the ARCHIBUS system, where "roomtype" is either AIRLOCK, CHEM STOR, ANIMAL, DRY, ANTE, CLEAN, MECH SHOP, DARK, LASER, HBAY, HEAVY, LAB EQUIP, TISSUE, EXAM, VEST, BENCH, GLWASH, or WET. Office space is determined based on the ARCHIBUS system, where "roomtype" is either BREAK, COPY/PRINT, BULLPEN, CUBE, ENCL, HOTEL, HUDDLE, RECP, WKSF, PRIV CONF, PUBL CONF, WORKBENCH, TRAINING, MAIL, CONTROL R, DROP IN or LIBRARY. All other roomtypes are considered "general" and are not counted as Laboratory or Office.

- Water
  - **Cooling tower**: Water consumption associated with cooling towers (evaporation and blowdown)
  - **Restroom and break rooms**: Water consumption associated with restrooms and break rooms and kitchens
  - **Lab equipment**: Water consumption associated with equipment used in laboratory spaces such as autoclaves, small chillers, compressors, water purifiers, etc.
  - **Other**: Uses that have not been broken down into the end uses above (labs, processes, leaks, or unmetered)

5.2.1.3 Data Collection

A data collection plan that reflects the collection and processing of energy-, water-, and greenhouse gas emissions-related data is provided in [EWMS Data Sources and Process Description](). This working document, owned by the Berkeley Lab Energy Manager, identifies each data source and information such as the data interval, the data processing frequency, and the processing steps for each data source. The plan includes energy and water consumption, relevant variables for SEUs, and static factors (such as monitoring point and building information). For applicable data sources, the processing steps are documented as a "script" that can be followed to perform the data processing (see [EWMS Processing Steps]()). [EWMS Data Sources and Process Description]() is updated as each data source is processed to identify the latest available data from each source. Processed data is made available at [sbl.lbl.gov/data]().

Past and current annual energy consumption data is available in [Energy Consumption Compared to Baseline](). Monthly and interval energy and water consumption data are also integrated to SkySpark. Past and current water consumption by fiscal year is available in [Potable Water Consumption per Square Foot](). Past and current scope 1 and 2 greenhouse gas emissions by fiscal year is available in [Scope 1 & 2 Emissions - Performance Against Targets]().

To ensure that data is accurate and repeatable, the Energy Manager or designee performs and documents the following steps:

- On a monthly basis, manual energy and water meter readings are collected using a mobile-based application, which documents photos of the meter readings. This helps ensure that manual meter readings entered by technicians are accurate and avoids erroneous entries. Collection of photos also ensures that meters are repeatedly read with accuracy, and provides an accurate reference when deviations are found.
- On a monthly basis, monthly energy reads and selected water reads are assessed for significant deviations using the process described in Section *5.2.1.1.* While the quantitative significant deviation is a primary screen, trends of monthly energy and water reads by monitoring point are also reviewed from the baseline period forward to visually identify any potential anomalies. The [Monthly Reads]() view in SkySpark is available to visually compare meter interval data (where available) with the monthly manual meter consumption at the facility level.
- Monthly energy data is continually reported in [Monthly Elec Reads]() and [Monthly Gas Reads]() views in SkySpark. Annual energy data is available by space type and fiscal year from FY 2014 to the present in [Energy Consumption by Facility](). Comparison of data across facilities helps inform an initial assessment of reasonable meter data quality.

- On a quarterly basis, the Energy Manager compares monthly sums of both sets of main sitewide Hill ION and WAPA (Electricity) interval meter data (15-minute or hourly intervals) with the sum of monthly manual submeter electricity consumption data for reasonableness (within 2%) using the Electricity Remainder view in Skyspark.
- On a quarterly basis, the Energy Manager compares monthly sums of the main sitewide Natural Gas Interval meter data (daily intervals) with the sum of monthly manual submeter natural gas consumption data for reasonableness (unmetered residual is <20% of site meter consumption) using the Gas Remainder view in Skyspark.

On an annual basis, the Energy Manager or designee performs the following steps to determine scope 1 and 2 greenhouse gas emissions for the federal fiscal year as part of the annual Site Sustainability Plan (SSP) process:

- Annual electricity consumption, natural gas consumption, released fugitive and process gasses, released refrigerants, on-site fleet fuel consumption, and on-site equipment fuel consumption are entered into the Department of Energy (DOE) Sustainability Dashboard using data compiled using some existing processes highlighted in the EWMS Data Sources and Process Description and from various SMEs and data contributors at the Lab.
- The energy consumption and fugitive gases and emissions that are entered into the DOE Sustainability Dashboard are then converted into greenhouse gas units of metric tons of CO_2 equivalents (MTCO2e) using emission factors from the DOE Sustainability Dashboard. These factors can also be viewed in GHG Emissions - Calculation Factors. The calculations performed by the DOE Sustainability Dashboard follow the Federal Greenhouse Gas Accounting and Reporting Guidance.
- The data in units of MTCO2e from the DOE Sustainability Dashboard is downloaded and compiled into Tableau, following the steps outlined in EWMS Processing Steps section 2.2 "Federal Reporting Data into Tableau". Past and current results by category in units of MTCO2e are displayed in the Site Sustainability Plan Tables Tableau report.
- Past and current scope 1 and 2 greenhouse gas emissions by fiscal year are available in Scope 1 & 2 Emissions - Performance Against Targets.
- For additional scope 1 and 2 greenhouse calculations, the CAMX eGRID emissions factors are tracked in eGRID Resource Mix.
- For scope 2 emissions, Berkeley Lab generally follows this Scope 2 reporting protocol guidance, which comprehensively addresses the details of how to account for Renewable Energy Certificates (RECs) and how to choose emission factors from suppliers like MCE, a community choice aggregator. This guidance is associated with the GHG Protocol Corporate Accounting and Reporting Standard. Berkeley Lab has not identified any inconsistency between these GHG protocols and the Federal Greenhouse Gas Accounting and Reporting Guidance.

