



Lawrence Livermore National Laboratory FY 2019 Site Sustainability Plan

Janet Adams, Jhon Arbelaez-Novak, Andy Ashbaugh,
Anna Maria Bailey, Jeff Brenner, Paul Burke, Bill Howing,
Stu Jossey, Hanif Nassor-Covington, Heather Ottaway,
Crystal Quinly, Carl Snyder, Alison Terrill, Jennifer
Vollbrecht, Tony Wegrecki,

Lawrence Livermore National Laboratory,
P.O. Box 808, Livermore, CA 94551-0808

December 7, 2018



Disclaimer

This document was prepared as an account of work sponsored by an agency of the United States government. Neither the United States government nor Lawrence Livermore National Security, LLC, nor any of their employees makes any warranty, expressed or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States government or Lawrence Livermore National Security, LLC. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States government or Lawrence Livermore National Security, LLC, and shall not be used for advertising or product endorsement purposes.

Lawrence Livermore National Laboratory is operated by Lawrence Livermore National Security, LLC, for the U.S. Department of Energy, National Nuclear Security Administration under Contract DE-AC52-07NA27344.

LLNL Internal Use Only



Acknowledgements

Project Management, Engineering and Construction
Operations & Business Principal Directorate

Responsible Managers

Anita Gursahani
Robert Warther

Publication Authors

Jennifer Vollbrecht

Contributing Authors

Janet Adams
Andy Ashbaugh
Anna Maria Bailey
Jeff Brenner
Paul Burke
Bill Howing
Stu Jossey
Hanif Nassor-Covington
Heather Ottaway
Crystal Quinly
Carl Snyder
Alison Terrill
Tony Wegrecki

This page intentionally left blank

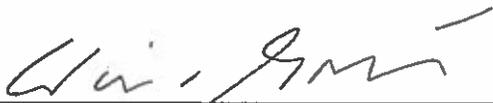
LLNL Internal Use Only

Lawrence Livermore National Laboratory

FY 2019 Site Sustainability Plan

December 7, 2018

Approved by:

A handwritten signature in black ink, appearing to read "W. H. Goldstein", is written over a horizontal line.

William H. Goldstein, Director
Lawrence Livermore National Laboratory

This page intentionally left blank

Contents

Disclaimer	2
Executive Summary.....	1
Overview of Lawrence Livermore National Laboratory	1
Site Management Vision.....	1
Major Planning Assumptions and Issues.....	1
Approaches to Site Management	2
Funding Strategies.....	2
Successes and Challenges.....	3
Energy Challenges.....	3
Goal Category Targets.....	4
Performance Review and Plan Narrative.....	16
SSP Category 1: Energy Management.....	16
1.1. 25% energy intensity reduction by FY2025 from an FY2015 baseline	16
1.2. EISA Section 432 energy and water evaluations.....	22
1.3. Meter all individual buildings for electricity, natural gas, steam, and water, where cost-effective and appropriate	22
1.4. 50% Scope 1 and Scope 2 GHG reduction by FY 2025 from a FY 2008 baseline.....	24
1.5. 25% Scope 3 GHG reduction by FY2025 from a FY2008 baseline	26
SSP Category 2: Water Management Category	29
2.1. 36% potable water intensity (Gal per gross square foot) reduction by FY2025 from a FY2007 baseline.....	29
2.2. 30% water consumption (Gal) reduction of industrial, landscaping, and agricultural (ILA) water by FY2025 from a FY2010 baseline.....	34
SSP Category 3: Waste Management	36
3.1. (Includes 3.1 and 3.2) Divert at least 50% of non-hazardous solid waste, excluding construction and demolition debris and Divert at least 50% of construction and demolition materials and debris.....	36
SSP Category 4: Fleet Management	38
4.1. 30% reduction in fleet-wide, per-mile greenhouse-gas emissions by FY 2025 from FY 2014 baseline (2018 target: 4%).....	38
4.2. 20% reduction in annual petroleum consumption by FY 2015 relative to a FY 2005 baseline; maintain 20% reduction thereafter (2018 target: 20%)	40

4.3. 10% increase in annual alternative fuel consumption by FY 2015 relative to a FY 2005 baseline; maintain 10% increase thereafter. (2018 target: 10%)..... 41

4.4. 75% of light-duty vehicle acquisitions must consist of alternative fuel vehicles (AFV). (2018 target: 75%) 42

4.5. 50% of passenger vehicle acquisitions consist of zero-emission or plug-in hybrid electric vehicles by FY 2025. (2018 target: 4%) 42

SSP Category 5: Clean and Renewable Energy..... 44

5.1. “Clean Energy” requires that the percentage of an agency’s total electric and thermal energy accounted for by renewable and alternative energy shall be not less than: 10% in FY2018, working towards 25% by FY 2025..... 44

5.2. “Renewable Electric Energy” requires that renewable electric energy account for not less than 10% of a total agency electric consumption in FY18, working towards 30% of total agency electric consumption by FY 2025 44

SSP Category 6: Green Buildings 46

6.1. At least 15% (by building count or gross square feet) of existing buildings greater than 5,000 gross square feet (GSF) to be compliant with the revised Guiding Principles for HPSB by FY 2025, with progress to 100% thereafter 46

SSP Category 7: Acquisitions and Procurement 47

7.1. Promote sustainable acquisition and procurement to the maximum extent practicable, ensuring biopreferred and biobased provisions and clauses are included in 95% of applicable contracts..... 47

SSP Category 8: Measures, Funding, and Training 49

8.1. Annual targets for performance contracting to be implemented in FY 2017 and annually thereafter as part of the planning of section 14 of E.O. 13693 49

SSP Category 9: Travel and Commute Category 50

9.1. 25% Scope 3 GHG reduction by FY 2025 from FY 2008 baseline 50

SSP Category 10: Fugitives and Refrigerants 52

10.1. 50% Scope 1 & 2 GHG reduction by FY 2025 from FY 2008 baseline..... 52

SSP Category 11: Electronic Stewardship Category 53

11.1. 95% of eligible acquisitions each year are EPEAT-registered products..... 53

11.2. 100% of eligible PCs, laptops, and monitors have power management enabled 53

11.3. 100% of eligible computers and imaging equipment have automatic duplexing enabled..... 54

11.4. 100% of used electronics are reused or recycled using environmentally sound disposition options each year..... 55

11.5. Establish a power usage effectiveness target in the range of 1.2-1.4 for new data centers and less than 1.5 for existing data centers..... 56

SSP Category 12: Organizational Resilience.....	58
12.1. Update policies to incentivize planning for, and addressing the impacts of, extreme events due to changes in weather patterns.....	58
12.2. Update emergency response procedures and protocols to account for projected change, including extreme weather events.....	59
12.3. Ensure workforce protocols and policies reflect projected human health and safety impacts.....	60
12.4. Ensure site/lab management demonstrate commitment to adaptation efforts through internal communications and policies	60
12.5. Ensure that site/Lab climate adaptation and resilience policies and programs reflect best available current science, updated as necessary.....	61

Attachments

- 1 DOE Building Exclusion Self-Certification Form
- 2 DOE Sustainability Dashboard Data Self-Certification Form

List of Figures

Figure 1. Energy-use intensity savings through end of FY 2018 (running year energy-intensity savings with FY 2017 exclusions).....	16
Figure 2. LLNL FY 2018 energy use.	17
Figure 3. Energy use—goal subject facilities only.	17
Figure 4. Comparison of cooling degree days (CDD).	18
Figure 5. Comparison of heating degree days (HDD).....	18
Figure 6. Overview of digital HVAC work.	19
Figure 7. Site projected electricity consumption with Exascale (x106 kWh).	21
Figure 8. LLNL energy load forecast with Exascale.	21
Figure 9. Proposed projects in support of energy management.	22
Figure 10. LLNL's current metering portfolio.....	23
Figure 11. Proposed projects in support of metering.	24
Figure 12. The three major scopes of GHG emissions.	24
Figure 13. Scope 1 and Scope 2 GHG emissions (MtCO ₂ e) by source.	26
Figure 14. Scope 3 GHG emissions (MtCO ₂ e) by source.	27
Figure 15. Potable water use intensity savings through end of FY 2018.....	29
Figure 16. LLNL FY 2018 potable water use breakdown.....	30
Figure 17. Estimated water use.	32

Figure 18. Proposed projects in support of water management. 34

Figure 19. LLNL progress in reducing white office-paper usage. 36

Figure 20. Priority chemical purchases. 37

Figure 21. LLNL petroleum consumption reduction. 41

Figure 22. Total alternative fuel dispensed. 41

Figure 23. List of compliant HPSB buildings. 45

Figure 24. Screenshot from the print management website developed in FY 2018. 52

Figure 25. STARS reutilization value. 53

List of Tables

Table 1. Summary of goal category targets. 4

Table 2. Digital HVAC detailed additions. 20

Table 3. Water infrastructure projects. 31

Table 4. FY 2018 EPEAT totals. 50

List of Highlights

Highlight 1. LLNL uses treated well water. 33

List of Photos

Photo 1. Personal vehicle charging station. 27

Photo 2. LLNL Deputy Director Tom Gioconda at the EV ceremony. 38

Photo 3. Ribbon-cutting of the Envision Solar Arc at LLNL. 39

Photo 4. A fully electric Ford Focus at LLNL. 39

Photo 5. Envision Solar Arcs in full use at LLNL. 40

Photo 6. 2018 Sustainability Award winning team. 40

Photo 7. 3.3 MW P-V solar plant at LLNL. 43

Photo 8. B-654 HPC Facility. 54

Photo 9. Wildfire damage at Site 300. 55

Photo 10. Workers review project requirements before starting work. 57

Photo 11. The LLNL Site 300 work release meeting enables management and workers to discuss activities each morning and ensures safe work conditions. 58

Photo 12. An LLNL worker sets up equipment as part of research on carbon capture. 59

List of Acronyms

Acronym	Definition
AC	Air conditioner
AF	Alternative fuel
AFV	Alternative fuel vehicle
APP	Affirmative Procurement Program
ASC	Advanced Simulation and Computing Program
ASE	Alliance to Save Energy
AWS	Alternate work schedule
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
BAAQMD	Bay Area Air Quality Management District
BART	Bay Area Rapid Transit
BTU	British thermal unit
CAC	Cold aisle containment
CBI	Capability-based infrastructure
CD	Critical decision
CDD	Cooling degree days
CEC	California Energy Commission
CEDR	Consolidated Energy Data Report
CEM	Certified energy manager
CHAMP	Cooling and Heating Asset Management Program
CO₂	Carbon dioxide
CRAC	Computer room air conditioners
CVP	Central Valley Project
D&D Team	LLNL's environmental restoration department decontamination and demolition team
DC Pro	Data center energy profiler
DCOI	Data Center Optimization Initiative
DCWG	Data Center Working Group
DDC	Direct digital control
DOE	Department of Energy
DOT	Department of Transportation
DUS	Donation, utilization, and sales
e-IWS	Electronic integration worksheet system

E85	Ethanol fuel
EACCS	East Alameda County Conservation Strategy
EDC	Enterprise data center
EFA	Environmental functional area
EISA	Energy Independence and Security Act
EMF	Emergency management facility
EMS	Environmental management system
EO	Executive order
EPA	Environmental Protection Agency
EPACT	Energy Policy Act
EPEAT	Electronic Product Environmental Assessment Tool
EPP	Environmental Affirmative Procurement Program
ES&H	Environment, safety, and health
ESGF	Earth System Grid Federation
ESPC	Energy savings performance contract
FedFMS	Federal fleet management information system
FEMP	Federal energy management program
FIMS	Facility information management system
FIRP	Facility and infrastructure recapitalization program
FMR	Functional management review
FY	Fiscal year
GAC	Granulated activated carbon
GBCI	Green Building Certification Institute
GHG	Greenhouse gas
GP	Guiding provisions
GPP	General plant projects
GSA	General services administration
GSF	Gross square foot/feet
HEMSF	High energy mission specific facility
HDD	Heating degree days
HPC	High performance computing
HPCIC	High Performance Computing Innovation Center
HPSB	High performance sustainable building
HVAC	Heating, ventilation, and air conditioning

ICPT	Integrated contractor purchasing team
IGA	Investment grade audit
IGPP	Institutional general plant projects
ILA	Industrial, landscaping, and agricultural
IPCC	Intergovernmental panel on climate change
ISMS	Integrated safety management system
ISO	International Organization for Standardization
IT	Information technology
kgals	One thousand gallons
kW	Kilowatt
kWh	Kilowatt-hour
LBNL	Lawrence Berkeley National Laboratory
lbs	Pounds
LCW	Low conductivity water
LEED	Leadership in Energy and Environmental Design
LFO	Livermore Field Office
LLNL	Lawrence Livermore National Laboratory
LLNS	Lawrence Livermore National Security
LOS	Lighting occupancy sensor
LVOC	Livermore Valley Open Campus
MBtu	One million British thermal units
MPS	Managed print services program
mtCO₂e	Megatons of carbon dioxide equivalent
MUSD	Maintenance and utility services department
MW	Megawatt
MWh	Megawatt hour
NA-50	Office of Safety, Infrastructure, and Operations
NEPA	National Environmental Policy Act
NIF	National Ignition Facility
NNSA	National Nuclear Security Administration
NPDES	National Pollutant Discharge Elimination System
OHSAS	Occupational Health and Safety Assessment Series
P2	Pollution prevention
PC	Personal computer

PCMDI	Program for Climate Model Diagnosis and Intercomparison
PG&E	Pacific Gas & Electric
PPA	Power purchase agreement
PSEG	Public service enterprise group
PUE	Power utilization effectiveness
P-V	Photovoltaic
R&D	Research and development
REC	Renewable energy credit
ROI	Return on investment
SC13	Supercomputing 2013
SCM	Supply chain management
SF	Square foot/feet
SF₆	Sulfur hexafluoride
Site 200	LLNL main Livermore site
Site 300	LLNL high-explosives experimental test site
SLAC	Stanford Linear Accelerator Center
SP2	Sustainability performance program
SSP	Site sustainability plan
SSPP	Strategic Sustainability Performance Plan (DOE)
STARS	Second Time Around Store
SWEIS	Site-wide environmental impact statement
SWPPP	Storm water pollution prevention plans
T&D	Transmission and distribution
TRR	Technical release representative
TYSP	Twenty-five year site plan
UESC	Utility Energy Service Contract
USGBC	U.S. Green Building Council
VRF	Variable refrigerant flow
WAPA	Western Area Power Administration
WCRP	World Climate Research Programme

Executive Summary

This document is presented as the Site Sustainability Plan (SSP) for Lawrence Livermore National Laboratory (LLNL), consistent with the guidance provided by the Department of Energy (DOE) and the supplemental guidance provided by NNSA received on September 20, 2018, as a deliverable for the DOE Order 436.1 *Departmental Sustainability* requirement.

Overview of Lawrence Livermore National Laboratory

LLNL is a DOE laboratory dedicated to enhancing United States security through the advancement of science and technology. LLNL's mission—to advance and apply science and technology for the benefit of the nation—specifically aims to ensure the safety, security, and reliability of the U.S. nuclear deterrent, reduce or counter threats to national and global security, enhance the energy and environmental security of the nation, and strengthen the nation's economic competitiveness.

LLNL's vision to “push the frontiers of knowledge to build the scientific and technological foundation that will be needed to address the national security issues of the future” aligns with the nation's vision for a sustainable future. LLNL has a long history of applying science and technological solutions to the toughest and most important problems affecting national and global security and is recognized for its excellence in business and operations, as well as for its responsible stewardship of the resources entrusted to the Lab. LLNL has long engaged in the practice of sustainability, which is integral to the Laboratory's mission, and the mission is vital to the nation's sustainable future.

LLNL is certified in environmental management (ISO 14001), occupational health and safety management (OHSMS 18001), and quality management (ISO 9001). Several environment, safety, and health (ES&H) action plans are in place under the Lab's environmental management system (EMS) to ensure that SSP goals are met.

Site Management Vision

LLNL's vision for site sustainability encompasses many objectives including:

- Supplying its programs with optimal conditions for success while undergoing continual improvement to existing energy infrastructure
- Collaborating with growing mission areas to identify ways of innovating towards more energy and water-efficient solutions for energy/water intensive facilities
- Pursuing innovative renewable energy generation—both for onsite use and as an ongoing research area
- Incorporating energy and water efficiency improvements into the ongoing energy management and facility operations of LLNL

Major Planning Assumptions and Issues

LLNL is planning for growth in mission-based facilities in the upcoming decade.

In FY 2018, the LLNL Operations and Business Principal Directorate—the organization that has provided most of the funding for LLNL's sustainability projects—has continued to fund the preventative maintenance program for real property assets with indirect funding. An adequately funded preventative maintenance program keeps real property and programmatic equipment in efficient operating condition, which results in energy savings.

LLNL has made modest progress on the sustainability goals for the Laboratory compared to the previous year—including greenhouse gas reduction and renewable energy goals. LLNL understands the importance of continuing to make progress towards the government’s sustainability goals, and this plan identifies important sustainability activities to work toward targets for greenhouse gas, energy, and water goals in FY 2019.

In FY 2018, the site-wide mechanical utilities valve replacement project was started with direct funds. Work started on a preliminary technical report, which is one of the requirements of the state water regulator in applying for a water supply permit for the water treatment plant at Site 200. While at S300, work started on a permit amendment to be able to use the water filtration (GAC) plant now under construction. These two facilities were found to be necessary to be able to use Hetch Hetchy Reservoir water at both sites. A return to using Hetch Hetchy water supply enables increased water savings at the cooling towers.

Approaches to Site Management

The Laboratory strives to be a leader in responsible environmental stewardship and sustainability, and incorporates sustainability and environmental management into the planning and performance of day-to-day operations and non-routine activities. LLNL’s EMS provides a framework for integrating environmental considerations into daily work processes—based on an international standard (ISO 14001)—to guide efforts toward achieving this goal and continually improving environmental performance. EMS is comprised of four main elements: environmental policy, planning, implementation, and review and improvement. LLNL’s ES&H action plans detail the objectives and track progress towards meeting environmental goals focused on decreasing climate impacts, conserving water, and reducing waste.

LLNL is dedicated to developing and maintaining sustainable buildings. Four buildings are currently Leadership in Energy and Environmental Design (LEED) certified. An additional six buildings have met the guiding principles for the federal High Performance Sustainable Buildings (HPSB) guidelines. Two new facilities—the Advanced Manufacturing Laboratory (AML) and the Security Fitness and Training Center—were completed in 2018. The AML is planned to be LEED Gold while the Security Fitness and Training Center is compliant with CalGreen. New facilities that will be constructed in FY19 and beyond will meet HPSB requirements, LEED certification, or an HPSB equivalent.

The daily electrical and natural gas demand at Site 200 and Site 300 is significant. LLNL uses 60 or more megawatts of electricity during peak times, and 12,491 therms of natural gas each day. The average energy use intensity is 154.7 kBtu/ft², without the excluded areas.

Funding Strategies

New and existing resources will be leveraged as much as possible to help achieve LLNL’s sustainability goals. A new National Nuclear Security Administration (NNSA) program to recapitalize and rehabilitate infrastructure funded by the Office of Safety, Infrastructure, and Operations (NA-50) provided life-extension projects for enduring facilities and infrastructure such as boiler and chiller improvements, and heating, ventilation, and air conditioning systems. When practical, these projects will ensure that the most energy and water efficient equipment is used.

The Cooling and Heating Asset Management Program (CHAMP)—an asset management program funded by NA-50 and managed by LLNS—will perform heating, ventilation, and air-conditioning (HVAC) projects throughout the National Security complex. CHAMP projects provide NNSA sites with HVAC replacement projects that include energy and water savings features and implement equipment level energy monitoring to demonstrate savings and concepts. The FY18 B321A ACU37-42 Replacements was executed by CHAMP and funded through LLNS site indirect funding. B170 DDC Replacement and B490 ACU16 and 17 Replacements are expected to be funded by CHAMP in FY19.