Since 2024, the Lab has made considerable progress in improving the quality of water monitoring data (which generally lags behind energy data). Progress has been made in:

- Segmentation of water data into functionally similar groups (for example: process loads, weather-sensitive cooling tower (CT) loads, other CT loads, remainder non-CT loads)
- Exploring weather correction for some water monitoring points

- Carefully establishing water monitoring points and improving data quality associated with those points
- Bringing more watering points into the significant deviation process
- Improving monitoring of campus level water consumption anomalies (including through tracking fire tank recharge process)
- Expanding rapid notification emails for cooling tower points and sitewide water meters

5.2.1.4 Significant Energy Uses (SEUs) and Significant Water Uses (SWUs)

A significant energy use (SEU) or significant water use (SWU) is:

- **Large**: Greater than
  - For an SEU: 20% of total facility GHG emissions (GHG emissions are used instead of total energy use since GHG emissions are the primary impacts from energy consumption.)
  - For an SWU: 20% of total water consumption
- **Growing**: With potential for growing consumption over time.

SEU: The electricity use for high-performance computing equipment and supporting systems at the National Energy Research Scientific Computing Center (NERSC, SBLID = 74, NAME= 59 Process) is currently identified as the only SEU at Berkeley Lab (see Facility Ranked Consumption). Improvement of energy and water performance at NERSC is addressed by its own Action Plan. Current energy performance of the SEU is tracked by Power Utilization Effectiveness and Water Utilization Effectiveness plus a suite of tools developed within Skyspark (see NERSC Monitoring/PUE Monitoring) and by following a regular process to review performance, based on the NERSC Metrics Script.

SWU: The water use at building 59 (which houses NERSC) is currently identified as the only SWU. See data on water consumption as a percent of total.

Virtual Tours of NERSC are available at the following links:

- Compute (HPC) floor
- First floor mechanical and electrical room
- Second floor electrical room

5.2.1.5 Relevant Variables

Weather: In general for energy and water performance at Berkeley Lab, the primary relevant variable is weather. Where applicable and feasible, energy performance indicators are normalized for weather. While weather does affect water consumption at the Lab (due to evaporation and blowdown in cooling towers), the Lab has not developed a weather normalization that is calibrated for water consumption.

- **Weather station calibration:** The Lab's Environment, Health & Safety division manages the biannual calibration of the Lab's weather station. On an annual basis, the Lab's two most recent Weather Station Calibration Reports are obtained by the Energy and Sustainability Manager (by emailing weather@lbl.gov), reviewed, and filed in the Monitoring, Measuring, & Analysis Records Folder.

Population: The Lab also has the ability to track population as a normalization divisor within the boundary of the EWMS and within facilities included in the EWMS. But population has not yet proven to be a relevant variable in analyzing energy and water performance. Population is expressed as full-time-equivalent employees and affiliates, excluding visiting users of the Advanced Light Source.

For the SEU: The relevant variables affecting energy uses at the SEU (NERSC) have been identified through implementation of energy and water saving measures at the facility and are:
- **Operating schedules**: The facility runs 24/7 but undergoes shut-downs for scheduled or unplanned maintenance
- **Weather**: Temperature and humidity affect the amount of energy required for cooling the facility
- **Optimization of cooling equipment operating sequences**: Operating sequences within the cooling system affect energy and water uses

The following variables are also known to affect energy uses at NERSC, but the Lab has not identified metrics to capture these variables within the context of energy and water performance.
- **Compute load**: That amount of compute load drives energy use as well as cooling energy and water uses
- **Optimization of computational algorithms**: Different algorithms affect energy and water uses

5.2.1.6 Energy and Water Performance Improvement Opportunities & Selection
The process to identify, prioritize, and record opportunities for improving energy and water performance are described in [Energy & Water Efficiency Opportunities](). The economic feasibility of a project may be evaluated using an approach that identifies a minimum financial performance threshold, which is described in [Project Financial Thresholds]().

5.2.1.7 Future Use and Consumption
Past and future energy and water use and consumption trends are available in a shared folder called [Forecasts](), which contains the current [electricity](), [natural gas](), [water](), and [greenhouse gas]() forecasts. Forecasts are updated annually at a minimum, and more frequently as needed in response to [Major Changes]() and updated information (typically changes to SEU computing). Electricity forecasts are kept current with changes in SEU loads. Discussion of changes in the forecasted SEU load is included as a standing agenda item in regular meetings with NERSC operations staff.

5.2.2 Outputs

5.2.2.1 Targets
The [Key Quantitative Targets in the EWMS](), introduced in section 5.1.1 and found in [Berkeley Lab Sustainability Targets and Requirements](), are inputs to [Strategic Planning](), but also form a key Tactical Planning output.

5.2.2.2 Energy and Water Performance Indicators (EWPIs)
Energy and Water Performance Indicators (EWPIs) allow for quantitative tracking of energy and water performance within the EWMS and enable demonstration of energy and water performance

improvement. See EWPIs for a list of currently maintained EWPIs. EWPIs are reviewed with the Core Team at least annually for completeness.

Where applicable, EWPIs are associated with the relevant key quantitative target. Some EWPIs are used to evaluate energy and water performance, and others are used simply to track and understand consumption, as indicated in EWPIs. For those EWPIs used to evaluate energy and water performance, evaluation frequencies, targets, and thresholds are identified to indicate a significant deviation. Responses to a significant deviation are captured through a core team meeting in which energy and water performance is evaluated (see Monitoring, Measurement, Analysis, and Evaluation). EWPIs also includes links to data presentations, generally also available at sbl.lbl.gov/data.

5.2.2.3 Baseline

EWPIs are measured against energy and water baselines where applicable. FY 2015 is the default baseline year because it immediately precedes the current era of work related to meeting climate, energy, and water targets and is a meaningful reference point in communicating with the Lab Community. But in some cases alternate baseline years are selected to be consistent with key quantitative targets that arise from external requirements. The EWPIs file includes a column designating the applicable baseline year. The energy baselines are normalized for weather.

A goal of the EWMS is to always present the most accurate performance data using the best available data. Methodologies for the calculation of baseline and current period performance are ideally the same. But in some cases, data may become available that enables calculation of a more accurate result for an EWPI in a performance period that is not available to support the exact same methodology in an applicable baseline period. In this case:

- If data is available to reasonably do so, the EWPI baseline methodology will be adjusted to improve consistency between the baseline and performance periods. The adjustment will be documented.
- If data is not available to reasonably do so, then a new EWPI baseline year will be identified for which consistency between the baseline and performance period is possible. The issue causing the new baseline will be documented.

The baseline years and methodologies will be reviewed for appropriateness and changed if:

- There has been a major change to Berkeley Lab operational patterns or energy systems (as defined in Energy and Water Review)
- Objectives or targets are significantly changed (See Relevant Issues and Requirements)
- Energy and Water Performance Indicators (EWPIs) are significantly revised

5.2.3 Objectives and Action Plans

Berkeley Lab's sustainability strategic plan identifies actions designed to meet key quantitative targets and other desired outcomes to address Relevant Issues and Requirements. SBL Key Priorities identifies objectives for each fiscal year associated with each of the actions in the strategic plan. Each objective has a priority owner within the SBL team, responsible for achieving the objective.

Activities to achieve objectives are organized as action plans. Action plans are documented quarterly during team meetings. The EWMS Sponsor is responsible for ensuring that Action Plans are achievable given available resources. See the [EWMS Action Plan Index](#).

See the [Strategic Planning](#) section for a description of how action plans are informed by issues, requirements, risks and opportunities. Plans are expected to be completed within a fiscal year. Plan effectiveness is informed by tracking Key Quantitative Targets as well as feedback from Core Team and Management Review meetings. Annually, progress against the strategic plan is shared.

Given the central role that the Ongoing Commissioning (OCx) team has in driving savings, specific metrics are used to track OCx effectiveness, below. Additional information about the Ongoing Commissioning Team and process is available at [ocx.lbl.gov](#).

- OCx team productivity metrics are updated monthly in Skyspark (see [Deficiencies/Sprints](#),).
- A list of all Ongoing Commissioning closed deficiencies, updated monthly, is available [here](#).

Also, across all action plans and activities, any improvements in energy and water performance are **verified** as defined in [Verification of Savings](#) and reported at [sbl.lbl.gov/data](#). See [Berkeley Lab Efficiency Savings Portfolio](#).

6 RESOURCES, COMMUNICATION, AND DOCUMENTATION

6.1 Resources

Fiscal year resource needs for the EWMS and energy and water performance improvement are identified, communicated, and allocated as part of Lab's standardized annual budgeting process. Resource needs that are unplanned or unanticipated are handled by the Sustainability Officer, from the general Sustainability budget.

6.2 Competence

Ensuring competence and awareness is prioritized for effective personnel. For the purposes of the EWMS and in consideration of the large number of Lab employees, effective personnel are those key staff with roles that materially affect energy and water performance and the EWMS. These include:

- Members of the Lab's Ongoing Commissioning Team
- Members of the EWMS Core Team directly involved in the Lab's energy and water performance
- Lab Leadership for Construction Design (Project Infrastructure Modernization Division), Procurement, Facilities, and Operations
- Key SEU Personnel

Competence needs are reviewed by the Core Team on an annual basis (see the [Annual Review Cycle](#)).

A list of effective personnel and their minimum training requirements can be found in the [Effective Personnel List](#). In addition, competence of personnel at Berkeley Lab is addressed in a variety of ways:

- For Staff:

- ○ Berkeley Lab's processes for screening and hiring are managed by Human Resources. Competency requirements for staff can be found in an employee's position description which can be requested from HR by submitting an email to opshr@lbl.gov.
  - ○ The following online learning management systems track an extensive list of training requirements for all Lab employees, which in turn contribute to a culture that values competence:
    - ■ Berkeley Lab Training System: training.lbl.gov
    - ■ University of California Learning Management System: https://uc.sumtotal.host/
  - ○ Training records for effective personnel are available at ISO 50001 Training Records.
  - ○ A Work Planning and Control (WPC) Activity Manager Berkeley Lab login credentials required) tracks additional training requirements and safety aspects relevant to specific job duties.
  - ○ Ongoing Commissioning Technicians, a subset of the Facilities Monitoring and Control Systems technicians group, participate in daily discussions about the operational status of existing systems and their continuous efforts to maintain and optimize them. Mentoring and oversight are key drivers for this effort.
- ● For Subcontractors:
  - ○ Berkeley Lab's process for subcontracting is managed by Procurement. Competency of subcontractors is maintained in subcontracting documentation, which can be obtained by contacting ProcurementHelp@lbl.gov. Additional documentation for SBL subcontractors is maintained in SBL Shared files.

6.3 Awareness and Communication

The key goals of EWMS awareness and communication are to:

- ● Demonstrate top management commitment to energy and water management
- ● Communicate
  - ○ The Lab's energy and water management policy
  - ○ The Lab's sustainability performance
  - ○ How employees can contribute to energy and water performance and the EWMS
- ● Gather feedback and enable two-way communication

The components of EWMS awareness and communications include:

- ● The SBL website, a public website that describes sustainability targets and activities
- ● Iso50001.lbl.gov, a public website that provides an introduction to the EWMS and EWMS Policy. Google Analytics has been established to observe site traffic.
- ● The annual Site Sustainability Plan and report to DOE, available on the Sustainability Reports page, which provides a comprehensive inventory of sustainability progress and future plans.
- ● An annual summary of performance and highlights, which is publicized to the Lab community through the Lab's newsletter, Elements.
- ● Graphs of sustainability performance, posted publicly at sbl.lbl.gov/data
- ● A long-term goal to ensure Labwide EWMS awareness across Scope & Boundaries, that takes into account the large number of Lab employees, and leverages the Lab's Training Site.
- ● A briefing/refresher presentation to orient key stakeholders

Subcontractors are made aware of the principles of the Lab's energy and water policy through:

- Subcontract language that requires adherence to clauses regarding energy and water conservation
- A requirement to follow of the Lab's policy on [Sustainability Standards for New Construction and Major Renovation](#) for major construction projects