Successes and Challenges

LLNL had several successes and challenges in FY 2018. Some highlights include:

- Achieved certification to the new ISO 14001:2015 and 9001:2015 standards and maintained certification of OHSMS 18001 with no deficiencies.
- Incorporated four ES&H action plans into the SSP to align efforts.
- Continued operation of the pilot project to divert treated well water effluent from the Arroyo to use as make-up water at cooling tower B133, thus saving about 2.59 million gallons of potable water.
- Continued to lead a robust scientific and research program that advances renewable energy and climate change research, builds energy efficiency, and mitigates greenhouse gases (GHG)
- Completed construction of the infrastructure for charging electric vehicles (at B611). Received 20 new government-owned electric vehicles. Continued a personal electric vehicle (PEV) charging program allowing more employees to drive and charge their personal electric vehicles while paying for electric consumption. The Lab now has a total of five Level 2 charging stations (16 charging cables), 31 Level 1 charging stations, and four solar-powered Level 2 charging stations.
- Continued the Irrigation Reduction Plan to reduce turf site-wide in response to the historic California drought (Gov. Brown's water irrigation reduction executive order was lifted in April 2017). However, EO B-40-17, Maintaining Conservation as a Way of Life indicates conservation measures shall be continued.
- B551 E&W demo garden is now using treated well water for irrigation—estimated to save about 1.4M gallons of potable water annually.
- The conceptual design for a wastewater treatment facility that would treat and recycle wastewater for make-up water at two cooling towers has been studied in the recently concluded UESC IGA report. A more detailed engineering and feasibility study at an estimated cost of \$100K is needed to continue to evaluate this option, which is estimated to save between 60-80 million gallons of potable water annually.
- Deferred maintenance projects totaling more than \$10 million were executed in FY 2018 to replace old HVAC systems with new energy-efficient equipment, cool roof replacements, and lighting with more efficient LEDs.
- Received three sustainability awards for projects in FY18:
 - DOE Sustainability Award for the LLNL Electric Vehicle Program in the Innovative Approach category
 - DOE Sustainability Honorable Mention together with Sandia National Laboratory for collaborative sustainability in the Strategic Partnerships category
 - USDA's Biopreferred 2018 Excellence in Biobased Procurement Award.

Energy Challenges

LLNL continues to face three ongoing energy challenges. The first is that LLNL continues to grow in mission areas that are particularly energy and water intensive, such as high-performance computing (HPC) and the National Ignition Facility (NIF). This demonstrates the success of the DOE and the Lab's efforts in science and technology development. However, these programs will impact LLNL's GHG emissions and potable water intensity. The LLNL mission is expanding with more personnel onsite, additional mission capabilities, and increased construction activities. Also, the rate of personnel assimilation exceeds the rate of new building development. As a result, old buildings with high energy intensity and water intensity are being refurbished.

The second issue is that—while the cost of electricity to LLNL is relatively inexpensive at approximately \$0.05 per kWh—many energy savings opportunities that have been identified through the Energy Savings Performance Contract (ESPC) or facility audits cannot demonstrate sufficient payback (of less than 20 years) to warrant the investment.

Third is the issue of aging facilities. Approximately 75% of LLNL buildings are over 30 years old. LLNL has consistently replaced and upgraded its basic real property with the most efficient and cost-effective equipment; however, older facilities are still less energy-efficient than new construction.

Goal Category Targets

Table 1 summarizes the goal category targets for each DOE Strategic Sustainability Performance Plan (SSPP) goal.

Table 1. Summary of goal category targets.

SSPP Cat. #	DOE Goal	Performance Status	Planned Actions & Contribution	Risk of Non-Attainment
SSP Category 1: Energy Management				
1.1	25% energy intensity (Btu per gross square foot) reduction in goal-subject buildings, achieving 2.5% reductions annually, by FY 2025 from a FY 2015 baseline.	Due to LLNL’s unprecedented growth and activity in FY 2018, LLNL’s estimated energy intensity reduction in FY 2018 (as normalized for weather) is about -1.75%.	Energy savings through proposed ECM projects will be actively pursued through significant funding for energy savings. Energy savings specifically in identified laboratory buildings will be pursued through an FY 2019 ES&H Smart Labs Initiative action plan.	High
1.2	EISA Section 432 energy and water evaluations.	LLNL has completed 50% of its EISA portfolio for the third round as of FYE 2018. Desk audits were performed on twelve (12) facilities in FY 2018.	Significant funding will bring about the recommended energy conservation projects. The recommendations need work to be cost effective to implement.	Medium

SSPP Cat. #	DOE Goal	Performance Status	Planned Actions & Contribution	Risk of Non-Attainment
1.3	Meter all individual buildings for electricity, natural gas, steam, and water, where cost-effective and appropriate.	90% of electricity achieved (some loss of meters has been experienced). 60% of natural gas achieved.	Metering Services Project funding will help arrest the declining state of advanced electric meters. Additional funding will upgrade natural gas meters to meet the FY 2019 goal requirements.	Medium
1.4	50% Scope 1 & 2 GHG reduction by FY 2025 from a FY 2008 baseline	In FY 2018, LLNL achieved an overall 38% reduction from FY 2008 baseline.	LLNL will be challenged to meet the 50% target as electricity usage is expected to increase. Continued aggressive management of fugitive emissions from equipment using SF ₆ , purchase of renewable energy credit (REC), and energy efficiency projects to reduce gas and electric consumption including an FY 2019 ES&H action plan focused on reducing energy use in laboratories through a Smart Labs Initiative will help offset electricity usage increase.	Medium

SSPP Cat. #	DOE Goal	Performance Status	Planned Actions & Contribution	Risk of Non-Attainment
1.5	25% Scope 3 GHG reduction by FY 2025 from a FY 2008 baseline	In FY 2018, LLNL's Scope 3 emissions were 16% below the FY 2008 baseline.	<p>Scope 3 emissions are likely to increase slightly due to electricity use. The 25% reduction goal will be challenging to meet.</p> <p>Scope 3 emissions reduction through materials use decrease will be pursued through an FY 2019 ES&H Smart Labs Initiative action plan and Electric Vehicle Infrastructure action plan under EMS.</p>	Medium
SSP Category 2: Water Management				
2.1	36% potable water intensity (Gal per gross square foot) reduction by FY 2025 from a FY 2007 baseline.	In FY 2018, LLNL was able to reduce its water intensity by 2% relative to the FY2007 baseline. This is primarily due to the unavoidable switch to Zone 7 water supply in mid-July of 2016.	<p>LLNL will aggressively continue irrigation reduction plans with a focus on water-wise landscaping. Additional funding will help LLNL meet FY 2025 goals with further implementation of reverse osmosis technology or other sources of water to replace potable water use in cooling towers and irrigation.</p> <p>An FY 2019 ES&H Smart Labs Initiative action plan will pursue additional water savings.</p>	Medium

SSPP Cat. #	DOE Goal	Performance Status	Planned Actions & Contribution	Risk of Non-Attainment
2.2	30% reduction in water consumption (Gal) of industrial, landscaping, and agricultural (ILA) water by FY 2025 from a FY 2010 baseline.	LLNL uses potable water for ILA (non-potable water is not used for ILA).	LLNL is investigating multiple strategies for reducing potable water used for ILA including using reclaimed water and xerophytic landscaping.	N/A
SSP Category 3: Waste Management				
3.1	Divert at least 50% of nonhazardous solid waste, excluding construction and demolition debris.	LLNL consistently meets or exceeds this goal. In FY 2018, LLNL diverted 75% of nonhazardous solid waste.	An FY 2019 ES&H action plan is in place to develop a municipal waste reduction strategy to increase diversion of mixed recycling and compostable waste.	Low
3.2	Divert at least 50% of construction and demolition materials and debris.	LLNL consistently meets or exceeds this goal. In FY 2018, LLNL diverted 66% of construction and demolition materials and debris.	Tracking of construction and demolition materials and debris continues for FY 2019.	Low
SSP Category 4: Fleet Management Category				
4.1	30% reduction in fleet-wide per-mile greenhouse gas emissions reduction by FY 2025 from a FY 2014 baseline. (2017 target: 4%)	In FY 2018, LLNL contributed towards NNSA/DOE achieving an overall 30% reduction in fleet-wide per-mile greenhouse gas emissions reduction. The final percentage contributed will be calculated in November, in the FAST.	LLNL will continue to contribute towards NNSA/DOE to achieve an overall 30% reduction in fleet-wide per-mile greenhouse gas emissions reduction.	TBD, insufficient information, unable to assess currently
4.2	20% reduction in annual petroleum consumption by FY 2020 relative to a FY 2005 baseline; maintain 20% reduction thereafter.	In FY 2018, LLNL's petroleum fuel consumption decreased 71.46% from the FY 2005 baseline.	LLNL will continue to strengthen its alternative fuel infrastructure by replacing conventional fueled vehicles with alternative fuel vehicles (AFV) and by promoting the use of alternative fuels.	Low

SSPP Cat. #	DOE Goal	Performance Status	Planned Actions & Contribution	Risk of Non-Attainment
4.3	10% increase in annual alternative fuel consumption by FY 2015 relative to FY 2005 baseline; maintain 10% increase thereafter.	FY 2018 alternative fuel consumption increased 13% compared to FY 2016. Overall increase compared to the FY 2005 baseline is 439%.	LLNL will maintain its AFV fleet and continue to replace the existing conventional fueled vehicles with E85, hybrid, and plug-in electric vehicles.	Low
4.4	75% of light-duty vehicle acquisitions must consist of alternative fuel vehicles (AFV).	LLNL met the required 75% replacement of fossil fuel light-duty vehicles with AFVs in FY 2018. 76% of light-duty vehicles replaced in FY 2018 were replaced with AFVs.	LLNL will continue replacing its conventional fueled vehicles with AFVs as manufacturers and GSA make them available.	Medium
4.5	50% of passenger vehicle acquisitions consist of zero emission or plug-in hybrid electric vehicles by FY 2025.	During FY 2018, LLNL added 20 electric vehicles to its fleet as part of a pilot program. In its second year, LLNL now has 30 fully electric vehicles in the fleet and have returned 20 vehicles that had used fossil fuel. In FY 2018, The LLNL EV program was recognized with a DOE Sustainability Award.	An FY 2019 ES&H action plan is in place to continue to work toward building a larger onsite charging infrastructure to support the growing number of both government and personally owned electric vehicles.	TBD
SSP Category 5: Clean and Renewable Energy				
5.1	“Clean Energy” requires that the percentage of an agency’s total electric and thermal energy accounted for by renewable and alternative energy shall not be less than: 10% in FY 2018, working towards 25% by FY 2025.	FY 2018 renewable contribution was 16%, exceeding the 10% goal with the 73% allotment of renewable power generated by the 3.3 MW solar plant and with the purchase of 88,512 MWh of renewable electric energy and 789 MWh of RECs through WAPA. Plans are in place to continue to meet the 25% goal.	The FY 2019 requirement will be met primarily with the 73% allotment from the renewable power generated by the 3.3 MW solar plant and through REC purchases as needed.	Low

SSPP Cat. #	DOE Goal	Performance Status	Planned Actions & Contribution	Risk of Non-Attainment
5.2	<p>“Renewable Electric Energy” requires that renewable electric energy account for not less than 10% of total agency electric consumption in FY 2018, working towards 30% of total agency electric consumption by FY 2025.</p>	<p>FY 2018 requirement was exceeded with the 73% allotment of renewable power generated by the 3.3 MW solar plant and with the purchase of 88,512 MWh of renewable electric energy and 789 MWh of RECs through WAPA. LLNL is currently at 19% relative to the 30% by FY 2025 goal.</p>	<p>As above, the FY 2019 requirement will be met primarily with the 73% allotment from the renewable power generated by the 3.3 MW solar plant and through REC purchases as needed.</p>	<p>Low</p>
<p>SSP Category 6: Green Buildings</p>				
6.1	<p>At least 15% (by building count or gross square feet) of existing buildings greater than 5,000 gross square feet (GSF) to be compliant with the revised Guiding Principles for HPSB by FY 2025, with progress to 100% thereafter.</p>	<p>Assessing and certifying 15% of the existing occupied buildings greater than 5,000 GSF is 50% complete by building count. No activity in FY 2018.</p>	<p>Additional HPSB assessments are planned; however, the recommendations need more work to make the implementation cost effective.</p>	<p>High</p>

SSPP Cat. #	DOE Goal	Performance Status	Planned Actions & Contribution	Risk of Non-Attainment
SSP Category 7: Acquisitions and Procurement				
7.1	Promote sustainable acquisition and procurement to the maximum extent practicable, ensuring biopreferred and biobased provisions and clauses are included in 95% of applicable contracts.	Sustainable Acquisition or Environmental Affirmative Procurement Program (EPP) clauses have been incorporated into all eligible LLNL general provisions (GPs) for purchase orders and subcontracts. As a result, LLNL is 100% compliant with the requirement to include sustainable acquisition clauses in all eligible contract actions.	LLNL will continue to include Sustainable Acquisition or Environmental Affirmative Procurement Program clauses as identified in the General Provisions in all eligible purchase orders and subcontracts. LLNL will continue to implement, review, and update Procurement Standard Practice 23.5, <i>Environmental Affirmative Procurement and Waste Reduction Requirements</i> as it applies to LLNL procurement activities. The procedure was last updated on 3/3/17.	Low
SSP Category 8: Measures, Funding, and Training				
8.1	Annual targets for performance contracting to be implemented in FY 2018 and annually thereafter as part of the planning of section 14 of EO 13693.	In FY 2016, LLNL evaluated the merits of the recommended four ECMs proposed in the IGA estimated at a cost of \$2 million, not including the third-party financing cost and LLNL support costs. No activity in FY 2018 due to manpower and resources.		
SSP Category 9: Travel and Commute				
9.1	25% Scope 3 GHG reduction by FY 2025 from a FY 2008 baseline.	GHG emissions in this category increased by 6.6% from last year due to increased travel activity and more employees.	Covered in Energy Management Category.	Medium
SSP Category 10: Fugitives and Refrigerants				

SSPP Cat. #	DOE Goal	Performance Status	Planned Actions & Contribution	Risk of Non-Attainment
10.1	50% Scope 1 & 2 GHG reduction by FY 2025 from a FY 2008 baseline.	GHG emissions in this category were reduced by 27.3% from last year primarily due to the aggressive management of SF ₆ .	Continue the aggressive management of SF ₆ and better manage refrigerants.	Medium
SSP Category 11: Electronic Stewardship				
11.1	95% of eligible acquisitions each year are EPEAT-registered products.	Purchases of EPEAT qualified mobile phones were tracked for FY 2018 and servers were added to the list of tracked purchases in quarter 4 of FY 2018. All mobile phones purchased were EPEAT gold.	Continue with program.	Medium
11.2	100% of eligible PCs, laptops, and monitors have power management enabled.	100% of eligible PCs, laptops, and monitors are implemented with power management functionality; monitors are powered off after 30 minutes idle time, PCs and laptops are put into stand-by mode after 30 minutes of idle time.	Continue desktop refresh program and desktop power management project.	Low

SSPP Cat. #	DOE Goal	Performance Status	Planned Actions & Contribution	Risk of Non-Attainment
11.3	100% of eligible computers and imaging equipment have automatic duplexing enabled.	<p>Multifunction devices and printers purchased under LLNL's managed print services (MPS) blanket agreement possess duplex capabilities and duplex is set as default when the contractor installs the device.</p> <p>In FY 2018, LLNL expanded MPS by adding open portions of WCI PD to the blanket agreement. This expanded the environmental benefits of MPS.</p>	<p>LLNL continues to work with programs to promote MPS.</p> <p>Baseline data has been captured to evaluate the impact on duplex rates resulting from machine refresh and subsequent training emphasizing duplex printing. In the pilot area, data will be contrasted to existing machine data and results used to develop awareness, training, and configuration initiatives.</p> <p>Additional efforts to reduce paper usage include raising awareness of secure print capabilities and fax forwarding to email as a method to reduce waste.</p> <p>LLNL is drafting a print management policy that will include environmental elements such as duplex printing and EPEAT Gold or Silver registered.</p>	Low
11.4	100% of eligible (i.e., not classified) used electronics are reused or recycled using environmentally sound disposition options each year.	LLNL has a process to evaluate excess electronics for either reuse or recycling options.	Continue with program.	Low

SSPP Cat. #	DOE Goal	Performance Status	Planned Actions & Contribution	Risk of Non-Attainment
11.5	<p>Establish a power usage effectiveness target in the range of 1.2-1.4 for new data centers and less than 1.5 for existing data centers.</p> <p>Data Center Optimization Initiative (DCOI) requires the development and annual reporting on data center strategies to consolidate inefficient infrastructure, optimize existing facilities, improve security posture, achieve cost savings, and transition to more efficient infrastructure (such as cloud services and interagency shared services or co-located data centers).</p>	<p>Continue efforts in evaluating options to further optimize, consolidate or close remaining 18 LLNL unclassified data centers by:</p> <p>Adoption of a Cloud Smart policy to the furthest extent practicable based on cost, security requirements and application needs.</p> <p>Migrating to available inter-agency co-located data centers.</p> <p>Migrating to more optimized data centers within the LLNL inventory.</p>	<p>LLNL will continue to implement and measure progress toward meeting the goals set forth in the FITARA memorandum.</p> <p>Actions will include:</p> <ul style="list-style-type: none"> • Review and report quarterly data center inventory metrics. • Freeze any significant expansions of existing data centers. • Achieve and maintain a PUE of less than 1.5 for existing tiered data centers by September 30, 2019. • Continue efforts, where feasible, to consolidate, close, or re-purpose existing LLNL data centers. 	Medium

SSPP Cat. #	DOE Goal	Performance Status	Planned Actions & Contribution	Risk of Non-Attainment
SSP Category 12: Organizational Resilience				
12.1	Update policies to incentivize planning for and addressing the impacts of extreme events due to changes in weather patterns.	Through LLNL's existing environmental policy, the Lab commits to continuously improve environmental performance.	LLNL has identified existing resilient actions and areas for increasing effort to prepare for predicted climate threats through a baseline assessment. LLNL plans to identify—and update as needed—policies relating to changes in weather patterns.	Low
12.2	Update emergency response procedures and protocols to account for projected change, including extreme weather events.	LLNL currently incorporates into its emergency response program a broad range of hazards and environmental aspects, potential consequences, and lessons learned from simulated and actual emergencies. Several hazards that are already incorporated into the emergency response program overlap with immediate climate change hazards, for example risks of wild fire from extreme drought.	In accordance with ISMS practices, LLNL will continue to improve upon the emergency response program.	Low
12.3	Ensure workforce protocols and policies reflect projected human health and safety impacts.	LLNL's existing workforce protocols and policies reflect the value of each worker returning home daily in the same or better condition than when they arrived at work. This sweeping approach to health and safety allows for adaptation as needed, including for extreme weather events.	Specific impacts of projected extreme weather events and other impacts from climate change were considered during the baseline review. Protocols and policies are currently sufficient and can be reviewed and adapted as needed to address health and safety impacts.	Low

SSPP Cat. #	DOE Goal	Performance Status	Planned Actions & Contribution	Risk of Non-Attainment
12.4	Ensure site/lab management demonstrate commitment to adaptation efforts through internal communications and policies.	LLNL management is committed to effective communication and is supportive of all Lab policies.	LLNL management will continue to demonstrate commitment to adaptation efforts through internal communications and policies.	Low
12.5	Ensure that site/Lab climate adaptation and resilience policies and programs reflect the best available current science, updated as necessary.	LLNL works to anticipate, innovate and deliver solutions for the nation's most challenging security problems. LLNL's scientists and engineers include those working on the front lines to advance climate science. LLNL applies the best available science in all decision making.	LLNL will take an integrated approach to climate adaptation and resiliency under direction from DOE—with input from our own climate scientists—and using the latest tools available for predicting and planning the effects of climate change.	Low

Performance Review and Plan Narrative

SSP Category 1: Energy Management

1.1. 25% energy intensity reduction by FY2025 from an FY2015 baseline

Performance Status

At the end of FY 2018, LLNL contribution to the DOE energy use intensity reduction goal was -1.75%, relative to the FY 2015 baseline, normalized for weather. Without a correction for weather, the intensity would be at -4.72%. One facility (B363) was demolished in FY 2018. The Energy Usage and Cost Report is entered in the DOE Sustainability Dashboard.