Core Team Communications include the following:

- Tactical [Monthly Sprint Meetings](#) of a subset of Core Team Members to review progress on addressing issues.
- Quarterly meetings, as part of the [Annual Review Cycle](#).
- [ISO 50001 Shared Drive](#), which contains the majority of the documents that comprise the EWMS.
- [ISO 50001 Calendar](#), on which quarterly meetings, audits, and other key events are scheduled. Events can be added to the ISO 50001 Calendar by inviting [its email address](#). Using a group Calendar avoids being tied to a single employee's account and helps the meeting record persist over time.
- [ISO 50001 Core Team Google Group](#), used for email communications, meeting invites, and providing access to the resources listed above

Additionally:

- The Core Team is empowered to engage in ad-hoc communications as part of day-to-day activities.
- The Chief Sustainability Officer attends a number of regular leadership meetings, periodically providing updates on sustainability performance, and which provide an opportunity to learn about organizational changes that may impact the EWMS. See more in **[Strategic Planning](#)**.

6.3.1 Feedback and Participation

We invite feedback on all sustainability activities, including the energy and water management system, through the email address, [sbl@lbl.gov](#). This address is managed by the Lab's [Sustainable Berkeley Lab](#) team and utilizes a google group so that a record of all of its traffic can be [maintained online](#). Suggestions received are reviewed by the team, and responded to by the relevant SME as needed. Program changes are made as appropriate.

The [SBL Your Role webpage](#) on the SBL website ([sbl.lbl.gov](#)) provides additional guidance on participating and providing feedback, such as:

- how to report problems or submit ideas for reducing energy, waste, or water, and
- the role of individual staff in contributing to the Lab's sustainability goals.

These resources are promoted in communications about the EWMS and sustainability.

6.4 Documentation

To support the effective function, consistency, and longevity of the EWMS, two types of documented information are maintained:

- Key working documents that are kept up-to-date, such as this Manual and other procedures. A Document Index is maintained in the Roles & Responsibilities document.
- Required records that are snapshots in time, such as utility bills. A list of required records is maintained in the Roles & Responsibilities document, and where possible, records are maintained in the Records Folder.

The table below provides general guidance on the creation, maintenance, control, and disposition of EWMS Documentation. More detailed information on specific Documents and Records can be found in Roles & Responsibilities.

6.4.1 General Guidance

	Documents	Records
Media & Format	Maintained online whenever possible Berkeley Lab does not mandate a format Documents should include descriptive text and be well-organized so as to efficiently serve the operational needs of Lab staff while also remaining understandable to stakeholders and auditors.	Maintained online, in PDF format, as practical Berkeley Lab does not mandate a format Records should be constructed as an effective reference for both lab staff and external auditors.
Identification	Title should be descriptive enough for a non-user, and to distinguish it from other documents. Avoid shorthand and acronyms.	For records under the control of the Core Team, name the file "Year-Month-Date", with a descriptive title that indicates type of record and subject, e.g., **2018-12-19 Management Review Presentation.pdf** For Records not controlled by the core team, there are no specific requirements for identification.
Location	Store in the Shared Drive if practical; otherwise, where appropriate for day-to-day operations, with appropriate view/edit access. Categorize in EWMS Roles & Responsibilities, to include document owner and minimum review frequency.	Store in a logical, permanent location, such as the Records Folder in Shared Drive, with appropriate view / edit access. Categorize in EWMS Roles & Responsibilities, to include types and locations of records, and links to them where possible.

	Location should be linked from the relevant section of the EWMS Manual.	
Date	Display a Revision Date, ideally that updates automatically (Follow guidance in Guidance for Controlled Document Timestamp).	Display a document date in the file, as appropriate, in addition to having the date indicated in the title.
Control of Changes	Version control is generally handled through Google Drive Version History.	Records are not changed, only corrected on rare occasions as needed.
Storage, Preservation, Retention, & Disposition	Not applicable	Record owner responsible for appropriate storage and preservation of their assigned records. Records shall be maintained for a minimum of six years, unless a longer period is specified by sponsor requirements. Reference: Lab Archives and Records Management Policy

6.4.2 Control Process

For the documentation identified in Roles and Responsibilities, the Area Owner shall --

- have edit access to the documentation
- review and approve for suitability and adequacy at the time of creation
- approve major changes
- review for suitability on the schedule indicated
- determine the necessary accessibility, retrieval, and distribution
- ensure the removal / adequate marking of obsolete documents
- follow the retention guidelines listed above

Note:

- EWMS documentation is not confidential.
- EWMS documentation is maintained electronically and considered uncontrolled when printed.
- The Lab's Energy & Water Policy (included in policy on Sustainability Standards for Operations) is considered an "authoritative" document within the Lab's Document Management, and follows the document management practices described therein.
- This manual is the official implementing document for the policy.

6.4.3 Document Access

The EWMS Sponsor shall provide overall oversight for EWMS documents, modifying edit access privileges as needed. To foster ongoing collaboration and continual improvement, an Area Owner may choose to grant Commenter rights to their collaborators, who can then comment on and suggest edits to documents without impacting the official current version. The Area Owner must approve suggested edits before they are codified into the official current version.

- Those with **View** access to a document will only see the official current version, devoid of any comments or suggested edits.
- Those with **Comment** access can add comments and suggested edits, and see the comments and suggested edits entered by others.
- Those with **Edit/Management** access can edit, as well as approve/resolve others' suggested edits and comments. For the main EWMS documents, this access is handled by adding the appropriate people to the ISO50001 Google Group, which provides permissions to the Shared Drive and other key documents.
- **Subject Matter Expert (SME) access** - Some documents require close coordination with SMEs. The document owner will provide the necessary SME(s) with appropriate access on a document-by-document basis.

Requests for non-public documentation will be reviewed on a case-by-case basis and examples shared following basic guidance.

6.4.4 External Documentation

Some documentation is the responsibility of other units at Berkeley Lab, or external sources. These are indicated in EWMS Roles & Responsibilities, and Area owners are responsible for ensuring access to the current versions.

6.4.5 Decommissioning Documents

When a document is no longer being used, it should be decommissioned as follows:

- In EWMS Roles & Responsibilities - Area Owners Tab, remove ALL references / links from ALL relevant cells (be sure to show all columns).
- Remove / update any references / links in this manual
- Add "Obsolete" to the start of the document title, and at the top of the document.
- Move the document to a "background" type folder in the Drive, or remove it altogether, as appropriate.
- Remove any code for timestamping the document:
  - For GoogleSheets: Clear Block A1 of the top sheet
  - For GoogleDocs: Select All in the footer and delete. Replace with plain text.

7 OPERATIONS

7.1 Operational Planning and Control

Operational planning and control activities focus on the significant energy use (SEU) and significant water use (SWU). Energy performance for the SEU (NERSC) is primarily dependent on matching optimal operating conditions to ranges of outdoor air conditions (expressed by wetbulb temperature, a function of drybulb temperature and humidity). Therefore, a key strategy to avoid significant deviation from intended energy performance of the SEU is to maintain calibration of drybulb temperature and humidity sensors. The SEU sensor calibration program describes details of the program.

A second strategy for avoiding significant deviation from the intended energy performance of the SEU involves the system monitoring "apps" in Skyspark for NERSC. These apps operationalize analysis that has been performed and acted upon to improve energy and water performance at NERSC. See NERSC Metrics Script that describes the analysis of NERSC energy and water performance. These metrics include a key water metric, called the Water Usage Effectiveness (WUE). Monitoring the WUE metric coupled with email alerts that key personnel receive when the SWU water meter exceeds expected consumption, ensure that significant deviations from intended water performance of the SWU are minimized or avoided.

Outsourced processes related to NERSC include modifications to mechanical, electrical, and plumbing systems, as well as controls modifications and sensor calibration. Such outsourced processes are controlled through general procurement practices that ensure defined scopes of work, competitive sourcing, and contractual controls. Berkeley Lab does not allow contracted project work to proceed until a purchase order is in place.

7.2 Design

For the design of new construction and major renovation projects, the Lab follows a policy on Sustainability Standards for New Construction and Major Renovations found in the Lab's Requirements and Policies Manual. Definitions of new construction projects, major new construction projects, and major renovation projects may be found in the policy. This policy was established in 2013 and is updated regularly. This policy has governed the energy and water performance design aspects of major new construction projects beginning with the Integrative Genomics Building, which was occupied in November 2019. In 2023, the policy was expanded to cover all new construction and major renovations, not just major new construction projects.

The Lab also has a policy on Sustainability Standards for Operations, which includes the Lab's lighting maintenance guidance (available at lightingprojects.lbl.gov) that guides the transition to LED technologies and controls in lighting maintenance activities.

The Energy Manager performs plan reviews of new construction projects, major new construction projects, and major renovation projects that check for compliance with the Sustainability Standards for

New Construction and Major Renovations. The Energy Manager also reviews other projects coordinated through the Code Compliance Office that do not meet these project definitions.

- The Plan Review Process is managed by a collaboration between the Code Compliance Office in Facilities Engineering and Project Infrastructure and Modernization Division (PIMD). The Energy Manager provides comments and reviews the comment responses as a Fully Integrated Reviewer representing Sustainable Berkeley Lab.

- Records of Plan Reviews and comments are recorded in the Facilities Engineering Jira Platform. In addition, major new construction records are available in the Major New Construction Records Folder.

- A Checklist for Major New Construction Design Reviews is used to facilitate project narrative, plan, and specification review for major new construction.

7.3 Procurement

Procurement activities - including the procurement and construction that results from the design of major new construction projects at Berkeley Lab - can have a significant impact on energy and water performance. The Lab has identified three key procurement processes, discussed in the three subsections below, that have a significant impact on the Lab's energy and water performance.

7.3.1 Procurement Impact on High-Performance Computing Systems

One of the selected procurement processes includes purchase of high-performance computing systems, which drives the energy consumption of NERSC, the SEU defined within the EWMS. The Sustainability Standards for New Construction and Major Renovations includes a "Procurement of High-Performance Computing Systems" policy item. This policy requires that lifecycle energy costs are used as an evaluation criterion in the award of procurement contracts for high-performance computing systems. For other equipment (not computing clusters), suppliers are notified of energy performance through plans and specifications.

7.3.2 Procurement of EPEAT and Energy Star Equipment

Berkeley Lab uses third-party criteria to indicate favorable energy or water performance of products instead of individual evaluations of energy or water performance of a product purchase over its expected lifetime. These criteria include:

- EPEAT certification, which is being used to meet federal low standby power purchasing requirements for computers, displays, and imaging equipment.
- Energy Star certification, which covers equipment such as appliances, HVAC units, refrigerators, ultra-low temperature (ULT) freezers, electronics, and office products.
- Federal Energy Management Program (FEMP) designation, which identifies efficiency levels for many categories of energy-consuming equipment (such as boilers, chillers, motors, and luminaires)
- WaterSense certification, which covers water efficient products.

In general, the Lab has well-established processes for assuring that EPEAT products are specified and purchased, with annual optional optional reporting (to the federal government) of EPEAT compliance.

The Lab is working to improve processes related to maximizing product procurements meeting additional third-party criteria. In March 2024, the Office of the Chief Financial Officer and SBL implemented many new standard procedures to support implementation of sustainable procurement requirements. As of June 2025, the Lab is working to implement a new software platform to assist with meeting sustainable procurement requirements, based on Federal Acquisition Regulations (FAR) that were modified by the federal government in early 2025.

7.3.3 Purchase of Energy and Water

The purchase of energy and water by Berkeley Lab is not directly within the control of the Lab or the EWMS.