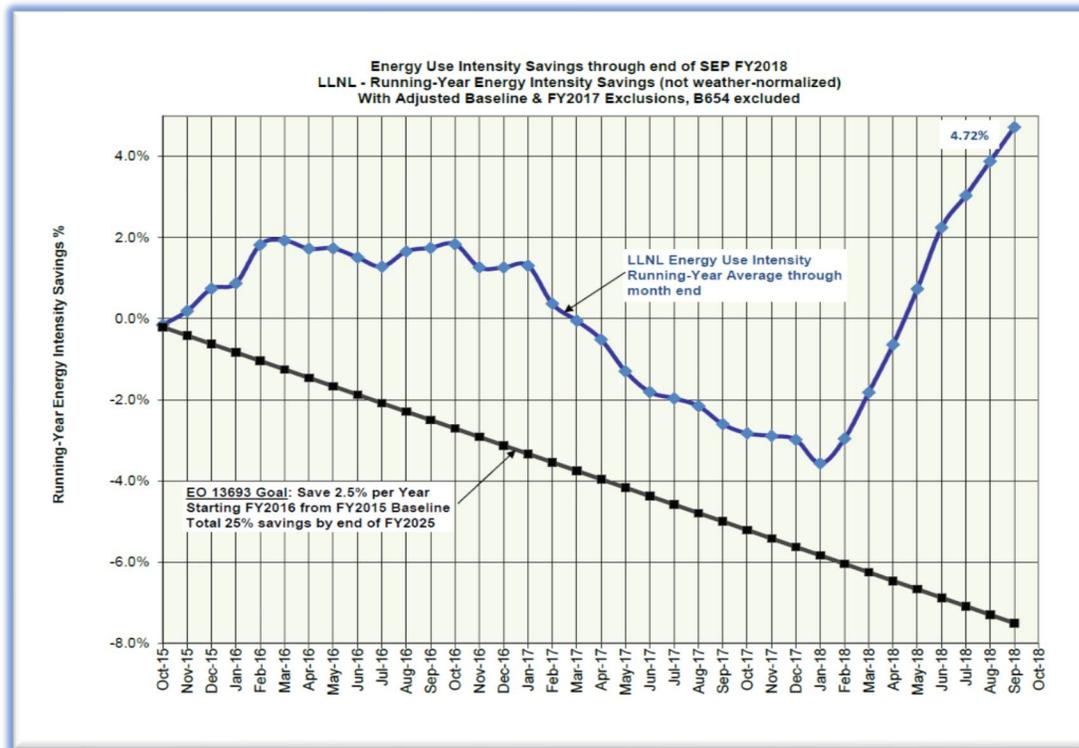


Figure 1. Energy-use intensity savings through end of FY 2018 (running year energy-intensity savings with FY 2017 exclusions).

LLNL continues to evaluate its energy usage to better understand how to encourage efficient energy reduction. The energy chart in Figure 2 estimates the sources of energy by type. The chart was updated with FY 2018 data and was created by incorporating metered data, lighting estimates, and equipment inventory. The energy consumed at LLNL is split between the excluded facilities (55.8%) and goal subject facilities (44.2%).

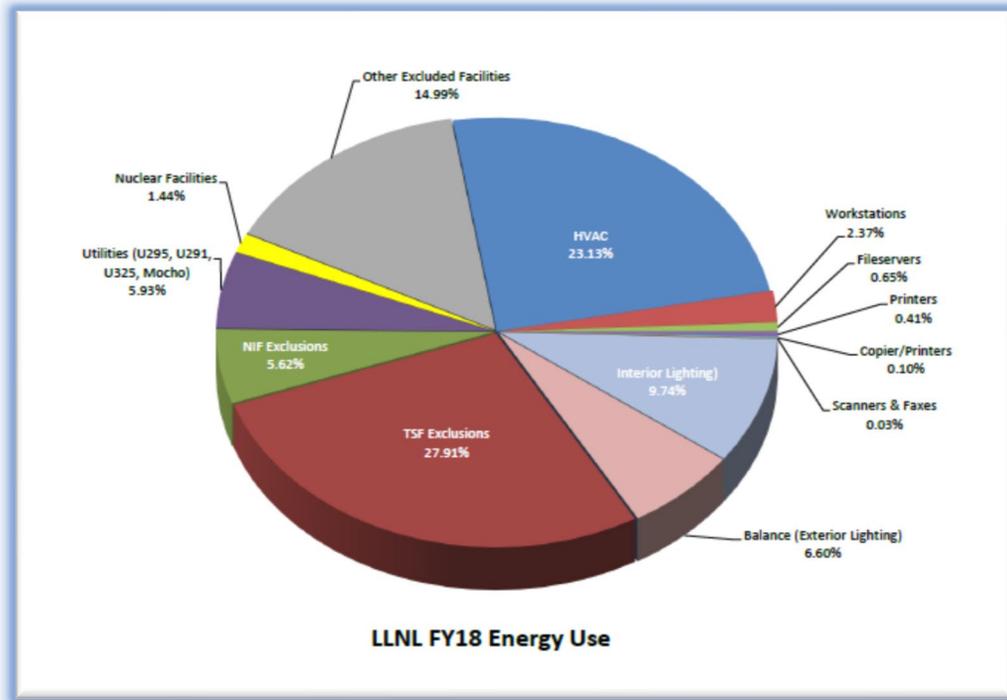


Figure 2. LLNL FY 2018 energy use.

With just the goal subject facilities (Figure 3), the energy breakdown shows that HVAC systems (55.38%) and lighting (36.57%) continue to be the two largest users of energy at LLNL. The breakdown helps to indicate where specific energy conservation efforts should be directed.

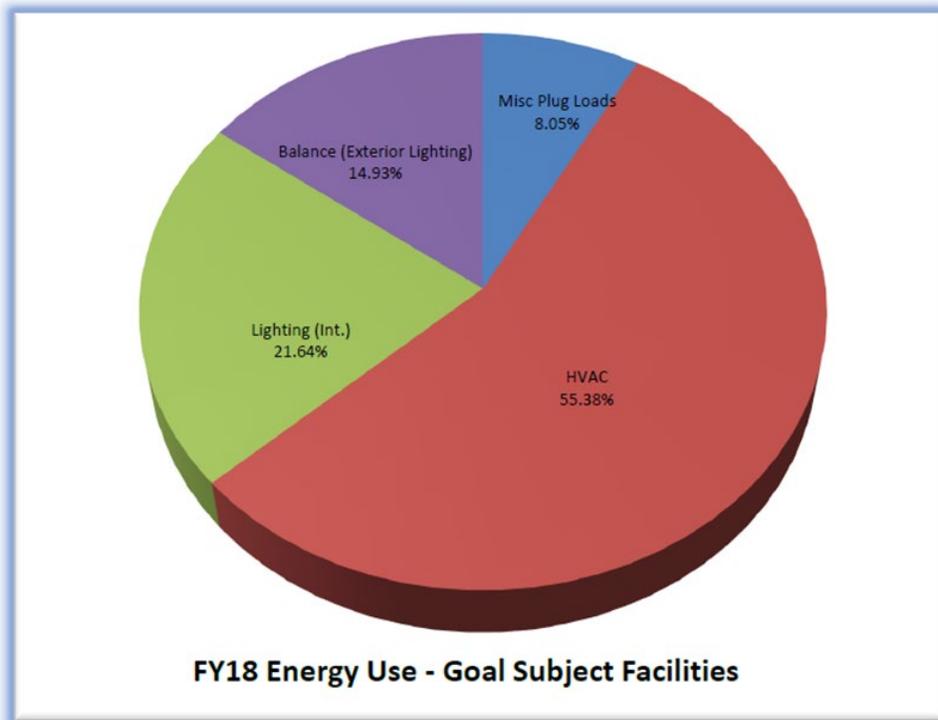


Figure 3. Energy use—goal subject facilities only.

In FY 2018, LLNL was again challenged to meet its energy intensity reduction goal. The milder-than-normal summer was helpful in decreasing the electricity consumption in the summer months, but the colder-than-normal winter was responsible for increasing natural gas consumption in the winter months. In the summer of FY 2018, there were 48% less cooling degree days (CDD) than the summer of FY 2015 (Figure 4).

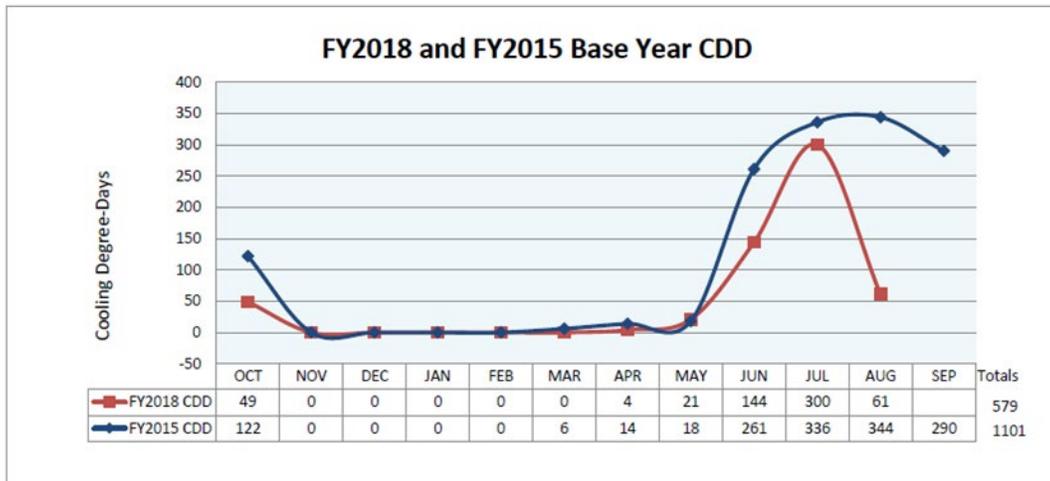


Figure 4. Comparison of cooling degree days (CDD).

The FY 2018 winter was colder compared to the base year FY 2015. There were 58% more heating degree days (HDD) than in the winter of FY 2015. This increased the burden on the boilers and heating system (Figure 5).

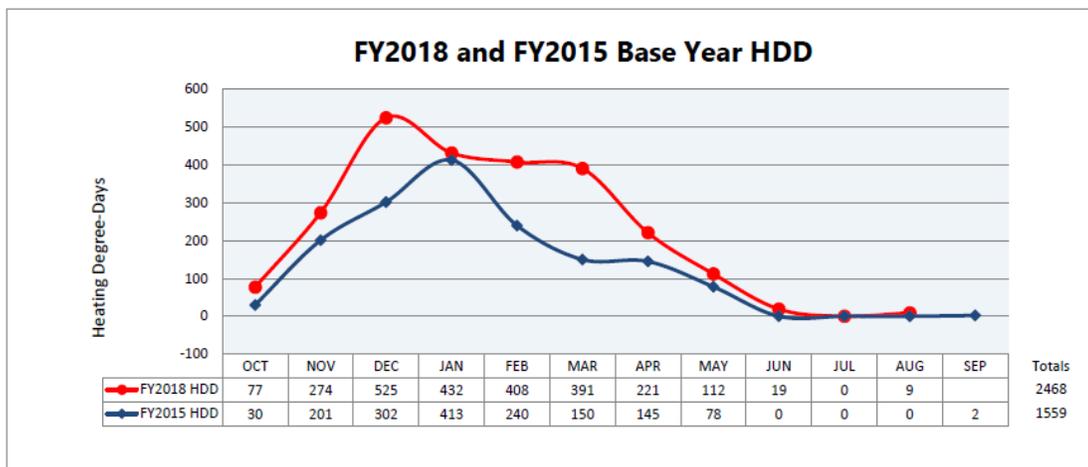


Figure 5. Comparison of heating degree days (HDD).

Plans and Projected Performance

LLNL has developed a comprehensive list of energy-savings projects that includes the results from the IGA report, EISA audits, compliance issues, deferred maintenance projects—that have a significant energy savings—metering evaluations, and grassroots suggestions. The list continues to evolve and expand as new energy-efficiency opportunities are identified. The list is prioritized by the energy savings return on investment (ROI) compared to the project costs.

LLNL has made progress in increasing HVAC funding for preventive and corrective maintenance for HVAC systems, as well as increasing staff and focusing attention on distributed elements of the HVAC system.

LLNL continues to evaluate and implement grassroots suggestions for energy-savings projects wherever possible and will implement them as funding permits. The Laboratory continues to distribute energy usage data on the metered facilities to the respective facility managers. When an increase in metered electricity is detected, the facility managers are engaged to find the cause and solutions for the increase.

Employees can contact the Green Hotline with energy saving suggestions. These ideas are evaluated, and—if deemed appropriate—are added to the comprehensive list of energy-intensity savings projects.

In addition, the preventive maintenance program included in the ESPC project has added several facilities to the WebCTRL system. The original ESPC project started with upgrades of HVAC controls on 24 facilities and over the years, LLNL has added 2-3 facilities per year on average to the original WebCTRL system.

Applying best practices continues to help reduce LLNL’s energy intensity and GHG emissions. These best practices include alerting facility managers of excessive use in their facilities, updating and adapting equipment operating schedules to meet the changing requirements of occupants, providing staff with the training and tools they need, and tracking energy use and comparing against expected performance.

LLNL’s Site 200 and Site 300 each have a site-wide direct digital control (DDC) system that is used to control temperatures, pressures, and humidity in many buildings. The system is state-of-the-art and uses approximately 581 high-speed, connected digital processors in 46 buildings so far with several more installations planned. The system allows subcontractors and trained onsite AC mechanics to program complex algorithms that optimize the use of electricity and natural gas in many of the HVAC systems without affecting employee comfort, and in many cases improving it through tighter control of temperature in offices and labs. Each system uses constant monitoring and remote alarming to alert building and maintenance staff of malfunctions so that they can be repaired in time to reduce programmatic impact, as well as minimize discomfort and overall energy usage. As always, available advanced energy-saving control algorithms are implemented depending on the hardware installed and programmatic needs.

In the last year, digital HVAC controls have been added to or expanded in many of our buildings as summarized below Figure 6 in and detailed in Table 2.

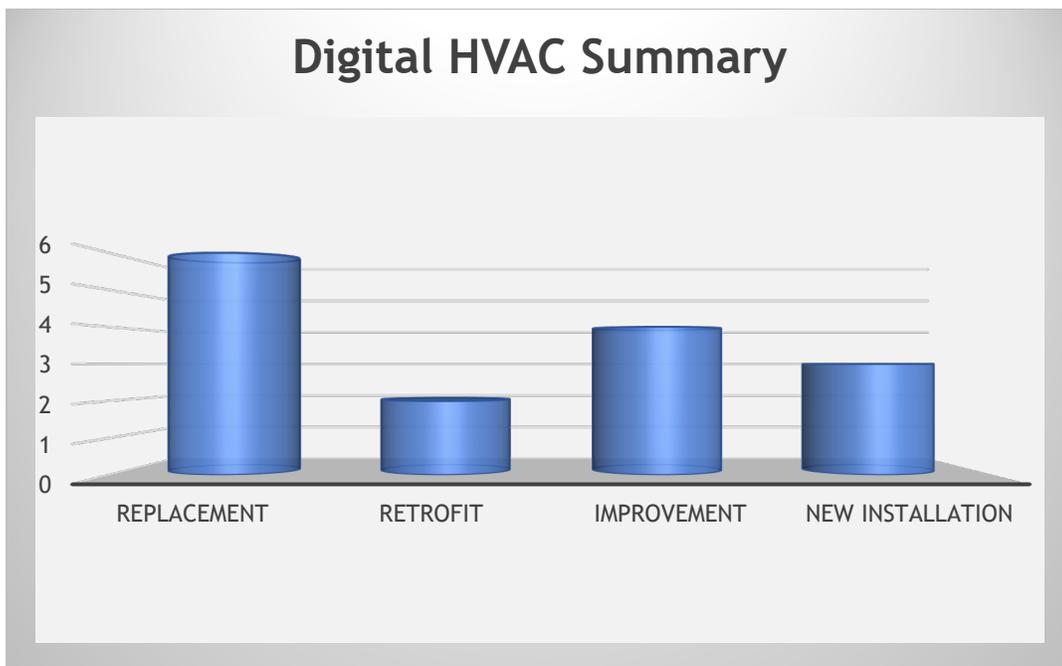


Figure 6. Overview of digital HVAC work.

Table 2. Digital HVAC detailed additions.

Building	Digital HVAC Controls Replaced, Expanded, or Added
B111	Replaced the temperature sensors in ACU01 and ACU02. This enabled the economizers to function as designed and allowed for better temperature control.
B132S	Two dry labs were converted to a single wet lab where the redundant controls were upgraded to a single system. This allowed for greater temperature control and reduced wasteful interaction between the two separate systems. In-house AC mechanics and engineering completed this work.
B191	Replaced two air handlers and three hood exhaust fans. The prior system was digitally controlled but was a poorly supported system from the vendor. The new DDC system uses optimization algorithms as best as possible.
B256	The existing relay-controlled system was replaced with digital controls to provide the maximum redundancy and reliability in this critical facility.
B271	CHAMP funding provided an extension of the existing control system to replace the pneumatic controls on all the existing mixing boxes. This implemented a trim-and-respond algorithm on the ACU to adjust the hot deck and cold deck temperatures to only what is needed to satisfy the zones. Remote monitoring of the critical AC units and exhaust fans was added, as well as alarming of the CW/LCW switchover and UPS systems that serve the critical spaces. There were scheduling upgrades and comfort improvements as well.
B365	With CHAMP program funding, this formerly-pneumatic-controlled building got a complete controls retrofit to add all of the energy saving algorithms that pneumatic controls simply cannot do. The retrofit improved room pressure control, temperature control, remote alarming, and reduced chiller and boiler usage. It also enabled the energy saving runaround loop that removes heat or cooling from the exhaust—that would have been wasted—and runs it back to the ACU inlet. Other updates were to schedule ACU02 to stay off unless it's needed, which is rare.
B381	Replaced four variable air volume boxes with new units. The old units were failing or had failed and the fans were running at 100% power and wasting energy. The custom cabinet was also removed, which had previously made maintenance and repairs difficult due to limited access.
B381	Improvements to the target fab high-bay continued by adding new temperature and humidity sensors. This allowed more accurate temperature and humidity control at the floor level, which reduced energy waste.
B391	Replaced controls in ACU03, which are the primary controls for clean room ACU43. The replacement help to reduce humidity in the clean room, but it had the added benefit of optimizing the HHW and CHW usage to the bare minimum required by ACU43. The system was previously heating the outside air just to have ACU43 cool it back down again.
B482	In-house technicians and engineering replaced the controls on ACU01, which allowed for control of the unit economizer, temperature set up, and air pressure optimization with the VAV units below.
B807	The CHAMP project funded a controls retrofit for B807 that added economizer controls to the ACU and trim-and-respond algorithms to the electric reheat coils to minimize their use—giving preference to the heat pump that is much more efficient for heating.
T4725	A state of the art, high efficiency HVAC variable refrigerant flow (VRF) system was installed in 2015. The efficiency difference between baseline code and actual is about 46%.

Building	Digital HVAC Controls Replaced, Expanded, or Added
B254	A 30-ton rooftop was installed with a new DDC system. The old system wasted energy by first cooling air to 55 degrees and then reheat it as needed at 7 different temperature zones. There was no correlation between outside air conditions, the supply air temperature, and the zone cooling/heating demand. With the new DDC system, an energy efficient strategy was implemented involving the use of zone demand to determine the right supply temperature and to not overcool, thereby saving energy. The approximate energy savings is 25%.
B218	System upgrade to high efficiency HVAC heat pumps. The old units were 12 SEER cooling only AC units with steam heat. The new units are high efficiency SEER heat pumps that replaced the old steam boilers. The approximate energy savings is 33%.
B654	A project was completed in 2018 to add two new, large air handlers for data center cooling. These custom-built air handlers use no compressors—instead using evaporative cooling. This is a highly efficient design with an energy savings of approximately 27%.

Based on best estimate of available resources for FY 2019, LLNL will attempt to maintain its energy intensity savings at current levels considering the total building area of 5,874 ft².

Below, Figure 7 shows the site projected electricity consumption and Figure 8 shows the load forecast.

Fiscal Year	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Forecast Total Electricity Consumption (MWh)	434	435	440	430	433	561	516	517	520	525
HEMSF Facility 1 B453 - COMP (MWh)	145	152	155	160	210	270	230	230	235	240
HEMSF Facility 2 B581 - NIF (MWh)	30	30	32	34	36	40	42	44	44	44
Estimated Load after Energy Efficiencies	434	435	440	430	433	561	516	517	520	525

Figure 7. Site projected electricity consumption with Exascale (x10⁶ kWh).

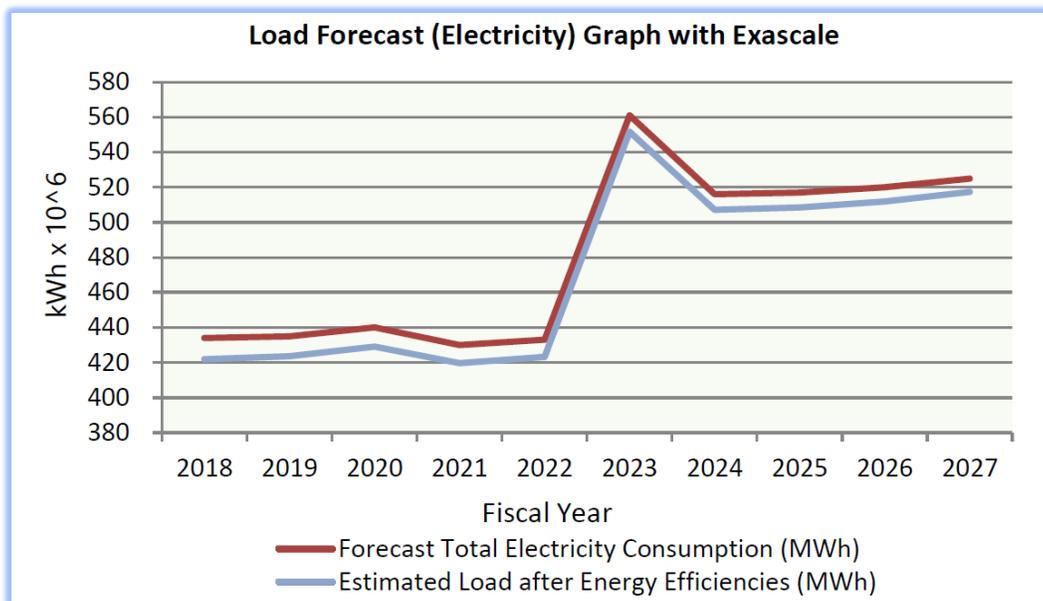


Figure 8. LLNL energy load forecast with Exascale.

Resources Required

Funding will be required for projects that have been identified, including the installation of more DDC systems or conversion of existing pneumatic control systems, additional programmable thermostats, interior and exterior lighting upgrade projects, and other energy conservation-related projects. LLNL is continuing to develop a strategy to justify energy conservation projects in comparison to its low cost of electricity.

Plans to reduce deferred maintenance, while at the same time increasing energy efficiency, will be implemented according to the prioritized project list for the site. When replacing aging equipment identified in the master deferred maintenance list, new equipment will be the latest, most energy-efficient type available.

Figure 9 lists projects that, if funded and implemented, would allow LLNL to meet its energy-intensity reduction goals.

Project	Project Cost (\$M)	Annual Savings (\$M)	Simple Payback (Yrs)	FY19 (\$M)	FY20 (\$M)	FY21 (\$M)	FY22 (\$M)
Building Automation Systems/EMCS	5	0.9	5.6	0.5	1.5	2	1
Electric Motors and Drives, Variable Speed Motors and Drives	2	0.54	3.7	0.5	0.5	0.5	0.5
Site-wide Lighting Improvements, Exterior	3	0.4	7.5	0.5	1	1	0.5
Site-wide Lighting Improvements, Interior	5	3.8	1.3	0.5	1.5	1.5	1.5

Figure 9. Proposed projects in support of energy management.

1.2. EISA Section 432 energy and water evaluations

In FY 2018, internal desk audits were performed on twelve facilities, B453, B451, B581, B133, B132N, B381, B132S, B194, B111, U325, B391 and U291.

These audited facilities made up the second 25% for the third round of audits.

Energy audits to meet EISA Section 432 and efforts to increase efficiency (e.g., combining energy audits with condition assessment surveys), along with recommissioning/retro-commissioning, are continually being evaluated. Meetings with managers of facilities identified with an increase in electricity are being held to discuss the recent energy audit recommendations to plan a path forward—beginning with those recommendations that offer the most energy savings opportunities.

There are two qualified certified energy managers (CEM) at LLNL, which is sufficient at this time. LLNL is working to identify facility managers or facility points of contact as candidates to enroll in the program for future years.

1.3. Meter all individual buildings for electricity, natural gas, steam, and water, where cost-effective and appropriate

Performance Status

The metering plan will continue to be updated to align with the November 2014 Federal Building Metering Guidance document. LLNL's commitment to support the DOE SSPP and comply with the Energy Policy Act (EPACT) 2005 and EISA 2007 regulations is exemplified in this latest issue of the metering plan. LLNL is committed to monitoring and reducing its energy usage and finding innovative ways to lead the lab complex while at the same time meeting its mission goals. This updated metering plan not only outlines the strategy

to continue repair of meters, but also highlights LLNL’s new goal of upgrading existing legacy meters before they fail.

LLNL’s metering portfolio—as of October 1, 2016—is shown in Figure 10. LLNL is currently developing a complete water meter deployment plan. Due to the low water usage, a measurement plan for water use at Site 300 has not been in place since 2007.

	Number of Meters	Number of Buildings
Electricity		
Advanced Individual	114	116
Advanced Shared	134	247
Standard	58	27
No Meter	0	21
Total	308	411
Natural Gas		
Equipment Meters	18	14
Building Meters	18	14
No Meter	0	0
Total	36	28
Water		
Advanced	14	0
Standard	13	1
Total	27	1

SSO-13-0002_RevA

Figure 10. LLNL’s current metering portfolio.

Plans and Projected Performance

Below is a summary of LLNL’s performance compared to the SSPP goals.

SSPP Metering Stretch Goals	FY 2017 Performance Status	Planned Actions and Key Issues
Meter all individual buildings for electricity, natural gas, steam, and water, where cost-effective and appropriate.	90% achieved as of the end of FY 2012.	The LLNL plan to repair failed legacy electricity metering was continued in FY 2018, but only at computation facilities. Additional funding will complete upgrades throughout the site. Funding for a metering services project estimated at \$500K was requested from management to arrest the declining state of advanced electric meters. Additional funding will upgrade natural gas and water meters to meet the FY 2019 goal requirements.

In FY 2015, modem-based electricity meters were taken out of production. As a result, LLNL shifted its strategy from repairing existing modem-based meters to complete meter upgrades to maintain compliance with its metering goals. The site decided to only perform electricity meter upgrades at computation facilities during FY 2017. As a result, the remainder of the LLNL site continued to experience legacy electricity meter failures both in communication and overall function.

Resources Required

Figure 11 lists projects that will ensure that appropriate LLNL facilities meet the metering goal for electricity, natural gas, and potable water metering. These projects are intended to help change behaviors and improve operations to achieve energy efficiencies.

Project	Project Cost (\$M)	Savings (\$M)	Simple Payback (Yrs)	FY19 (\$M)	FY20 (\$M)	FY21 (\$M)	FY22 (\$M)	FY23 (\$M)
Electricity Metering	4.2	N/A	N/A	0.5	1.0	1.0	1.0	0.7
Natural Gas Metering	3.6	0.065	54	0.5	0.8	1.0	0.75	0.6
Potable Water Metering	1.5	0.025	59	0.25	0.25	0.5	0.25	0.25

Figure 11. Proposed projects in support of metering.

1.4. 50% Scope 1 and Scope 2 GHG reduction by FY 2025 from a FY 2008 baseline

LLNL’s GHG footprint is defined by three major scopes of GHG emissions, which are depicted below in Figure 12. LLNL quantifies emissions within each scope, as well as targets reductions according to scope-related reduction goals. LLNL owns or controls sources from all three direct GHG emissions. Scope 3 emissions are addressed under goal 1.2 in this section.

LLNL’s Scope 1 emissions are the result of direct emissions associated with fuel combustion or fugitive emissions. LLNL’s Scope 2 emissions are a result of indirect emissions associated with consumption of purchased or acquired electricity. All other potential Scope 2 emissions are not applicable to LLNL. Scope 1 and Scope 2 GHG emissions are offset by the estimated annual GHG emissions avoided by renewable energy produced onsite and reduced by purchased renewable energy credits (REC).

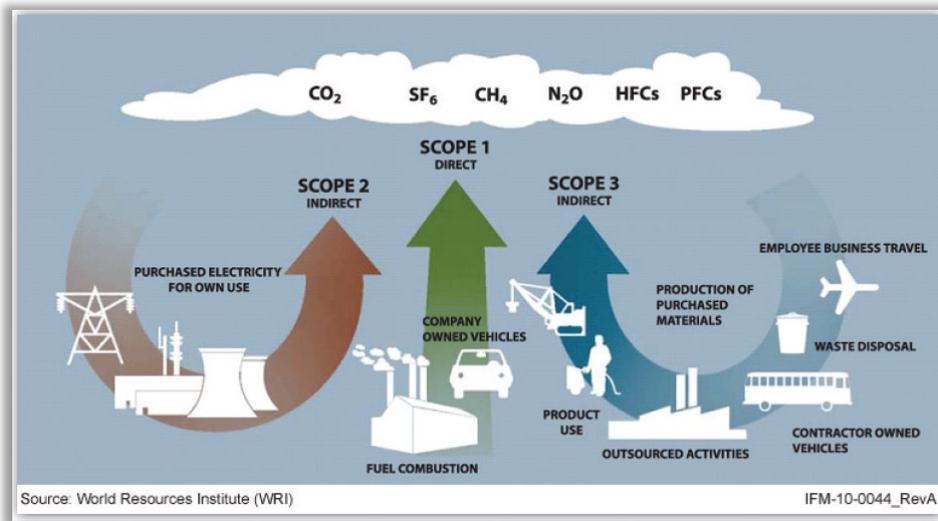


Figure 12. The three major scopes of GHG emissions.

LLNL’s Scope 1 and Scope 2 emissions include:

- Natural gas fuel combustion for the generation of electricity, heat, cooling, or steam (e.g., boilers and furnaces)
- Fuel combustion (e.g., gasoline; E85, a blend of 85% ethanol and 15% gasoline; and diesel) in mobile sources including LLNL’s GSA-leased vehicles, commercially leased, and agency-owned vehicles
- Fugitive emissions from fluorinated gases and refrigerants including mixed refrigerants used in refrigeration and air conditioning equipment

- Operation of the sewage lagoon at Site 300
- Indirect emissions associated with electricity consumption
- Estimated indirect emissions avoided by onsite clean renewable energy production (solar) and reduced by purchased RECs (emissions offset)

LLNL continues to assist DOE in working to achieve the 50% GHG reduction goals. LLNL's Site 200 and Site 300 major sources of Scope 1 and Scope 2 GHGs are influenced primarily by the management of electricity, natural gas, fossil fuels and fugitive emissions—i.e., sulfur hexafluoride (SF₆) and others.

Factors influencing Scope 1 and Scope 2 emissions are addressed in the various activities and accomplishments described throughout this document, which include:

- Energy intensity reduction
- Renewable energy consumption
- Reducing fleet fuel use
- Metering
- Cool roofs
- Pollution prevention and waste reduction
- Sustainable acquisition and electronic stewardship

Overall Reduction of Scope 1 and Scope 2 Greenhouse Gas Emissions¹

DOE's goal for Scope 1 and Scope 2 is a 50% reduction in the generation of Scope 1 and Scope 2 GHG emissions by FY 2025 from the FY 2008 baseline. LLNL's GHG reductions for Scope 1 and Scope 2 are largely driven by the plans described in this document. LLNL achieved an overall reduction of 38% (estimated) from FY 2008 baseline for Scope 1 and Scope 2 emissions during FY 2018. Aggressive reduction of SF₆ in programmatic equipment since 2008 coupled with the purchase of RECs has helped LLNL exceed the FY 2018 reduction goal of 29%.

Performance Status

In FY 2018, LLNL achieved a reduction of 38% (estimated) in Scope 1 and Scope 2 GHG emissions, relative to its FY 2008 baseline. Significant efforts, focusing on LLNL's continued management of SF₆ usage, the offsets of purchased RECs from wind power, the purchase of green energy incremental hydropower and minimizing electrical energy use, have contributed to this year's reduction achievement. Also, the 3.3 MW solar farm at Site 200 contributed 5,018 MWh of energy to the Lab that resulted in avoiding approximately 1,206 mtCO₂e of GHG emissions during FY 2018. These efforts have helped LLNL exceed the Scope 1 and Scope 2 emissions reduction target of 29% for FY 2018.

Plans and Projected Performance

LLNL has already successfully reduced GHG emissions through aggressive reduction and management of fugitive emissions from equipment using SF₆. Implementation of the recently amended federal refrigerant management regulation effective January 1, 2019 will put more emphasis on leak inspection and leak repair, which should help lower fugitive refrigerant emissions. Also, LLNL is planning to replace the SF₆ compressor on its Site 300 FXR flash x-ray system with a newer compressor less likely to leak. The Site 300 FXR is a large source of SF₆ emissions. Scope 1 and Scope 2 GHG reductions for FY 2019 and beyond will largely be dependent on Laboratory management of electrical energy because this is LLNL's largest contributor to Scope 1 and Scope 2 GHG emissions (see Figure 13). For more information, refer to the sections that address Goal 2.1 (energy intensity reduction) and Goal 3.1 (electrical consumption from renewable energy sources).

¹ Scope 1 and Scope 2 GHG emissions and GHG emission reductions presented in this document are current estimates. Actual Scope 1 and Scope 2 GHG emissions and GHG emission reductions will be published in the final DOE Sustainability Dashboard.

Scope 1&2 GHG Emissions Breakdown			
Categories	Baseline (2008)	FY 2017	FY 2018
Facility Energy	156,688	103,093.5	103,704.2
Non-Fleet V&E Fuel	0	0.0	0.0
Fleet Fuel	1,773	1,224.8	1,224.8
Fugitive Emissions	34,947	22,103.3	16,064.9
Onsite Landfills	0	0.0	0.0
Onsite WWT	7	14.9	15.2
Renewables ^a (Avoided)	0	1,094.2	1,210.8
RECs (subtracted)	N/A	(12,671.0)	(598.1)
Total (MtCO₂e)	193,415	113,765.5	120,411.0

Figure 13. Scope 1 and Scope 2 GHG emissions (MtCO₂e) by source.

Note: Scope 1 and Scope 2 GHG emissions presented in this document are estimates. Actual Scope 1 and Scope 2 GHG emissions will be published in the final DOE Sustainability Dashboard.

The measures described in this document all have the potential to assist in GHG emission reductions, and they will be carried out if deemed economically feasible and supportive of mission. Future growth of LLNL continues to be centered on energy-intensive facilities and research including the NIF, HPC, and other program-related areas—all of which will increase LLNL’s GHG emissions. It should be noted that though LLNL has been successful with the reductions in SF₆, this is only part of the picture and does not necessarily translate into overall GHG reductions.

LLNL will continue to maintain the SF₆ management and capture plan for managing SF₆ purchase, usage, and storage. Ongoing efforts to support SF₆ regulatory reporting include maintaining documentation on R&D uses and reporting emission data from electrical utility usage.

Resources Required

Most resources required to reduce LLNL’s overall Scope 1 and Scope 2 emissions are related to activities addressed under other goals, especially those related to energy intensity reduction and renewable energy use. LLNL can achieve additional emissions reductions by decreasing electrical energy consumption.

LLNL will continue to work on documenting and tracking SF₆ uses onsite. As the LLNL SF₆ management program becomes more developed, the number of projects where alternatives to SF₆ can be used becomes smaller. However, the remaining uses—specifically those in the high-voltage applications and accelerators—are typically characterized by robust containment and transfer systems that can detect significant releases fairly quickly. While the major users of SF₆ may not be able to eliminate the use of SF₆ in the near future, program management and researchers need to continue to ensure that the gas is used in a manner that minimizes the amount released.

1.5. 25% Scope 3 GHG reduction by FY2025 from a FY2008 baseline

Scope 3 includes all indirect emissions not included in Scopes 1 and 2. Employee commuting and business air travel—along with transmission and distribution (T&D) losses associated with electricity use—continue to account for most Scope 3 emissions. LLNL’s Scope 3 emissions are offset by the estimated annual GHG emissions associated with T&D losses that were avoided by purchased RECs.

LLNL Scope 3 GHG emissions include:

- Employee commuting
- Employee business travel
 - Air travel
 - Rental or privately-owned vehicle mileage

- Offsite (contracted) domestic wastewater treatment
- Offsite municipal solid waste disposal
- Electrical T&D losses
- Estimated avoided T&D losses associated with purchased RECs (emissions offset)

Performance Status

In FY 2018, the Laboratory maintained an overall reduction of 16% in Scope 3 emissions from the FY 2008 baseline—slightly better than the 15% reduction target for FY 2018. Contributing factors to this year's emissions reduction relative to FY 2008 include a reduction in commute and T&D losses.

Scope 3 GHG Emissions Breakdown			
Categories	Baseline (2008)	FY 2017	FY 2018
T&D Losses	8,624	5,210.0	5,239.4
Air Travel	9,709	9,156.3	9,675.2
Ground Travel	1,218	1,400.7	1,615.4
Commute	25,708	20,113.8	21,400.9
Offsite MSW	730	674.6	660.2
Offsite WWT	5	14.9	4.8
Total (MtCO_{2e})	45,994	36,570.3	38,595.9

Figure 14. Scope 3 GHG emissions (MtCO_{2e}) by source.

Note: Scope 3 GHG emissions presented in this document are estimates. Actual Scope 3 GHG emissions will be published in the final DOE Sustainability Dashboard.

LLNL continued its personal electric vehicle (PEV) pilot program that was started in 2014. The program currently has a total of 56 charging plugs at 20 building locations. The program has 70 employee participants paying a monthly charging fee. This reduces GHG emissions by an estimated 250 MtCO_{2e} annually based on the average employee commute.



Photo 1. Personal vehicle charging station.

LLNL has a well-established recycling program that consistently exceeds the 50% goals for diversion of municipal waste from landfill. Everything from aluminum soda cans to toner cartridges are included in LLNL's recycling program. In addition, compostable materials are collected in both onsite cafeterias and many high-occupancy office buildings. Composting and recycling programs that divert waste from landfills are discussed in detail under their respective SSP goals.

Plans and Projected Performance

LLNL Scope 3 emissions reductions will continue to focus on opportunities to reduce employee commuting and business travel. Any efforts related to Scope 3 emissions reductions will also be impacted by electrical energy use. Annual GHG emissions due to T&D losses associated with electrical energy use are a significant contributor to Scope 3 emissions.

Resources Required

Normal business processes are in place for this goal.

SSP Category 2: Water Management Category

2.1. 36% potable water intensity (Gal per gross square foot) reduction by FY2025 from a FY2007 baseline

Performance Status

In FY 2018, LLNL's contribution to the DOE potable water intensity savings goal was 2% (Figure 15). LLNL's drop in potable water intensity savings from the previous year was primarily due to the following factors:

- An unavoidable switch to the secondary water supplier (Zone 7) after mid-July 2016. Prior savings were attained with the primary water supplier Hetch Hetchy water.
- Continued growth and activity in FY 2018 increased the domestic water demand at the site. LLNL mission is expanding with more personnel onsite. Rate of personnel assimilation exceeds the rate of infrastructure development. Old buildings with higher water intensity are being refurbished. Computing (cooling) capability is expanding and there are no exclusions for water intensity calculation.

The water consumption and cost data report is entered in the dashboard.