- **Main Campus Electricity**: DOE is responsible for procuring electricity on behalf of the Lab and executing associated contracts. This is currently done through the Western Area Power Administration (WAPA). The EWMS Sponsor and the Energy Manager participate in a buying power consortium that meets every 6 months to review and advise on energy purchasing decisions. A copy of a memorandum of agreement with WAPA is available as a Record (see Energy Contracts).
- **Main Campus Natural gas**: DOE receives natural gas through a third-party supply contract, managed by a buyer in Berkeley Lab's Office of the Chief Financial Officer (see Individuals Tab of EWMS Roles & Responsibilities). A copy of the contract is available as a Record (see Energy Contracts).
- **Main Campus Water:** Provided through standard utility accounts held by UC Berkeley and recharged to Berkeley Lab. See Utility Bill Data in EWMS Data Sources and Process Description.
- **Offsite Electricity and Water:** Provided through standard utility accounts.

8 Performance Evaluation

8.1 Monitoring, Measurement, Analysis, and Evaluation

The core team evaluates *energy and water performance* in the following ways:

- Evaluation of energy and water performance at least twice a year (see Annual Review Cycle), which includes: EWPIs (compared to baselines), operation of SEUs, and actual versus expected energy consumption. Those EWPIs used to evaluate energy and water performance are indicated in the EWPIs document.
- Corrective actions to respond to deviations in energy performance are developed and tracked in Issue & Improvement Tracking. These actions are identified with a Source of "Eval of E and W Perf."
- The energy and water performance of NERSC (the EWMS SEU and SWU) is evaluated on a monthly basis referencing the NERSC Metrics Script and reviewed with NERSC on a monthly basis.

The core team formally evaluates the *effectiveness of the EWMS* at least once annually. The evaluation of EWMS effectiveness includes: the effectiveness of action plans as well as methods and timing for monitoring, measurement, and evaluation and effectiveness of the EWMS.

The evaluations of energy and water performance and effectiveness of the EWMS are retained as documented information (see Records).

Internal audit and management review findings will each be reviewed at least annually. Analysis will consider: EWMS section, ISO 50001:2018 Standard section, frequency of findings, and extent of findings conditions. As adverse trends are evaluated, findings will be classified, analyzed, and corrective actions developed and tracked in Issue & Improvement Tracking.

The monitoring, measurement, and evaluation information is provided through required reports to the federal government and the University of California on an annual basis. These reports are available at sbl.lbl.gov/reports.

8.2 Internal Audit

Berkeley Lab conducts internal audits of its EWMS on an annual basis, where specific ISO sections are audited on a 3-year cycle, ensuring that each section is covered at least once during the cycle. Some sections may be covered more than once during the cycle if deemed appropriate by the auditing team or auditor. Internal audits are conducted according to the Internal Audit Procedure. This procedure, forms, and related documents are maintained in the Audit Procedures & Templates Folder. Those conducting the internal audit shall maintain their working documents (checklists, etc.) as confidential in a separate folder, outside the Shared Drive, while the audit is being conducted.

Audit Records are identified in the Audit Records Folder. Audit working documents are identified in the Audit Working Documents folder.

Corrective action is covered under the **Continual Improvement** section of the Manual.

External Audits follow a similar procedure for scheduling, records, and corrective action. Berkeley Lab will provide a prepared Audit Plan template, but the Third Party auditor may use their own forms.

8.3 Management Review

Top management reviews the EWMS at least annually to ensure its continuing suitability, adequacy, effectiveness, and alignment with the Lab's strategic direction. These reviews shall consist of
- a management review meeting, and
- a high-level briefing with the Lab's Executive Sponsor of the EWMS.

See the Individuals Tab of EWMS Roles and Responsibilities for the current Executive Sponsor and those involved with Top Management review. Also for reference, the Lab Org chart lists the people in top leadership positions.

Management reviews cover the following topics (From ISO 50001:2018 sections 9.3.3 & 9.3.4):
An update on items relevant to the EWMS:
- Status of actions from previous management reviews
- Changes in relevant external and internal risks and issues
- Changes to the Energy & Water Policy
- Opportunities for continual improvement
- EWMS performance, including
  - nonconformities and corrective actions

- ○ monitoring and measurement results
- ○ audit results
- ○ results of the evaluation of compliance with legal requirements and other requirements
- Energy & Water performance, including
  - ○ the extent to which objectives and targets have been met
  - ○ performance and improvement based on monitoring and measurement results including the EWPIs
  - ○ status of the action plans.

Outputs of the Management Review shall include decisions, actions, or needed changes to the EWMS based on the above items, such as:
- Opportunities to improve sustainability performance
- Energy & Water Policy
- EWPI(s), baselines, objectives, energy targets, action plans, etc., and actions to be taken
- Improving integration with business processes
- Resource allocation
- Improvement of competence, awareness, and communication
- Other ways the EWMS can add value to the Lab, and in particular, how to ensure its suitability, adequacy, effectiveness, and alignment w/ the Lab's strategic direction.

Management Review Records are maintained in the [Management Review Records Folder](), and the list of record types is maintained in [Roles & Responsibilities]().

9 CONTINUAL IMPROVEMENT

The goal of the EWMS is continual improvement of both system performance and energy and water performance. Improvement opportunities for both the EWMS and energy and water performance are identified through:
- Internal Audits (annual)
- External Audits (every three years with annual check-ups)
- Management Reviews (annual)
- Core Team Reviews or ad-hoc identification of improvements by the Core Team (quarterly)
- Targeted activities as described below under 9.1
- Suggestions made by other interested parties

9.1 Energy & Water Performance
The process to identify, prioritize, and record opportunities for improving energy and water performance are described in [Energy & Water Efficiency Opportunities]().

9.2 System Performance & Corrective Action
- Issues and opportunities to improve EWMS system performance (as well as general opportunities related to energy and water performance that are not tracked through more formal methods described in [Energy & Water Efficiency Opportunities]()) are tracked in [EWMS Issues & Improvement Tracking]().

- Where possible, issues are broken into tasks that can reasonably be completed within a one-month time period.
- Issue trending is managed through Issue & Improvement Reporting, which provides several graphical views of this tracking data.
- Causal analysis is conducted for nonconformities where the issue is recurring or likely to recur.
- Where a nonconformity represents a noncompliance with Lab's policies & procedures, or relevant laws; or a condition that may lead to noncompliance, the issue should also be entered into the Lab's Corrective Action Tracking System (CATS).