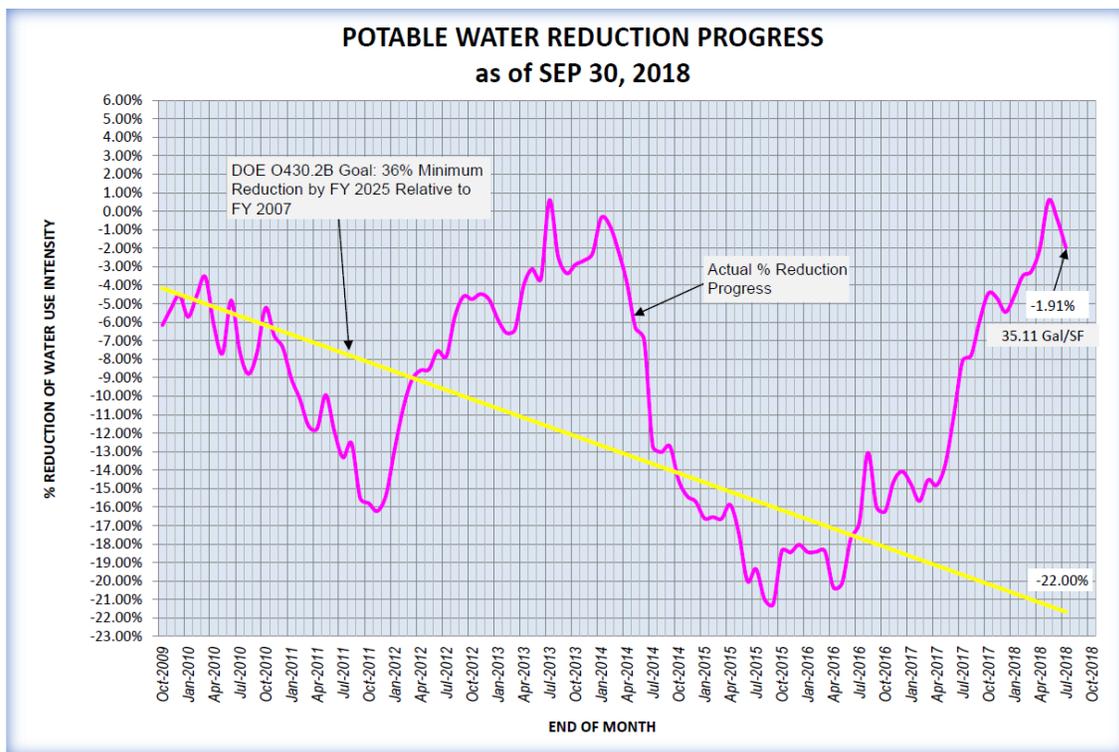


Figure 15. Potable water use intensity savings through end of FY 2018.

Potable water use at LLNL's cooling towers increased nearly 6.3% (7,270 kgal) from FY 2015. FY 2018 was not as warm as FY 2015, but due to the undesirable mineral content in the water supply, the cycles of concentration in the cooling towers could not be maximized and the towers had to be blown down more often. The R.O. Treated Groundwater Pilot Project at B133 Cooling Tower—where treated well water is run through a reverse osmosis unit to produce near Hetch Hetchy-quality water, then recycled to the tower as make-up—saved about 2,591 kgal of potable water in FY 2018 but was unavailable for four months.

California Governor Jerry Brown lifted his executive order of mandatory water reductions for potable water use and irrigation in April 2017—after five years of unprecedented drought in the state. By the end of September 2017, the estimated irrigation savings was about 5 million gallons for the year. The total

irrigation reduction to date is about 57%, and about 11% on potable water use with respect to the 2013 baseline.

The Laboratory applies various intensity levels of landscaping as appropriate to the contextual environment—ranging from special-use to transitional and natural settings. As stated in the 2011 Sustainable Landscape Concept Plan, one of the site landscaping goals is to reduce the amount of irrigation for water-intensive lawn. The use of turf would be limited to only certain special aesthetic and recreational applications. Other lawn areas with no specific functional requirements would be converted to drought tolerant/Livermore Valley-compatible planting.

LLNL will continue to do incremental landscape and irrigation modifications to reduce water use as funding allows—reducing lawn areas and optimizing irrigation efficiency with alternate sustainable landscaping.

A breakdown of LLNL potable water consumption is illustrated in Figure 16. The cooling tower make-up component is the highest user at 49.78%, with facility process use second at 25.83% and domestic use third at 13.52%.

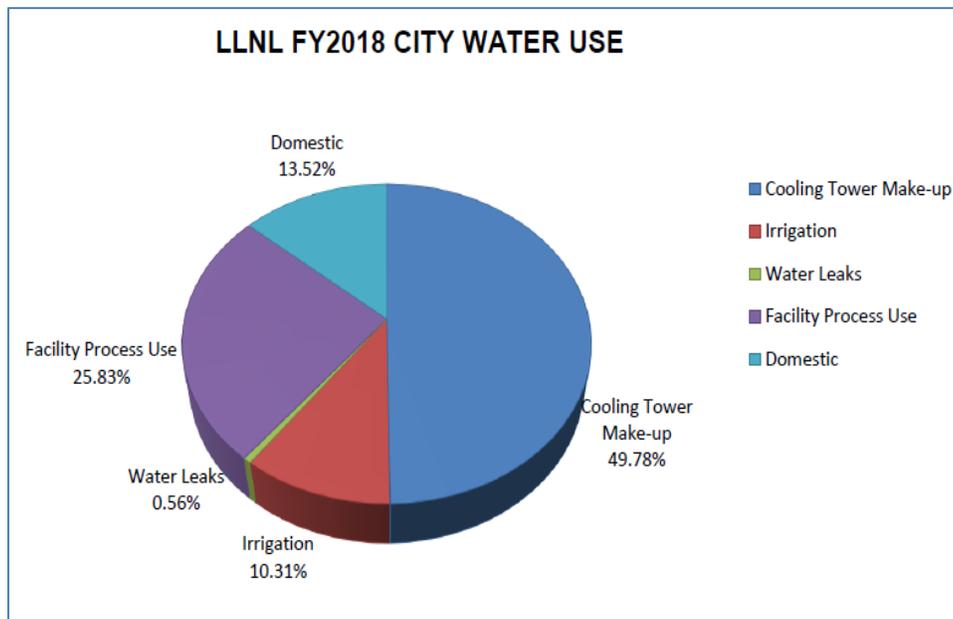


Figure 16. LLNL FY 2018 potable water use breakdown.

Current LLNL practice is to meter areas or zones of greatest water use—such as the cooling towers and irrigation zones—rather than at individual buildings as it would be prohibitively expensive. All five cooling tower make-up water systems at LLNL are furnished with standard water meters. LLNL plans to upgrade all water meters to advanced water meters, which is included in the metering project proposal and outlined in Figure 11. This will allow a more timely and accurate accounting of the total cooling tower make-up water load.

Plans and Projected Performance

There are several factors that will make it difficult to meet the FY 2025 goal without additional resources to execute the needed water savings projects. Some challenges in the future include:

- In FY 2018, LLNL was using the secondary water supplier Zone 7 due to chlorine issues with the primary supplier Hetch Hetchy water. This unavoidable switch to Zone 7 has imposed an insurmountable burden to the biggest user—the cooling tower make-up system.
- Continued Livermore computing mission growth requires additional cooling tower make-up. Unlike energy-intensity calculations, there are no exclusions for mission growth for water reduction.

- As noted in the performance status, continued growth and activity in FY 2018 has increased the domestic water demand at the site.

There are several water infrastructure projects underway—or being planned—that will assist the Laboratory in meeting the federal water-reduction goal.

Table 3. Water infrastructure projects.

Location	Description
Site 200 Water Treatment Project	Completed in FY 2018 and includes an engineering technical report and design of a water chlorination facility at the Sandia water tanks area, which will treat the Hetch Hetchy water to make it compliant with the required potable-water drinking standards. The engineering report is a requirement for a water supply application permit. A return to Hetch Hetchy water will allow the cycles of concentration to be maximized at the cooling towers, thereby reducing blowdown and saving on make-up potable water. Current plan is to proceed with the permit application and construct the facility in FY 2019. Operations would start thereafter, and the site should see results in FY 2020.
Site 300 Water Filtration Project	In construction and involves the installation of a filtration facility using granulated activated carbon (GAC). This project will allow the use of Hetch Hetchy water instead of ground water.
Site-wide Mechanical Utilities Valve and Water Distribution Piping Replacement Project	Will strategically replace failed isolation valves and affected water piping in the utility systems—including potable water—to better serve the mission and efficiently mitigate line breaks.
S300 Tank Inspections	<p>Previous 5-year inspections of eleven water tanks had two options for execution. The first method required placing a diver inside the tank with a communications tether that would report the diver's findings. The second method required the tank to be isolated, tank drained and then place the inspector inside the tank to conduct the inspection. Both methods would take approximately 80-100 combined work hours to complete each tank inspection for a total completion time of 880-1100 work hours.</p> <p>This past fiscal year, tank inspections were completed using a remotely-piloted underwater vehicle (ROV) with a high definition camera and lighting system—requiring fewer personnel to complete the inspection. This new method resulted in 16 combined work hours to inspect each tank for a total completion time of approximately 160 work hours for all tanks. The total amount of potable water saved by using this method was approximately 1.116 million gallons.</p>
B801 Cooling Tower	Noted to be using considerable amount of domestic water for its make-up needs. A chemical treatment consultant analyzed the make-up water and the blowdown water to compare the chemical concentrations between the two. The consultant advised on the optimum level of concentration so that blowdown water could be reduced. This saved thousands of gallons of water per day.
Recently submitted UESC Investment Grade Audit (IGA)	Included a proposal for three water ECMs: well water cooling tower make-up for U325, wastewater reclamation for cooling tower make-up at U291 and OS454 Livermore computing (formerly the terascale facility), and xeriscaping at B170.

Location	Description
Water Testbed Project	Continues to harvest rooftop rainwater at Building 471 for irrigation use in the area. Other candidate areas are being identified as funding becomes available.

In keeping with its high standard of environmental stewardship and commitment to meeting DOE's water intensity reduction goals, LLNL continues to evaluate ways to identify, monitor, and mitigate inefficiencies in its water-distribution systems. This will have an additional benefit of reducing electrical energy expended in water distribution across the site.

LLNL's search for the most advanced and efficient leak detection technologies has created an opportunity to collaborate with industry leaders who employ the latest technological and environmentally sound methods to detect, locate, and correct leaks. Additional resources are required to pursue the currently available improved leak-detection strategies. However, since the estimated amount of water lost due to leakage is minimal—and with the relatively low cost of water—LLNL is sensitive to investing funds in long payback projects that may not consistently yield the desired results. As the cost of water is projected to increase over the next few years, LLNL will re-evaluate the recommended water saving ECMs for prioritization.

DOE's FY 2019 water intensity reduction goal is 24%. Based on LLNL's best estimate of available resources for FY 2019 and recognizing the primary water supplier (Hetch Hetchy) is not back in service, LLNL will struggle to meet this goal and will strive to maintain current savings.

Estimated water use over the next years is depicted below in Figure 17.

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Total Water Consumption (Mgal)	244	254	238	247	256	265	330	274	274	276	277
B453- COMP	46	44	50	90	95	125	160	135	135	140	140
B581- NIF	15	15	15	16	16	17	17	18	18	20	20
Water Efficiencies (Mgal)	237	246	231	240	249	258	320	266	266	268	269

Figure 17. Estimated water use.

Highlight 1. LLNL uses treated well water.

LLNL Uses Treated Well Water

...in cooling towers

In FY2013, LLNL initiated a pilot project to demineralize treated well water for use as make-up water in its cooling towers. The well water now goes through an additional treatment that includes running it through a reverse osmosis unit to eliminate the possibility of the water doing harm to the cooling towers. Until recently, treated well water was discharged to the arroyo.

As the percentage of water use is greatest at the cooling towers, a conversion to treated water now assists LLNL in meeting its water reduction goals. Using recycled treated well water as make-up water is estimated to save at least 5,500 kgals annually. The pilot project was completed FYE2013 and is expected to be fully deployed by the end of the calendar year. A photo of the reverse osmosis unit is shown at right.



...for irrigation

Another plan to evaluate the use of recycled and treated well water for irrigation is being considered. Treated well water is diverted to the reverse osmosis system where it is purified for use in the cooling tower. The treated well water will be blended with potable water to ensure a nondeleterious effect to the landscaping. Resources are needed to fully evaluate this plan.



Resources Required

For FY 2019, LLNL has requested funding to complete the water infrastructure projects that would allow a return to the Hetch Hetchy water system. Water saving projects identified in previous audits can also assist in intensity-reduction measures and are shown in Figure 18. Funding and implementing these projects would better allow LLNL to meet its water intensity reduction goal.

Project	Project Cost (\$M)	Annual Savings (\$M)	Simple Payback (Yrs)	FY19 (\$M)	FY20 (\$M)	FY21 (\$M)	FY22 (\$M)
Use RO Treated Wellwater at U325	4.9	0.23	21.6	0.5	0.5	1	2.9
Use RO Treated Wellwater at U291	3.5	0.17	20.2	0.5	1	1	1
Use RO Treated Wellwater at NIF	3.5	0.17	20.2	0.5	1	1	1
Use Reclaimed Wastewater at U291 and TS	13	0.61	21.3	3	3	4	3

Figure 18. Proposed projects in support of water management.

2.2. 30% water consumption (Gal) reduction of industrial, landscaping, and agricultural (ILA) water by FY2025 from a FY2010 baseline

Performance Status

LLNL uses potable water for industrial (i.e., cooling tower make-up) and landscape irrigation at Site 200. At Site 300, potable well water is used for all purposes. A planned cutover from well water to Hetch Hetchy water is in construction and could be started up in 2019—pending the completion of the Site 300 Water Filtration (GAC) project.

The 30% water consumption reduction of ILA water goal does not strictly apply to LLNL since by definition ILA is non-potable water. However, LLNL is committed to reducing industrial use of potable water at the cooling towers and for landscape irrigation. As a subset of the water reduction savings, the portion attributable to ILA can also be tracked.

Storm-Water Management

The management and control of storm-water runoff quantity, timing, and water quality are important considerations in low-impact development and sustainability. Storm-water management is a component of LLNL's EMS through various environmental aspects—including groundwater discharges, inadvertent releases, water use, and land resource use. LLNL also considers storm-water management an element in water conservation and green building.

LLNL's storm-water program has been designed to address regulatory requirements and DOE Orders. Storm-water discharges at both Site 200 and Site 300 are regulated by the State of California under the authority of the Clean Water Act using industrial and construction storm water National Pollutant Discharge Elimination System (NPDES) permits. The state also regulates storm-water discharges under the Porter-Cologne Water Quality Control Act using waste discharge requirements. LLNL's storm-water programs must also comply with DOE orders as specified in Contract DE-AC52-07NA27344. LLNL implements the storm-water programs through procedures and Storm Water Pollution Prevention Plans (SWPPP).

In December 2007, Congress enacted EISA, which established storm-water runoff requirements for development and redevelopment projects. Section 438 of this act requires all projects at federal facilities adding more than 5,000 square feet of new development or redevelopment to restore the predevelopment hydrology to the maximum extent feasible. LLNL has begun to use site planning, design, construction, and maintenance strategies to maintain or restore—to the maximum extent technically feasible—the predevelopment hydrology of the property with regard to the temperature, rate, volume, and duration of flow. This ensures that no adverse impacts to the site hydrology occur as a result of construction activities. In December 2009, the U.S. EPA published the "Technical Guidance on Implementing the Storm Water

Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act” (EPA Guidance), which provides recommendations for implementing low-impact development strategies for runoff control.

In addition, the state-wide Storm Water General Permit for Construction Activities 2009-0009-DWQ (Construction General Permit) was reissued by the State of California in July 2010. This permit revision added additional water balance and runoff requirements for construction designs at sites of one acre or more to protect storm-water quality. Construction SWPPPs are prepared for each individual project and specify all best management practices required by the Construction General Permit.

Storm-Water Management Performance Status

New construction at LLNL will include storm-water controls consistent with EISA 438 and EPA Guidance—to the maximum extent technically feasible.

Storm-Water Management Planned Actions

LLNL continues to identify other water-conservation activities including additional rainwater-harvesting projects. Consistent with EISA 438 and low-impact development, LLNL is including water-balance considerations into designs for the East Campus Site Improvement project and Applied Materials and Engineering campus. These projects will include many low-impact development designs to meet or exceed a 95th percentile storm—consistent with the EPA guidance.

The State Water Quality Control Board issued a new Storm Water Industrial General Permit (IGP) (2014-0057-DWQ) that took effect July 1, 2015. LLNL modified the storm water monitoring plan for both sites to achieve compliance with this new permit. Storm water monitoring at both sites also follows the requirements in the U.S. DOE handbook Environmental Radiological Effluent Monitoring and Environmental Surveillance (U.S. DOE 2015) and meets the applicable requirements of DOE Order 458.1.

Storm-Water Management Resources Required

As LLNL develops and redevelops areas of the site, storm-water runoff management will be integrated into the planning process. This may incur a 15-30% increase in landscape and runoff management costs. As significant construction or renovation is scheduled for FY 2019, the additional resources required will be identified during the design phase.

SSP Category 3: Waste Management

3.1. (Includes 3.1 and 3.2) Divert at least 50% of non-hazardous solid waste, excluding construction and demolition debris and Divert at least 50% of construction and demolition materials and debris

LLNL’s waste reduction and pollution prevention (P2) efforts have been guided by federal executive orders (EO), and are firmly entrenched in many of its management practices. Many of the goals have been in place at LLNL and have been exceeded. P2 is a key component of LLNL’s EMS, which includes training for all employees. DOE’s SSP waste reduction goals and a summary of LLNL’s status and plans are listed below.

Goal: Divert at least 50% of routine non-hazardous solid waste from landfill by the end of FY 2018.

LLNL status: LLNL consistently meets or exceeds this goal. In FY 2018, LLNL diverted 75%.

Goal: Divert at least 50% of construction and demolition materials and debris by the end of FY 2018.

LLNL status: LLNL consistently meets or exceeds this goal. In FY 2017, LLNL diverted 66%.

Performance Status

Paper Use

LLNL continues to focus on reducing printing paper and to purchase uncoated paper containing at least 30% post-consumer fiber. Figure 19 highlights LLNL’s progress in reducing paper usage. The Laboratory is identifying opportunities to go paperless wherever possible.

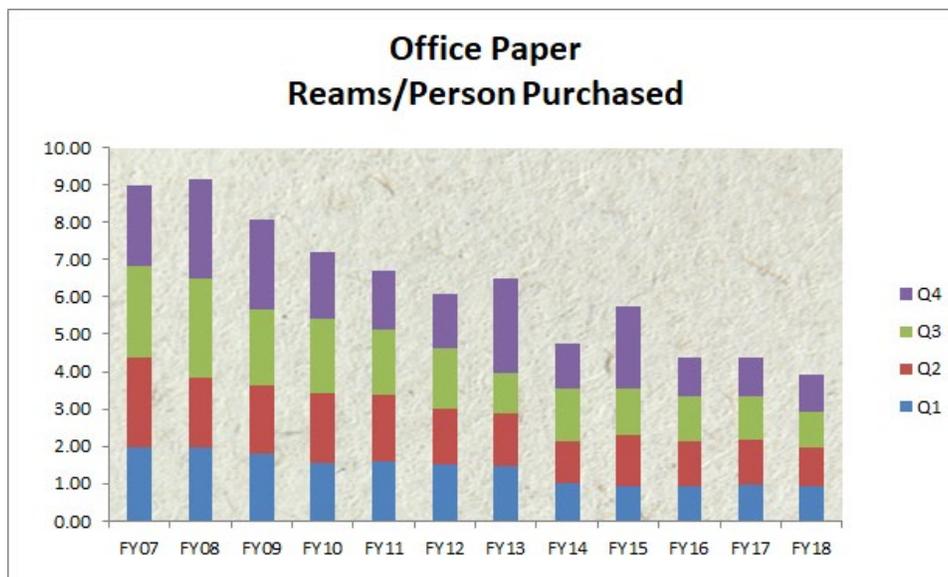


Figure 19. LLNL progress in reducing white office-paper usage.

Waste Minimization and Recycling

LLNL regularly exceeds the EO 13693 goal that specifies that federal agencies divert at least 50% of routine non-hazardous solid waste—including food and compostable material but not construction and demolition debris. LLNL continues its mixed recycling and composting program in thirteen buildings (housing about 30% of LLNL’s population) and in both onsite cafeterias. During FY 2018, 68 metric tons of compostable waste and 45 metric tons of mixed recycling were collected under this program.

Waste collection areas in both LLNL onsite cafeterias have designated waste-collection areas with detailed graphics, signs, and bins to encourage better separation of recyclable, compostable, and trash items. To make separation easier for employees and decrease the amount of waste sent to landfill, the cafeterias switched all disposable foodservice ware to compostable products in 2015.

Other accomplishments in waste management include the following:

- Raising awareness through awards, outreach, and numerous Laboratory events
- Encouraging reducing consumption and reusing items when feasible
- Performing reuse and recycling opportunity assessments in specific areas
- Promoting green meetings and events

Although the employee population and construction activities are expected to increase in FY 2019, the robust waste minimization and recycling programs in place will ensure that the Lab continues to meet waste diversion goals.