9.2.1 Review of Issues & Improvement Opportunities

On a monthly basis, issues and improvement opportunities are reviewed in an "Issues and Improvement Planning" meeting that includes at least the EWMS Sponsor, the Owner of section 10.1 of the ISO 50001 Standard (Nonconformity and Corrective Action), and the Energy and Sustainability Manager. This meeting includes selection of items to complete in the next month and review of applicable items against 50001 Standard 10.1.b, which involves identifying causes and evaluating the effectiveness of corrective actions (see Effectiveness of Corrective Actions report). Each issue or opportunity is tracked through a series of statuses.

Note: this table is embedded from the Issue & Improvement Tracking System - edits should be made there and this table refreshed.

Status	Description
0. New	This status is selected by the person who first creates the item, to indicate that the issue has recently been entered, but has not yet been reviewed during an Issues and Improvement Planning meeting.
1. Backlog	An issue is moved to Backlog during Issues and Improvement Planning to indicate that it has been reviewed but not yet chosen as an item to complete over the next month.
2. To Do	Issue is assigned to be completed within a particular month. The To Do status is assigned during Issues and Improvement Planning. Issues marked as To Do should be assigned to a Sprint.
3. In Progress	Issue is being worked on but is not yet complete. This status is set by the person addressing the item as they begin their work. Issues marked as In Progress should be assigned to a Sprint.
4. Resolved	Required for Nonconformities (major or minor); optional for other types. The person assigned to address the issue or improvement opportunity has completed corrective action. This item is ready for review during the "Issues and Improvement Planning" meeting.
5. Done	Item is complete. For items that are not Nonconformities, this status is set by the person assigned to address the issue or improvement opportunity. For Nonconformities, this status is set during the "Issues and Improvement Planning"

	meeting following review.

9.2.2 Timelines

The timelines below are associated with review and resolution of items, as part of the Corrective Action Process. *Note: this table is embedded from ISO 50001 Internal Audit Procedure - edits should be made there and this table refreshed.*

Type	Description	Tracking	Causal Analysis & Corrective Action
Major Nonconformity	A nonconformity of major significance or a series of minor nonconformities in the same requirement. Such findings indicate a systemic failure with the energy and water management system (EWMS). Major nonconformities require corrective action development.	Enter within 1 week of final audit report.	Causal Analysis and Corrective Action are identified within 3 months of the entry date, and entered into the pink cells on the far right of the Tracking System.
Minor Nonconformity	A nonconformity of minor significance. Such findings represent isolated deviations, and/or deficiencies with the EWMS that do not affect the capability of the EWMS to achieve the intended results. Minor nonconformities require corrective action development	Enter within 1 month of final audit report.	Cause and corrective action are identified within 3 months of the entry date, and entered into the pink cells on the far right of the Tracking System.
Concern	An existing or potential problem, issue, or risk with the EWMS. Concerns can become nonconformities if they persist or the condition extends to other areas of the EWMS. Concerns require development and tracking of mitigations.	Enter within 1 month of final audit report. Items not related to an audit may be entered at any time	Closing of a "Concern" item is expected within 6 months. Corrections and actions taken are recorded, but the corrective action process (pink cells) is not required.
Improvement	Improvement idea or suggestion; NOT required for Conformance to Standard; Could be Opportunity for Energy / Water savings worth considering	These items help guide continual improvement. No set timelines are defined.	N/A
Positive Finding	Noteworthy practice, program strength, or performance item that exhibits a level of performance that could be worthy of applying to other areas of the EWMS because it is innovative or indicates a high level of excellence. Positive findings should be reviewed by the EWMS team and, as appropriate, shared with the EWMS Core	Positive findings should be added to the SBL Progress Tracking System as appropriate. No set timelines are defined.	N/A

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	Team.		
Informational	Any additional information that was noted by the internal auditor(s) during documentation review or interview with auditees, but does not require action.	Communicated with the EWMS Sponsor and included in the Internal Audit Report findings.	N/A

9.2.3 Priorities

Issues and opportunities are prioritized as follows:
- Major Nonconformities
- Minor Nonconformities
- Concerns
- Improvements

9.2.4 Corrective Actions and Tracking

Corrective actions associated with Major and Minor Nonconformities identified through the auditing processes are tracked in EWMS Issues & Improvement Tracking, following the Corrective Action Process which defines the process for entering, tracking, and addressing corrective actions. More detail and timeframes by issue type are found there. Past Corrective Actions can be reviewed in the Effectiveness of Corrective Actions Report. While a formal corrective action process is not followed for concerns and improvements, root causes are identified as applicable and the correction or action taken is documented in the tracking system.

9.2.4.1 Corrective Action Process
Note: the content below is embedded. Edits should be made in the original source and then refreshed here. Source: the Corrective Action Process in the EWMS Tracking System

1	**Take immediate action**, if applicable, to control and correct
2	**Enter Into Issue Tracking System**
3	**Causal Analysis - for Nonconformities,** eliminate the cause & avoid recurrence by**:** - Determining the Cause (enter into **Cause** Column): - Determining if similar nonconformances exist, or could occur, and enter into **Determination** column
4	**Develop corrective action(s)**
5	**Implement action needed**
6	**Make changes as needed to EWMS and/or Manual**
7	**Review effectiveness of corrective action** in a subsequent team meeting, and document in the **Review for Effectiveness** column

10 GLOSSARY AND INDEX OF TERMS

Note: this table is embedded from [EWMS Glossary](#) - edits should be made there and this table refreshed.