Toxic Chemical Reduction

Using a priority-based approach, LLNL addressed the chemical usage-reduction requirements of EO 13514 that focused on toxic, hazardous, and GHG-contributing chemical emissions. Twenty-seven chemicals were selected as “priority” chemicals in 2008 and continue to be tracked and reported regularly (Figure 20).

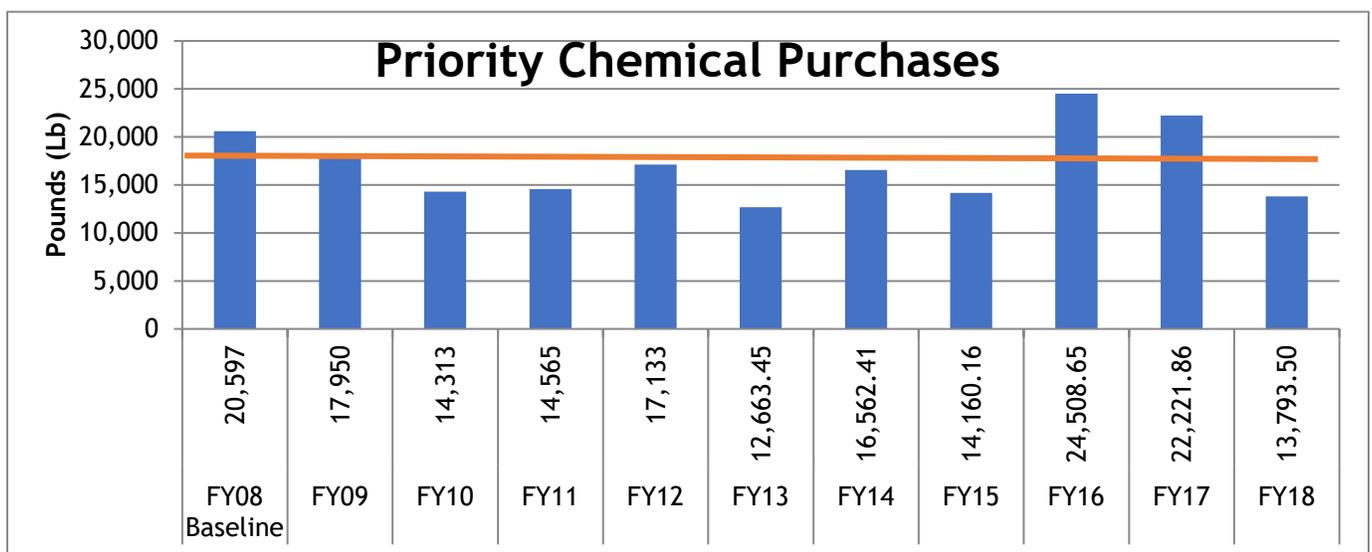


Figure 20. Priority chemical purchases.

Plans and Projected Performance

LLNL plans to continue to reduce pollution and increase recycling during FY 2019 by focusing on the following actions:

- Implementing a municipal waste reduction strategy under the EMS program to collect recyclable and compostable materials across selected buildings
- Raising awareness through awards, outreach, and Laboratory events
- Continuing to reduce high-risk chemical inventory for chemicals that do not have a foreseeable mission use
- Improving coordination of tracking efforts for construction and demolition debris between P MEC and ES&H to more accurately report recycling of these materials

Resources Required

Normal business processes are in place for LLNL to meet this goal.

SSP Category 4: Fleet Management

4.1. 30% reduction in fleet-wide, per-mile greenhouse-gas emissions by FY 2025 from FY 2014 baseline (2018 target: 4%)

Performance Status

Executive Order 13693 was issued in March 2015. DOE Federal Energy Management Program guidance related to GHG emissions calculations is pending. In FY 2018, LLNL contributed towards the NNSA/DOE by achieving an overall 30% reduction in fleet-wide, per-mile GHG emissions reduction. The final percentage contributed towards this goal will be calculated in the dashboard in November when the LLNL usage data is inputted from FAST. LLNL is evaluating the best alternatives to impact GHG emissions from vehicles (i.e., E85, hybrid, electric, etc.).

Plans and Projected Performance

LLNL will continue to rely on E85 fuel, and has incorporated an additional 20 electric vehicles into its fleet—now totaling 30—as part of the 2018 target. In addition, LLNL will seek alternate procurement channels where practical and required to support target achievement. The Laboratory is dependent on sources such as CAFÉ standards and the OEMs that are outside of our sphere of influence, which results in insufficient information to fully assess the projected performance at this time.

Government-Owned Electric Vehicle Program

Building on the commitment established with the DOE in 2015, LLNL agreed to accept an additional 20 electric vehicles into its fleet and has returned 20 vehicles that used fossil fuel. In its second year, LLNL now has 30 fully electric vehicles in its fleet.

On October 23, 2017, a special ceremony (Photo 2 through Photo 4) was held at LLNL to highlight the accomplishments of the electric vehicle (EV) program. In attendance were representatives from the DOE vehicle program, ChargePoint, Envision Solar, senior LLNL management, Sandia Livermore, Lawrence Berkeley Lab, and the City of Livermore mayor's office.



Photo 2. LLNL Deputy Director Tom Gioconda at the EV ceremony.



Photo 3. Ribbon-cutting of the Envision Solar Arc at LLNL.

LLNL continues to work toward building a larger charging infrastructure onsite to support the growing number of both government-owned and personally-owned electric vehicles. In fact, LLNL's infrastructure in FY18 has grown from 39 to 41 Level I chargers, and from four to 16 Level II chargers.



Photo 4. A fully electric Ford Focus at LLNL.

In FY 2018, the LLNL EV committee continued to strategically develop its EV program and was supported by the DOE ordering 20 additional EVs for use at LLNL. One focus area for LLNL was to expand on the initial construction of the Level II charging lot at Building 611. LLNL continued its relationship with ChargePoint Inc., procuring four additional Level II stations to bring the total number of Level II charging space up from two to nine.

Based on the success of Level II solar charging provided by the Envision Solar International charging platforms, LLNL placed an order for two additional units. LLNL also upgraded one of their existing units to increase solar charging capacity onsite from two spaces to seven. Each of these solar units were also equipped with ChargePoint terminals to manage and monitor usage.



Photo 5. Envision Solar Arcs in full use at LLNL.

By mid FY18, fleet management received and deployed the 20 EVs into the programs. Programs were contacted to schedule vehicle exchanges and training sessions. This deployment allowed for 20 petroleum-fueled sedans to be replaced by EVs. (It should also be noted that LLNL will continue with its primary E85 alternative fuel and electric vehicle strategy.) Additionally, LLNL will seek alternate procurement channels where practical and required to support achievement of the target. Lastly, on August 24th, LLNL was presented with the 2018 Department of Energy Sustainability Award for its innovative approach to sustainability with regard to EVs. LLNL was proactive in reducing emissions and meeting sustainability goals. In implementing the EV program at LLNL, innovative methods and cutting-edge technologies were used—and are transferable to other DOE facilities. This project strengthened the relationship between the DOE and the Lab.



Photo 6. 2018 Sustainability Award winning team.

4.2. 20% reduction in annual petroleum consumption by FY 2015 relative to a FY 2005 baseline; maintain 20% reduction thereafter (2018 target: 20%)

Performance Status

In FY 2018, LLNL decreased its petroleum fuel consumption by 71.46% relative to the FY 2005 baseline. This decrease was a direct result of more vehicles being assigned to LLNL's Site 300 in Tracy, California. LLNL will continue to replace petroleum-use vehicles with AF and EVs at its main site in Livermore. The Laboratory will also continue to promote the reduction of petroleum fuel by acquiring more electric vehicles and by advertising and leveraging taxi services. However, it should be noted that the fueling station at Site 300 does not have E85 fuel, and therefore must use regular unleaded fuel. Figure 21 shows the decrease of the overall petroleum consumption.

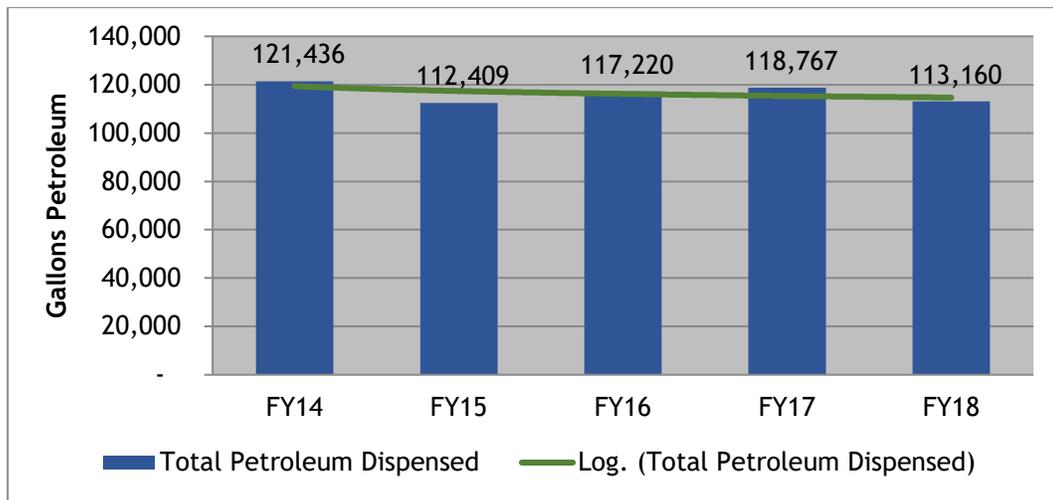


Figure 21. LLNL petroleum consumption reduction.

Plans and Projected Performance

LLNL will continue to strengthen its AF infrastructure by replacing conventional fueled vehicles with AFVs and by promoting the use of AFs.

4.3. 10% increase in annual alternative fuel consumption by FY 2015 relative to a FY 2005 baseline; maintain 10% increase thereafter. (2018 target: 10%)

Performance Status

LLNL continues to focus its AF strategy primarily with the use of ethanol fuel (E85) as its fuel of choice. In 2007, LLNL built an ethanol fuel station with a 12,000-gallon underground tank at a cost of \$1.3 million. Subsequently, LLNL restructured its fleet strategy to be composed of E85-compatible vehicles. In FY 2018, LLNL’s use of AF increased 13% relative to the previous year’s consumption. This increase was due in large part to CARB compliance standards for the state of California. For example, E85 Ford Transits could not be offered in California. The overall increase compared to the FY 2005 baseline is 439%. As shown in Figure 22, LLNL has entered the maturity stage on AF consumption and year-over-year increases are anticipated to level off. In FY 2018, LLNL received an additional 20 EVs (sedans) and is supporting these vehicles with enhanced charging infrastructure. LLNL anticipates receiving more EVs in subsequent years. Further infrastructure development will bring an increase in additional EVs.

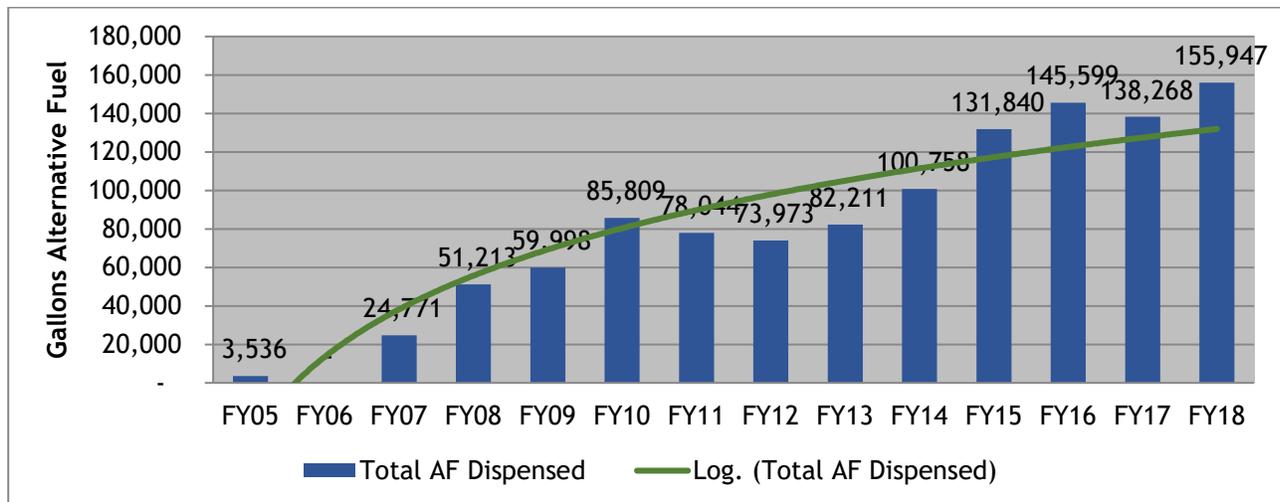


Figure 22. Total alternative fuel dispensed.

Plans and Projected Performance

LLNL plans to increase its overall EV fleet to greater than 50 vehicles in a few years.

4.4. 75% of light-duty vehicle acquisitions must consist of alternative fuel vehicles (AFV). (2018 target: 75%)

Performance Status

In FY 2018, LLNL met the required 75% replacement of fossil-fuel, light-duty vehicles with AFVs. LLNL replaced 76% of the light-duty vehicles scheduled for exchange with AFVs. LLNL's current AF fleet accounts for 82% of its total light-duty vehicles.

Plans and Projected Performance

LLNL will continue replacing its fleet with AFVs as manufacturers make them CARB-compliant for the state of California, and as they become available. LLNL will also explore different AFV options. LLNL replaced 20 petroleum-fueled sedans with EVs. The Laboratory also plans to increase its overall EV fleet as the EV infrastructure develops. In the meantime, LLNL will continue with its primary E85 alternative fuel vehicle fleet strategy.

In accordance with EO 13693, the Laboratory launched a personal vehicle charging program in FY 2014. The program is designed to allow employees to charge their personal vehicles using existing Livermore site-designated charging locations for a monthly fee. Employees who choose to participate in the program are asked to sign an end-user agreement that provides details and terms of the program requirements. End-users pay a monthly fee that provides them with access to charging stations. Initially, LLNL had 37 charging stations available under the program. In FY 2018, LLNL added four Level I electric charging station to the program (totaling 41). LLNL also added four Level II electric charging station (with seven charging receptacles), and two enhanced Level II solar units. The enhanced units would be equipped with two charging receptacles, and each would be equipped with a ChargePoint data unit (for data collection). One existing unit was retrofitted by adding an additional charging receptacle—and ChargePoint data unit—bringing its total to 16 charging stations. All charging station are based on a first-come, first-served basis. Currently, there are approximately 70-plus employees enrolled in the program—and more are being added, which is an increase of 20 plus from the total in FY 2017. This program is in response to employee requests and in support of NNSA/DOE and the Lab's site sustainability efforts.

DOE Fleet Management Information System

Plans and Projected Performance

NNSA HQ-fleet will submit one NNSA fleet management plan that incorporates each site's accomplishment. LLNL will report status on the goals to the collective NNSA/DOE fleet goal.

LLNL has reviewed the current reporting requirements for the implementation of the DOE Federal Fleet Management Information System (FedFMS) as it relates to DOE-owned vehicles. Metadata for each DOE-owned vehicle will be validated and updated. Monthly summaries of fuel costs and mileage will be entered beginning in November—with October data. A unique fuel card has been issued to each vehicle to facilitate proper accounting. Odometer readings are collected using field transaction data gathered during fueling and vehicle representative data collection.

4.5. 50% of passenger vehicle acquisitions consist of zero-emission or plug-in hybrid electric vehicles by FY 2025. (2018 target: 4%)

Performance Status

LLNL is evaluating the best alternatives to impact GHG emissions from vehicles. Alternatives may include alternate vehicle procurement channels.

Plans and Projected Performance

In FY 2018, LLNL evaluated the charging infrastructure required to support an EV fleet that meets the 2025 goal. LLNL replaced 20 petroleum-fueled sedans with 20 EVs, and plans to increase its overall EV fleet—as infrastructure development allows. In the meantime, LLNL added four Level II electric charging units with seven receptacles. LLNL added four Level I electric charging stations to the program—totaling 43. LLNL also added four Level II electric charging station with seven charging receptacles, and two enhanced Level II solar units. The enhanced units are equipped with 2 charging receptacles and a ChargePoint data unit for data collection. One existing unit was retrofitted by adding an additional charging receptacle—and ChargePoint data unit—bringing its total to 16 charging stations. LLNL will continue with its primary E85 alternative fuel and EV strategy. The Laboratory will also seek alternate procurement channels where practical and required to support achievement of the target. LLNL is dependent on sources such as CAFÉ standards and the OEMs, which are outside of our sphere of influence resulting in insufficient information to fully assess the projected performance at this time.

SSP Category 5: Clean and Renewable Energy

5.1. “Clean Energy” requires that the percentage of an agency’s total electric and thermal energy accounted for by renewable and alternative energy shall be not less than: 10% in FY2018, working towards 25% by FY 2025

Performance Status

LLNL’s energy consumption comes from electricity and natural gas. The “Clean Energy” goal was met by the purchase of RECs in addition to the 73% allotment from the 3.3MW PSEG Lawrence Livermore Solar Center (see Photo 7).

Plans and Projected Performance

LLNL will continue with the purchase of RECs in addition to the use of the renewable electrical energy output of the P-V solar facility.



Photo 7. 3.3 MW P-V solar plant at LLNL.

The P-V solar plant located at the northwest buffer zone started commercial operations in February 2016. This renewable energy plant generated a total of 6,341 MWh in FY 2018. LLNL’s share of this renewable energy was 5,018 MWh. That is the equivalent energy used by 1.65 million homes for one hour or GHG emissions of about 745 vehicles for a year. It is anticipated that this renewable energy plant will produce about 6M kWh annually and contribute to the renewable energy goal for DOE.

5.2. “Renewable Electric Energy” requires that renewable electric energy account for not less than 10% of a total agency electric consumption in FY18, working towards 30% of total agency electric consumption by FY 2025

Performance Status

Due to the low cost of purchased power, installing renewable energy at LLNL has been a challenge. LLNL is a member of the Northern California Sites Electric Power Consortium (the Consortium). The Consortium includes LLNL, Lawrence Berkeley National Laboratory (LBNL), and Stanford Linear Accelerator Center (SLAC). The Consortium currently uses two sources of power to meet its annual energy requirements: the Central Valley Project (CVP) base resource allocation of hydropower, and wholesale market power

purchases. WAPA is the Consortium's procurement agent and makes any required wholesale purchases on the Consortium's behalf.

The wholesale power rates are considerably less expensive when compared to local public utilities such as PG&E. These low rates have also made renewable energy development incur a longer ROI relative to projects with standard utility rates. The 7.5% renewable energy consumption requirement was exceeded at 20% through the purchase of RECs and renewable electric energy in FY 2018. LLNL purchased 789 MWh of RECs, 88,512 MWh of renewable electric energy from incremental hydropower, plus 5,018 MWh of renewable electric energy from the onsite solar plant.

LLNL has deployed solar energy at a smaller scale—including several pathway and parking lot lights—and environmental sensors. In FY 2012, LLNL discussed renewable energy options—including fuel cell purchases—with renewable energy providers, yet the relatively high cost of these projects prohibited their actualization.

Details of the REC purchases can be found in the dashboard under Renewables.

Plans and Projected Performance

For FY 2019, LLNL will purchase RECs to comply with the renewable energy requirement. The amount of RECs purchased can decrease substantially due to the contribution of the P-V solar plant at LLNL. LLNL will continue to explore research opportunities for renewable power generation at Site 300. If these projects come to fruition, then LLNL will use that power as well. Additionally, the Site 200 renewable energy goals would contribute to DOE's goals.

Even with a 3.3 MW P-V array, LLNL will still need to purchase additional RECs—renewable energy projects are capital-intensive. In general terms, a 6 MW solar array would be required to meet the renewable energy goals for LLNL—this would require a multi-million dollar investment. A 6 MW solar array would also greatly contribute to LLNL's energy reduction goals. The high cost of onsite renewable power indicates an ROI that would exceed the projected 20-year useful life of the equipment. When compared to WAPA rates, renewable energy only becomes economically feasible when the producer is a private entity eligible for tax credits, tax exemptions, depreciation, and other assorted incentives.