Abbreviation	Term	Definition	Reference
	Action Plans	Actions designed to meet key quantitative targets and other desired outcomes.	[Action Plans](#)
	Audit	Systematic, independent, documented process for objectively evaluating the EWMS and determining its conformance with the ISO 50001 Standard and the EWMS Manual.	[Internal Audit](#)
	Awareness & Communication	Processes for demonstrating the Lab's commitment to energy and water management, as well as communicating policy, performance, and the role of the Lab community.	[Awareness and Communication](#)
	Baseline	A reference year or period against which improvements energy and water performance improvements are measured.	[Baseline](#)
	Competence	Ability to apply knowledge and skills to achieve intended results.	[Competence](#)
	Continual Improvement	Ongoing enhancements to energy and water performance, as compared to baselines. Also see [Improvement Opportunities](#).	[Continual Improvement](#)
	Core Team (Energy and Water Management Team)	Staff with responsibility and authority for effective implementation of EWMS and performance improvement.	[Core Team](#)
	Corrective Actions	Action to eliminate the cause, and prevent recurrence, of a non-conformance.	[Corrective Action](#)
DOE	Department of Energy	The US Department of Energy, to whom Berkeley Lab serves as a contractor.	[Department of Energy](#)
	Design & Procurement	Series of activities focused on the design, purchase of materials, construction, and remodel of buildings and facilities.	[Design & Procurement](#)
	Documentation	Information necessary for recording the EWMS, processes, activities, and performance.	[Documentation](#)
	Effective Personnel	Key staff members whose roles materially affect energy and water performance and the EWMS.	[Competence](#)
EWPI	Energy / Water Performance Indicator	One of a series of key quantitative metrics for tracking energy and water performance.	[Energy and Water Performance Indicators (EWPIs)](#)

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Abbreviation	Term	Definition	Reference
	Energy / Water Target	Quantifiable objective of energy or water performance improvement.	Targets
	Energy / Water Use	Type of consumption of energy or water, such as ventilation, lighting, heating, cooling.	
EWMS	Energy & Water Management System	A set of procedures that defines how Berkeley Lab manages its energy and water performance in accordance with ISO 50001.	EWMS Manual
	Energy & Water Policy	Top management of commitments and direction related to energy and water management, as formalized in policy.	Energy Policy
	Energy & Water Review	A review of how energy and water performance is measured and monitored.	Energy & Water Review
FAM	Facility Area Manager	Facilities personnel who oversees activities for a subset of the Lab's buildings (See List)	Facility Area Managers
FMCS	Facility Management Control System	Berkeley Lab's Building Management Control System, managed by the Facilities Division's Engineering Department.	
ILAM	Integrated Laboratory Airflow Management	A program of the Lab's EHS Division to optimize air flow in lab spaces	
ISO	International Standards Organization	The International body that creates and maintains consensus standards	ISO
	Key Facilities	Lab buildings or facilities with high energy or water consumption or significant greenhouse gas emissions.	
	Legal & Other Requirements	Needs and expectations that drive EWMS targets.	Legal & Other Requirements
	Major Change	A major change in facilities, equipment, systems, or energy- (or water-) using processes.	Major Change
	Management Review	A review by Lab management, at least annually, of energy and water performance, and to ensure the EWMS's continuing suitability, adequacy, effectiveness, and alignment with the Lab's strategic direction.	Management review
	Monitoring, Measurement, & Analysis	The processes used to measure and monitor the Lab's energy and water performance.	Monitoring, Measurement, Analysis, and Evaluation

Energy and Water Management System (EWMS) Manual

Abbreviation	Term	Definition	Reference
NERSC	National Energy Research Scientific Computing Center	A user facility at Berkeley Lab that conducts high performance computing	NERSC
OCx	Ongoing Commissioning	The process of identifying, prioritizing, and fixing building issues to continuously generate significant and persistent operational energy and water savings, as well as continuing to measure and monitor to maintain those savings. The Berkeley Lab OCx team conducts these activities.	OCx
	Operational Controls	Activities focused on managing the significant energy use (SEU).	Operational Planning and Control
	Organizational Context	The external and internal issues relevant to the Lab's purpose and that affect the ability to achieve EWMS outcomes.	Organizational Context
PDCA	Plan-Do-Check-Act	A continual improvement framework described in ISO 50001	
PUE	Power Usage Effectiveness	Ratio of total energy in a data center to energy used for computing	
	Relevant Variables	Quantifiable factor that routinely changes and that impacts energy and/or water performance, such as staffing levels or weather.	Relevant Variables
	Resources	Staff and funding required to support the EWMS.	Resources
	Risks	Uncertainties, potential events, and consequences that may impact the EWMS and the ability to achieve its intended outcomes.	Risks & Opportunities
	Roles and Responsibilities	Who and how people are involved in, and have responsibility for, the EWMS.	Roles and Responsibilities
	Scope and Boundaries	Set of activities and processes, as well as the physical / organizational borders, to which the EWMS applies.	Scope and Boundaries
	Significant Deviation	A substantial difference between actual and expected energy or water consumption, based on pre-established criteria.	Major Change
SEU	Significant Energy Use	Energy use (facilities, systems, processes, or equipment) accounting for substantial energy consumption, and/or having a potential for significant energy savings.	Significant Energy and Water Uses
SWU	Significant Water Use	Water use accounting for substantial water consumption, and/or having a potential for significant water savings	

Abbreviation	Term	Definition	Reference
	SkySpark	The proprietary software for energy and water data collection and storage that SBL added to the FMCS	
	Stakeholders (Interested Parties)	Those who have been deemed relevant to energy and water performance and the EWMS, in particular those who set requirements and to whom the Lab reports on its sustainability performance.	Stakeholders (Interested Parties)
SBL	Sustainable Berkeley Lab	A unit at Berkeley Lab that directs the activities related to Sustainability, including the EWMS sbl.lbl.gov	SBL
	Top Management	Person or group who directs and controls the organization at the highest level, is empowered to delegate authority and provide resources, and provides leadership and commitment in establishing, supporting, and maintaining the EWMS.	Top Management
ULT	Ultra-Low Temperature [Freezer]	A freezer that keeps scientific samples at extremely low temperatures for preservation. Not choosing efficient units, and not providing proper monitoring and management can result in significant energy waste and system failure, with catastrophic results for research.	
UC	University of California	University of California is one of the renowned and leading public research university systems, based in the United States. Berkeley Lab is managed by the University of California.	UCOP
WUE	Water Use Effectiveness	A measure of how much water is used for cooling in a data center center	
	Weather Normalization	Adjusting energy performance indicators to account for the effects of weather variations.	