For the next fiscal year, LLNL will accomplish the following:

- Continue exploring scientific opportunities in renewable energy
- Continue discussions with renewable energy providers on innovative opportunities in renewable energy for LLNL
- Continue collaboration in the Northern California DOE Laboratory Consortium

SSP Category 6: Green Buildings

6.1. At least 15% (by building count or gross square feet) of existing buildings greater than 5,000 gross square feet (GSF) to be compliant with the revised Guiding Principles for HPSB by FY 2025, with progress to 100% thereafter

Performance Status

Four LEED building certifications (B142, B264, B451, and B453) were completed in 2008-2011 and six initial building assessments using the DOE HPSB assessment tool were completed in 2011-2012 (see Figure 23).

Building Name	GSF	Notes
B142	20,306	LEED Certified
B264	20,461	LEED Certified
B276	8,487	CalGreen Compliant
B451	51,398	LEED Certified
B453	240,598	LEED Certified
B655	13,277	In LEED process
T1878	6,292	HPSB Assessed
T1888	11,520	HPSB Assessed
T1889	16,821	HPSB Assessed
T4727	9,891	HPSB Assessed
T4729	10,018	HPSB Assessed
T5627	8,470	HPSB Assessed
Total	417,539	

Figure 23. List of compliant HPSB buildings.

The current number of occupied buildings over 5,000 square feet in the enduring inventory is 168 with a total square footage of 6,433,655—15% of which is 25 buildings with a total square footage of 965,048. As of FY 2018, 12 buildings had been assessed using the LEED system, HPSB, or are CalGreen compliant—with a total square footage of 417,539. An additional 13 assessments based on building count and an additional 547,509 square feet based on square footage need to be assessed to achieve the 15% goal.

Plans and Projected Performance

Two new buildings in the Applied Materials and Engineering (AME) complex—the Polymers Capability Facility (Building 223) and the AME office building (Building 224)—will be constructed in the next two years with the goal of achieving LEED certification. A third building in the AME complex—the Joining Capabilities and Vapor Disposition Facility (Building 225)—will follow immediately after the construction of B223 and B224, and will also be built to attain LEED certification. These three buildings will contribute approximately 60,000 square feet to the assessed and/or certified totals, bringing the total to 477,539 sf.

Resources Required

The overall scope of this project is anticipated to require a multi-year effort, and scheduling of upcoming projects is based primarily on staff availability. While there is no dedicated HPSB staff at this time, new construction projects that are currently in both planning and design phases are designed and constructed with LEED certification and HPSB compliance in mind. Funding needed to complete the long-range tasks will be requested in future fiscal years.

SSP Category 7: Acquisitions and Procurement

7.1. Promote sustainable acquisition and procurement to the maximum extent practicable, ensuring biopreferred and biobased provisions and clauses are included in 95% of applicable contracts

According to LLNL policy, LLNL shall ensure 95% of new contract actions—including task orders under new contracts and existing contracts—require to the extent possible, the supply or use of products and services that are energy-efficient (ENERGY STAR or Federal Energy Management Program [FEMP]-designated), water-efficient, bio-based environmentally preferable (including Electronic Product Environmental Assessment Tool [EPEAT]-registered products), non-ozone depleting, contain recycled content, or are non-toxic or less toxic alternatives. LLNL shall update affirmative procurement plans—also known as green purchasing plans or environmentally preferable purchasing plans—policies, and programs to ensure that all federally mandated designated products and services are included in all relevant acquisitions.

Performance Status

LLNL has an Affirmative Procurement Program (APP) that ensures environmentally preferable products and services, recycled-content products, and bio-based products are purchased to the maximum extent practicable and are consistent with federal law and related procurement requirements. Sustainable acquisition or Environmental Affirmative Procurement Program (EPP) clauses requiring subcontractors to use environmentally preferable products/services and recovered or recycled content have been incorporated into all LLNL general provisions (GP) for purchase orders and subcontracts. As a result, LLNL is 100% compliant with the requirement to include sustainable acquisition clauses in eligible contract actions.

LLNL continues to implement Procurement Standard Practice 23.5, *Environmental Affirmative Procurement and Waste Reduction Requirements*. This standard practice describes the requirements for acquiring environmentally preferable products and services, products with recycled content, and bio-based products, to promote cost-effective waste reduction in Laboratory subcontracts. It is reviewed periodically by the environmental functional area (EFA) in order to ensure all regulatory revisions, updates, and changes have been incorporated. The standard practice was last updated on March 3, 2017.

Sustainable Acquisition Highlights

- EPEAT: 85 % of all computers, monitors, imaging equipment, and televisions purchased during FY 2018 successfully met the EPEAT criteria.
- All mobile phones purchased during FY18 were 100% gold EPEAT.
- LLNL continues to manage sustainable integrated contractor purchasing team (ICPT) agreements with Fisher Scientific, Grainger Industrial Supply, and VWR International Scientific Products. These agreements offer special promotional pricing discounts off of GSA pricing.
- Blanket agreements with Holman's and Technology Integration Group have requirements to include EPEAT ratings by product on their electronic ordering system and to provide quarterly EPEAT reports.
- LLNL continues to award subcontracts to suppliers who offer DOT-critical carbon steel drums made out of 15% recycled content material. During FY 2018, 10 purchase orders were awarded to Skolnik Industries totaling \$175,151.
- One subcontract totaling \$28,140 was awarded to Stockton Tri-Industries, Inc. to manufacture metal waste boxes containing 22% recycled content material.
- LLNL computer subcontractors maintain an EPEAT-rated description field on their websites.
- LLNL's supply chain management (SCM) department continues to require the major suppliers of desktops, laptops, computer monitors, imaging equipment, and televisions to issue EPEAT reports on a quarterly basis directly to the sustainability performance program manager and the contract analyst. Receiving detailed reports more frequently throughout the fiscal year assists the EFA in analyzing and projecting the total EPEAT buys for the year.

- The Office City manages a punch-out list that identifies recycled content items offered to its customers. The catalog allows LLNL's technical release representatives (TRR) to see and search for recycled products.
- The current Blanket Agreement with Perfect Output (H100477) for the purchase of multi-function devices (copiers/printers) has a requirement to produce and submit reports detailing their progress in reducing energy consumption, solid waste, and GHG emissions over the life of the subcontract. This agreement has quarterly EPEAT reporting requirements in the statement of work and they are encouraged to promote EPEAT-qualified equipment in their quotes.
- The controlled items/services list (CISL) identifies the items and services requiring guidance, notification, or approval from a specific LLNL organization prior to their acquisition by a TRR. It lists the types of approvals that are required to be obtained from an EFA subject matter expert when the purchase of non-EPEAT-rated desktops, notebook workstations, computer monitors, imaging equipment, or televisions are requested on a requisition.

Plans and Projected Performance

LLNL will continue to support the purchase of environmentally preferable products and services, recycled content products, and bio-based products—to the maximum extent practicable—by ensuring the clauses identified in the GPs are included in all purchase orders and subcontracts.

LLNL will also continue to revise Standard Practice 23.5 as required and have each revision reviewed by an appropriate member of the LLNS EFA. This will ensure all regulatory revisions, updates, and changes have been incorporated and that the standard practice is in compliance with LLNL's prime contract requirements.

Resources Required

Business processes are in place for LLNL to meet this goal. Resources from the SCM department are required to ensure green-related clauses/articles are incorporated into purchase order and subcontract pro-forma documents and to update standard practices, as required.

SSP Category 8: Measures, Funding, and Training

8.1. Annual targets for performance contracting to be implemented in FY 2017 and annually thereafter as part of the planning of section 14 of E.O. 13693

LLNL has engaged in energy performance contracts—most recently an ESPC—wherein new HVAC controls and WebCTRL software were installed in 24 facilities as part of ECM3.1, and 79 advanced electric meters and energy management software (EEM Suite) was installed as part of ECM3.2.

As stated in the energy management category, DDC HVAC controls were added to or expanded in about 17 additional buildings to control temperatures, pressures, and humidity. Each system uses constant monitoring and remote alarming to alert building and maintenance staff of malfunctions so that they can be repaired in time to minimize discomfort and energy usage. In reviewing the building energy usage, a 4% reduction in electricity consumption was realized when comparing the usage to before the controllers were added.

The 3.3 MW P-V solar plant project on 10 acres in the northwest buffer zone started generating renewable electricity in February 2016. This is a power purchase agreement (PPA) between PSEG Solar and WAPA. LLNL uses most of the produced renewable power with LBNL using 20% and SNL/CA using 7%. The plant is estimated to generate about 6M kWh of renewable electricity for LLNL annually, and removes the equivalent GHG emissions of about 890 automobiles a year.

Challenges to Use of Energy Performance Contracts

LLNL's low cost of power and water has traditionally been an obstacle to justifying the payback on projects. This hurdle is expected to continue. Small investments upfront can buydown the project, and lifecycle cost analysis can assist with improving the project's payback and will be applied as appropriate.

SSP Category 9: Travel and Commute Category

9.1. 25% Scope 3 GHG reduction by FY 2025 from FY 2008 baseline

The Laboratory maintains an active alternate work schedule (AWS), allowing most employees to opt in to a 9/80 or 4/10 work schedule. Approximately 3,247 employees—roughly 50% of the workforce—have elected an AWS that reduces their commute by 10% (9/80s) or 20% (4/10s).

Bay Area Air Quality Management District (BAAQMD) Regulation 14, Rule 1 was adopted in March 2014. Regulation 14 addresses mobile source emissions reduction measures, and Rule 1 implements the Bay Area Commuter Benefits Program. Employers having over 50 employees—such as LLNL—are required to offer at least one of three commuter benefit options to all covered employees. LLNL had previously already established a pre-tax option program—allowing employees to pay for transit passes or vanpool charges from pre-tax wages. This existing LLNL program meets Option 1 of the Commuter Benefit Options requirement.

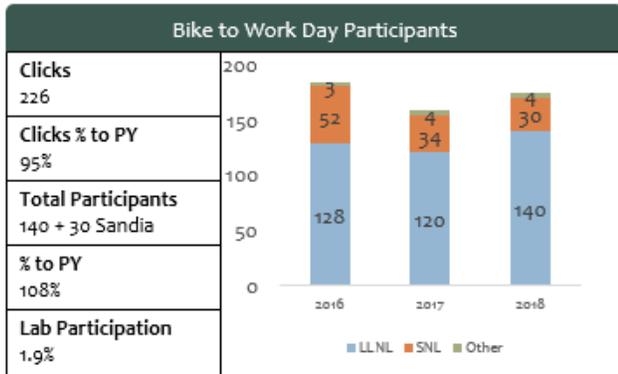
GHG emission estimates due to LLNL employee commuting were computed using the most recently available annual U.S. DOT transportation statistics for California (Table 4-1 - Commuting to Work: 2013). This table is used to apportion the LLNL employee population by commuting category. Note that the “Worked at home” category is merged with the “Car, truck or van drove alone” category to more closely reflect the LLNL employee population.

Many webinars and other online conferencing options are increasingly available and can be used in lieu of business travel. LLNL’s information and communications services organization provides a WebEx Meeting Center for audio-visual communications with other locations, as well as support for audio and video conferencing—including voice over IP (VoIP). A travel-authorization process ensures that employee business travel is necessary and appropriate. Opting for teleconferencing and webinars instead of travel has had the additional incentive of reduced business costs over traditional travel.

These efforts have helped LLNL reduce its GHG emissions due to air and ground travel by 3.3% from baseline 2008 levels but has increased 6.9% from FY 2017 due to increased business activity. LLNL’s FY 2018 GHG emissions due to employees commuting are 17% less than baseline 2008 levels. However, these emissions have increased 6.4% from FY 2017 levels due to a larger workforce in FY 2018. LLNL’s travel- (air and ground) and commute-related GHG emissions for FY 2018 are shown in Figure 12.

In May, LLNL, SNL/CA, and LLESA—a non-profit employee services group that supports both sites—hosted a joint Bike to Work and Share Your Ride event for the fourth consecutive year. This event is held in conjunction with other cities in the San Francisco Bay Area, and helps both sites promote alternative commute options for employees. On the morning of Bike to Work Day, LLESA and volunteers from LLNL and SNL/CA set up an energizer station where cyclists check in and enjoy refreshments. This station is included in the overall San Francisco Bay Area Bike to Work Day outreach and was one of 142 stations supported in the region this year. It is in an open area where it serves local Livermore residents as well. Local agencies were invited to provide local transportation information at the energizer station. The energizer station also provides an opportunity to gather data on the number of employees who commute by bike or ride share. Since 2016, data has been collected to track participation statistics. These data help LLNL and SNL/CA calculate Scope 3 GHG reductions realized through employee alternative commuting and to better direct outreach on available alternative commute options.

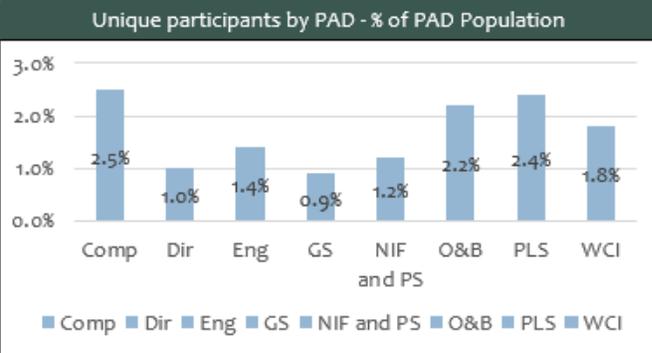
Bike to Work Day



Attendee Details

	Bike to Work Day	Share Your Ride
Total Participants	174	7
# of Pledges	100	17
Pledges who checked-in	67 (67%)	5 (29%)
# of First Time Riders	22	0
Average Round Trip Mileage per person	10.8	109
Total Round Trip Mileage saved	1838	2798
Average # of Bike Commuting Days per Month	13.1	N/A

	Total Participants	Repeat B2WD Participants
Comp	31	10 (32%)
Director Group	9	4 (44%)
Engineering	26	8 (31%)
Global Security	2	0 (0%)
NIF and PS	4	1 (25%)
O&B	26	9 (35%)
PLS	25	8 (32%)
WCI	7	4 (57%)
Other	10	2 (20%)
Sandia	30	11 (36%)
Non-Lab	4	
Totals	174	57 (32%)



SSP Category 10: Fugitives and Refrigerants

10.1. 50% Scope 1 & 2 GHG reduction by FY 2025 from FY 2008 baseline

The LLNL SF₆ Management and Capture Plan (LLNL-AR-483031-REV-1) documents ongoing SF₆ use, describes current and future efforts to minimize emissions to the extent practical, and provides the basic framework for how LLNL plans and manages SF₆ operations with reduction goals in mind.

Since 2010, LLNL has significantly raised the awareness on environmental issues with the continued use of SF₆. As a result, FY 2018 SF₆ emissions have been reduced nearly 60% from baseline 2008 SF₆ emissions and 30% from FY 2017 SF₆ emissions. Plans to replace an old SF₆ compressor in the Building 801 FXR flash x-ray system should lead to future SF₆ emission reductions.

LLNL technicians who maintain, service repair, and dispose of equipment containing refrigerants are certified as required by EPA regulations found in Code of Federal Regulation Title 40, Part 82, Subpart F. The purpose of these regulations is to reduce refrigerant emissions. The regulation was amended in November 2016 and placed greater emphasis on leak inspection, repair, and recordkeeping beginning January 1, 2019, which should help to further reduce refrigerant emissions. Refrigerants and other fugitives—especially SF₆ emissions—contributed approximately 12.3% of LLNL's Scope 1 and Scope 2 total GHG emissions in FY 2018.

SSP Category 11: Electronic Stewardship Category

11.1. 95% of eligible acquisitions each year are EPEAT-registered products

Performance Status

Each fiscal year, LLNL is tasked with meeting the goal that 95% of all eligible acquisitions be EPEAT-registered products. To monitor success against this goal, LLNL's SCM department requires the major suppliers of desktops, laptops, computer monitors, imaging equipment, and televisions to issue EPEAT reports on a quarterly basis directly to the EFA representative and the contract analyst. Receipt of these detailed reports assists EFA in analyzing and projecting the total EPEAT buys throughout the fiscal year.

During FY 2018, the overall percentage of EPEAT desktop electronics, imaging equipment, and television buys totaled 85% for the year as identified in the chart below (Table 4). The primary reason why LLNL did not meet this goal is due to continued purchase of non-EPEAT-rated monitors (i.e., 32 and 34-inch curved Dell). However, these monitors are being used to replace dual-monitor setups throughout the Laboratory as they greatly reduce power consumption when in use and make it easier for the user to navigate across multiple applications. These monitors also have ergonomic benefits as they reduce neck strain by keeping the neck in one position without requiring the user to rotate their neck from one side to the other while looking at the monitor. For these reasons—and the fact that there are no similar-sized EPEAT monitors available—LLNL has completed an exemption justification to continue to procure the Dell 32-inch monitor.

Despite not meeting the overall EPEAT goal, LLNL did make several improvements in other categories including 96% EPEAT purchases for imaging equipment—an increase from 1% to 15% EPEAT television purchases—and 100% gold EPEAT mobile phone purchases.

Table 4. FY 2018 EPEAT totals.

EPEAT Total FY18			
Category	EPEAT	Non-EPEAT	Percentage EPEAT
Desktop electronics	6923	1246	85%
Imaging equipment	505	23	96%
Televisions	14	82	15%
Mobile Phones	327	0	100%
Overall for all three categories	7769	1351	85%

The overall percentage of EPEAT desktop electronics, imaging equipment, television, and mobile phone buys for the year.

Plans and Projected Performance

LLNL will continue to review requisitions to see where EPEAT-related products can be substituted for non-EPEAT requirements. LLNL will also continue to mandate that blanket agreement suppliers Holman's, The Office City, and Perfect Output submit quarterly reports that identify all EPEAT equipment acquisitions placed under these agreements. This data will be used to monitor performance and allow LLNL to make adjustments where necessary to assist in meeting the goal.

11.2. 100% of eligible PCs, laptops, and monitors have power management enabled

Performance Status

LLNL continues to make progress in automating the electronic stewardship of its personal computing environment. Power management is actively managed on all eligible PCs, laptops, and monitors. New

standard PCs, laptops, and monitors adhere to ENERGY STAR and EPEAT gold requirements whenever possible based on cost, performance, and availability.

Plans and Projected Performance

LLNL will continue its power management on all eligible PCs, laptops, and monitors. As computers are replaced, new systems will continue to be automatically included in the power management program.

11.3. 100% of eligible computers and imaging equipment have automatic duplexing enabled

Performance Status

The statement of work for LLNL's MPS blanket agreement states that at a minimum, all multifunction devices and printers purchased under the agreement shall possess duplex printing capabilities. The MPS vendor does not install all devices; however, when they do the installation, they are directed to configure the device to default to duplex printing.

In the first quarter of FY 2018, the print management website was launched to promote MPS and provided users with helpful tips on how to print smarter and more securely. In addition, O&B started to configure all new MFDs to black and white printing default settings. In addition, LLNL's print management services had initiated a pilot study to determine the effectiveness of setting machine and driver defaults.

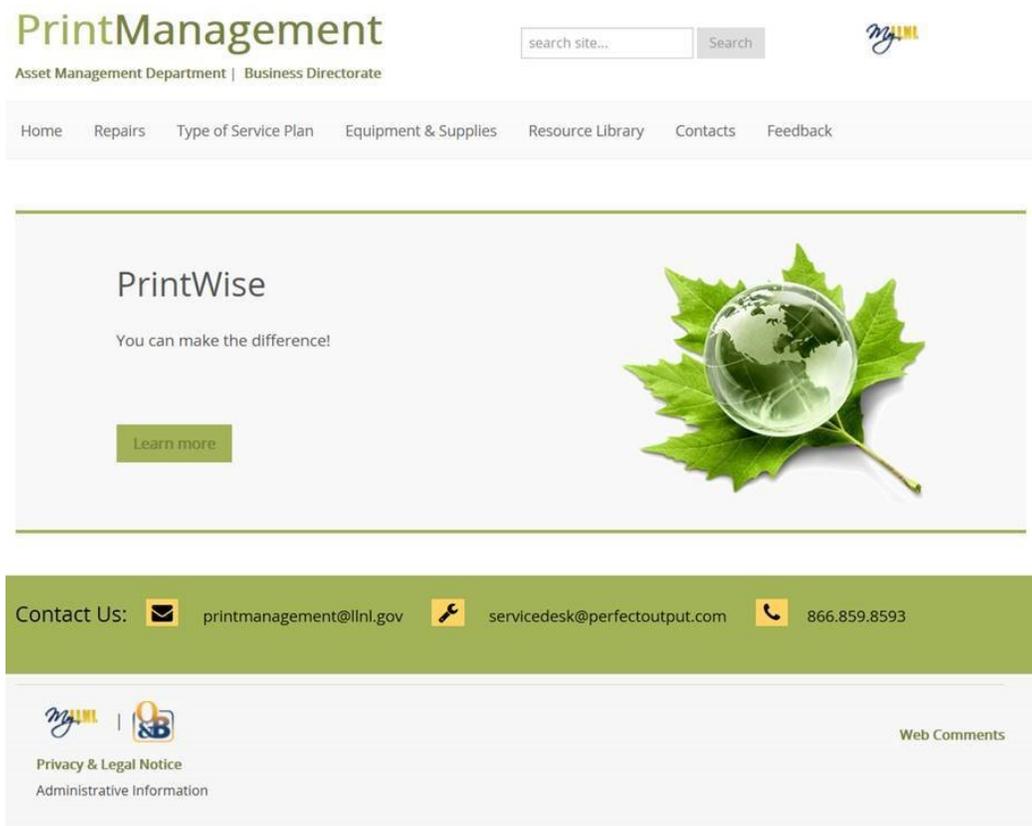


Figure 24. Screenshot from the print management website developed in FY 2018.

Plans and Projected Performance

In FY 2018, LLNL evaluated its contract with the current MPS provider and determined it was best to exercise the final option of the contract. As a result, the contract will sunset at the beginning of 2020.

11.4. 100% of used electronics are reused or recycled using environmentally sound disposition options each year

Performance Status

LLNL manages electronic assets through the donation, utilization, and sales (DUS) group within the property management division. DUS receives excess electronics and either donates, sells for reuse, or sends them to a certified recycling facility. DUS maintains a database that tracks the disposition of electronic devices sent offsite for reuse or recycling. Some electronic devices and storage media that contain sensitive information are handled by individual project areas and must first be purged of the information and then destroyed (e.g., shredded). All residual material is handled appropriately according to universal or hazardous waste regulations.

LLNL continually looks for new opportunities to reuse or recycle electronics. DUS maintains an outlet—the Second Time Around Store (STARS)—where new and used items are made available to employees free of charge for use onsite. In FY 2016, DUS moved the store to a new location and did extensive product organization and promotional outreach to increase use of the service. Outreach efforts included development of a marketing plan, an intranet article, tabletop advertisement tents in the cafes, a revised newsletter layout, distribution of posters to bulletin boards across the Lab, as well as pamphlets to the training centers, outreach at lab events, and email campaigns.

Continued promotion of STARS has shown an increase in reuse as demonstrated by the reutilization dollars estimated from the items taken from the store (Figure 25). In addition, nearly 19,000 items were exchanged through the STARS in FY 2018.

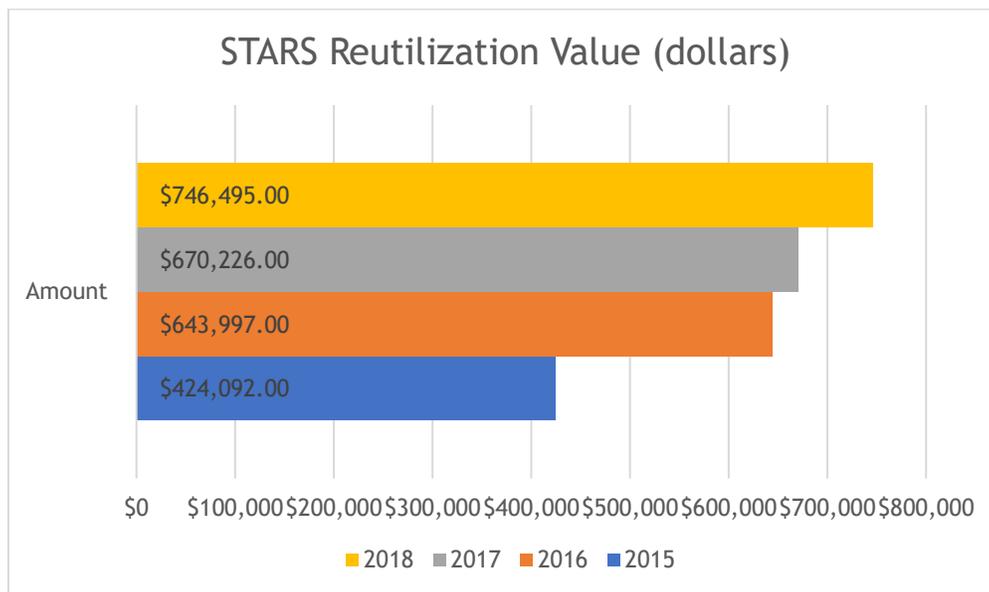


Figure 25. STARS reutilization value.

Increase in Estimated Value of Items Taken from the Second Time Around Store for reuse.

Plans and Projected Performance

LLNL will continue to track reuse and recycling of electronic devices, and encourage reuse through online mechanisms and the Lab's STARS.

11.5. Establish a power usage effectiveness target in the range of 1.2-1.4 for new data centers and less than 1.5 for existing data centers

Performance Status

DOE Data Center Optimization Initiative (DCOI)

In 2016, the DOE established a Data Center Working Group (DCWG) to review data center facilities across the complex. This working group has amended the definition of a data center for reporting purposes and established reporting metrics. LLNL has since completed a comprehensive data center inventory based on these new criteria. LLNL is currently evaluating options for the consolidation and closure of 18 existing unclassified data centers by adoption of a cloud first policy and migrating hardware to more optimized data centers within the LLNL inventory.

Plans and Projected Performance

In line with the DOE Data Center Optimization Initiative (DCOI) and the DOE DCWG, LLNL will continue to look for opportunities to evaluate reductions in the data center inventory through consolidation and closure of existing tiered and non-tiered data centers. For 2018, there are identified opportunities to consolidate and close three data centers. In addition, it is anticipated that through the DCWG, LLNL will support the migration of inter-agency, co-located data centers into the enterprise data center (EDC).

LLNL will continue to optimize the efficiency of HPC with the new Sierra and Lassen platforms. A combination of liquid-cooling and air-cooling techniques will be used for cooling with higher temperature ASHRAE W3 water being used to improve energy efficiency without the use of chillers.

In addition to Sierra and Lassen, LLNL continues to optimize the efficiency of HPC with other platforms that are also liquid cooled.

LLNL is heavily involved in the Energy Efficiency HPC working group (EEHPCWG), which participates in many HPC events. One such event is the IEEE Supercomputing annual all day workshop where many energy efficient topics are reviewed and where HPC challenges and best practices are identified. The working group meets monthly and is comprised of nearly 1000 contributing members from the HPC industry—including national laboratories, universities, and vendors. This working group is also working with the Green Top 500 list to develop the required metering to attain standardized energy levels during LINPACK runs.

Because HPC computational efficiency is an ongoing contribution to mission excellence, LLNL will continue to research and develop techniques to improve the energy efficiency of the highly energy-intensive HPC. LLNL is involved in a number of efforts that not only aim to reduce the energy use of HPC, but promote new standards of quantifying efficiency gains beyond gross energy use. It aims to drive the DOE complex to adopt the approach to use computational efficiency as a viable alternative to measuring advances in HPC sustainable stewardship.

Lawrence Livermore National Laboratory dedicates new supercomputer facility (Photo 8).



Photo 8. B-654 HPC Facility.

The \$9.8 million modular and sustainable facility provides LLNL flexibility to accommodate future advances in computer technology and meet a rapidly growing demand for unclassified HPC. In-house modeling and simulation expertise in energy-efficient building design was used in drawing up the specifications for the facility—HVAC systems were designed to meet federal sustainable design requirements to promote energy conservation. The flexible design will accommodate future liquid cooling solutions for HPC systems. The building can scale to 7.5 MW of electric power to support future platforms and was designed so that power and mechanical resources can be added as HPC technologies evolve.

Supercomputers at LLNL will continue to be retrofitted and studied with liquid cooling systems under a California Energy Commission (CEC) grant to assess potential energy savings. The selected systems for the first phase of the project were retrofitted with Asetek's all-in-one liquid cooling technology. The liquid cooling technology is used to reduce power and greenhouse gas emissions. The second phase of the project is on-going and the analysis studies are being performed.

Resources Required

Normal business processes are in place for LLNL to continue server consolidation efforts. Funding will be requested for optimization efforts required to bring enduring data centers to performance targets.

SSP Category 12: Organizational Resilience

12.1. Update policies to incentivize planning for, and addressing the impacts of, extreme events due to changes in weather patterns

LLNL is committed to be a leader in responsible environmental stewardship and so incorporates pollution prevention, resource conservation, and sustainable acquisitions into planning and decision-making processes. The Lab complies with all applicable environmental requirements, and ensures that interactions with regulators, DOE, and the community are based upon integrity, openness, and adherence to national security requirements. Through LLNL's existing environmental policy, the Lab commits to continuously improve environmental performance.



Photo 9. Wildfire damage at Site 300.

Wildfire risk is an annual reality for LLNL's Site 300, which sits in the California grassland's fire-prone ecosystem. A 2017 wildfire scorched grass and trees, but did not impact facilities due to the capable response from emergency management and fire crews. In accordance with ISMS practices, LLNL takes an integrated approach to continuous improvement procedures and policies—ensuring the Lab's resiliency to the impacts of climate change. (Photo Credit: Lisa Paterson/LLNL)

Performance Status

The Lab has begun to consider the immediate impacts on mission, workers, and physical property projected to result from sea-level rise, increased precipitation, extreme temperatures, flooding, drought, and extreme storm events. According to the National Climate Assessment, the Southwest region is projected to experience an increase in the number of extreme heat days, a reduction in snowpack, and an increase in wildfire risks as a result of climate change. These risks in particular continue to have an apparent and immediate potential to impact LLNL operations and mission (Photo 9).

The number of extreme heat days and the number of cooling degree days experienced at LLNL are also anticipated to increase due to climate change. While this has not yet had a substantial or lasting impact on operations, increases in the number of extreme heat days and changes in the number of cooling days would likely—over the long-term—increase cooling needs in facilities at both sites. Increases in cooling needs would result in increasing costs onsite, and create a greater potential for blackouts or brownouts of the electrical grid. LLNL continues to maintain and replace HVAC systems as practicable—thus improving energy usage and system reliability. See Category 1, Energy Management, for a list of recent DDC and HVAC upgrades. LLNL's emergency preparedness actions include practicing for the potential for extreme heat to

impact workers. LLNL conducts training for workers that includes strategies for the prevention of heat illness with work-rest regimens.

Climate change impacts are anticipated to include more frequent and severe droughts, and a reduction in snowpack. Current plans for maintenance and upgrades to the aging LLNL utility system would support reducing unnecessary water consumption that results from leaks and breaks and increase the reliability of the water supply for both sites. Modifications planned for Site 300 and the Livermore site drinking-water systems would also increase the reliability of LLNL's supply. LLNL continues to explore ways to adapt to long-term water shortages including using treated wastewater for make-up water at certain cooling towers, treated-ground water for cooling tower make-up, and strategically replacing turf-grass with drought tolerant and native landscaping.

Plans and Projected Performance

LLNL's existing emergency management and response-planning considers a breadth of situations including those that may result from near-term climate impacts. A comprehensive approach to considering the long-term risks from climate change as they relate to physical property, mission, and workers may be taken as funding and resources allow. In accordance with underlying ISMS procedures for continual improvement, LLNL will continue to identify existing resilient actions and areas for increasing actions to build resilience against predicted climate threats. As needed, LLNL may also identify and update policies as they relate to climate change.

12.2. Update emergency response procedures and protocols to account for projected change, including extreme weather events

LLNL currently incorporates into its emergency response program a broad range of hazards and environmental aspects, potential consequences, and lessons learned from simulated and actual emergencies. Simulated emergencies are practiced under varying conditions at both the Livermore site and Site 300 to address the broad range of hazards. Additionally, through the general security policy and the security-risk management policy, LLNL will follow DOE directives and federal law to protect DOE/NNSA interests against a wide range of threats.

Performance Status

In some cases, proactive ongoing activities at LLNL already serve to address risks from potential climate hazards. For example, the Site 300 annual prescribed burn minimizes risks to assets from wildfires. As climate models predict more extreme droughts that persist for longer than normal periods of time, the risks from wildfires to Site 300 and Livermore site assets may increase beyond those experienced in previous years.

Changes in the earth's climate patterns promise lasting, impactful alterations to LLNL operations. While the Lab has not yet completed a full vulnerability assessment, LLNL has identified that any projected climate hazard could impact circumstances surrounding emergency situations, the way the Lab responds to emergencies, or the extent of the emergency. The frequency with which the Lab may need to address emergency situations that are associated with droughts and heat waves may increase as the impacts from climate hazards increase.

Plans and Projected Performance

Near-term impacts on mission accomplishment from climate-related threats are already considered and incorporated into existing emergency response procedures. As needed, LLNL may also evaluate current activities that—while not initiated explicitly due to climate change impacts—would contribute to building resiliency into operations and assets and long-range impacts from ongoing climate risks.

12.3. Ensure workforce protocols and policies reflect projected human health and safety impacts

LLNL's existing workforce protocols and policies reflect the value of each worker returning home daily at end of shift in the same or better condition than when arrived at work. This sweeping approach to health and safety allows for adaptation for the impacts of climate change, such as heat stress or other environmental factors.



Photo 10. Workers review project requirements before starting work.

(Photo Credit Paul Hara/LLNL)

Performance Status

LLNL has committed to protecting workers and the public through the occupational health and safety management system (OHSMS). The Lab's ES&H requirements and safe work practices maintain compliance with federal, state, and local regulations. LLNL is dedicated to improving health and safety performance and to creating a workplace that is safe, healthy, and injury-free. Though not initiated with the intent of addressing climate change impacts, the Lab's existing protocols and policies fully support addressing projected human health and safety impacts of climate change.

Plans and Projected Performance

LLNL continues to consider impacts on worker safety and health from climate change related risks. As these events become more likely and new climate patterns emerge, LLNL may need to consider short term impacts, as well as the long-term projections and implications of climate change on worker health at work and outside of work, and to enhance protocols and policies to protect LLNL's workforce. Higher temperatures associated with climate change could lead to increases of heat stress for outdoor workers, and cause raised levels of ground-level ozone that leads to worsened air quality. Greater risk of wildfires will continue to affect air quality at the Livermore site and Site 300. Exposure to wildfire smoke is linked to increased incidences of respiratory illnesses (Reid et al. 2016)², which lead to outdoor work restrictions in 2017³ and 2018, and the first ever closure of LLNL for non-essential personnel for several days.

12.4. Ensure site/lab management demonstrate commitment to adaptation efforts through internal communications and policies

The Lab has demonstrated its commitment to environmental stewardship and to protecting workers and the public through both its existing environmental policy and its existing health and safety policy, respectively.

² <https://ehp.niehs.nih.gov/doi/10.1289/ehp.1409277>

³ <https://bit.ly/2QzTMcu>

Through EMS and OHSMS, LLNL management demonstrates a strong commitment to the policies, and consistently communicates internally to the Lab.

Performance Status

Existing LLNL policies were not initiated due to climate-change hazards and impacts but have established a culture of demonstrating management's commitment to environment, health, and safety. The LLNL director introduces the annual ES&H briefing for all employees. All ES&H action plans are reviewed and approved by the LLNL deputy director.

Plans and Projected Performance

LLNL management will continue to demonstrate commitment to environmental stewardship and worker safety and health (Photo 11). As needed, LLNL management may consider issuing internal communications or updating policies relating to adaptation efforts.



Photo 11. The LLNL Site 300 work release meeting enables management and workers to discuss activities each morning and ensures safe work conditions.

(Photo Credit Paul Hara/LLNL)

12.5. Ensure that site/Lab climate adaptation and resilience policies and programs reflect best available current science, updated as necessary

LLNL works to anticipate, innovate, and deliver solutions for the nation's most challenging security problems including those that relate to energy and environmental security. LLNL scientists and engineers comprise those working on the front lines to advance climate science (Photo 12).



Photo 12. An LLNL worker sets up equipment as part of research on carbon capture.

(Photo credit: Jackie McBride/LLNL)

Performance Status

LLNL applies the best available science in all decision making. LLNL's Program for Climate Model Diagnosis and Intercomparison (PCMDI) develops improved methods and tools for the diagnosis and comparison of general circulation models that simulate the global climate. PCMDI also supports modeling studies initiated by the World Climate Research Programme (WCRP). PCMDI contributed to the work for which the Intergovernmental Panel on Climate Change (IPCC)—who reports on scientific conclusions from climate-change modeling—was awarded the Nobel Peace Prize in 2007.

Plans and Projected Performance

LLNL resources are currently focused on research relating to climate modeling and other energy-related R&D efforts. Allocating funding and resources for an integrated effort will specifically address risks from climate-change impacts. Should LLNL pursue this integrated effort, then LLNL scientists and experts would advise on the use of the latest tools and science available for predicting and planning the effects of climate change. LLNL would also contribute research on the application of climate projections appropriate to Livermore's regional climate. The Laboratory will continue to apply the best-available science in all decision making including decisions relating to climate change adaptation and resilience.

DOE SUSTAINABILITY DASHBOARD DATA
SELF-CERTIFICATION FORM

FROM: Lawrence Livermore National Laboratory
Lead Program Office: NNSA

TO: Sustainability Performance Office

DATE: 11/15/2018

SUBJECT: SELF-CERTIFICATION FORM FOR DASHBOARD DATA ACCURACY
VERIFICATION

The Department of Energy (DOE) annually reports the agency's greenhouse gas emissions, energy and water use, fleet optimization, green buildings, and renewable energy to comply with the sustainability goals mandated in E.O. 13693 and DOE Order 436.1 *Departmental Sustainability Directive*.

To fulfill the Department's sustainability reporting requirements, data was previously collected through the Consolidated Energy Data Report (CEDR) and verified by a Site's manager or Program Office through the SSP submission process. The CEDR has been retired and a new system for data collection, the DOE Sustainability Dashboard (Dashboard), has been created as the official DOE sustainability reporting tool.

I certify that the data submitted for the current fiscal year through the Dashboard as of November 15, 2018 for Lawrence Livermore National Laboratory (LLNL) has been accurately entered and completed to the best of my knowledge and expertise.

Jennifer Vollbrecht 

LLNL Sustainability Lead- Signature

Karin King 

DOE Site Office Official - signature

12/4/18
Date

Contact Information:

Name: Karin King

Title: LFO Sustainability/Federal Energy Manager

Phone: (925) 422-0756

email: karin.king@nnsa.doe.gov

Contact Information:

Name: Jennifer Vollbrecht

Title: Sustainability Program Manager

Phone- (925) 423-9279

email: vollbrecht2@llnl.gov

DOE BUILDING EXCLUSION
SELF-CERTIFICATION FORM

FROM: Lawrence Livermore National Laboratory
Program Office Landlord: NNSA

TO: Sustainability Performance Office

DATE: 11/15/2018

SUBJECT: SELF-CERTIFICATION FORM FOR THE ENERGY INTENSITY GOAL OF
EISA 2007

Each buildings or group of buildings excluded under the criteria for a Part G or Part H exclusion is/are metered for energy consumption and their consumption is reported annually.

If any building has been excluded under the criteria for Part H for impracticability then all practicable energy and water conservation measures with a payback of less than 10 years have been installed. A justification statement that explains why process-dedicated energy in the facility may impact the ability to meet the goal has been provided in the Dashboard Energy Exclusions Report.

I certify that the buildings listed on the Excluded Buildings List produced by the Dashboard as dated November 15, 2018 for Lawrence Livermore National Laboratory (LLNL) meet the exclusion criteria in *Guidelines Establishing Criteria for Excluding Buildings* published by FEMP on January 27, 2006.

Karin King

DOE Site Office Official – printed name



DOE Site Office Official Signature

12/3/18

Date

Contact Information:

Name: Karin King
Title: LFO Sustainability/Federal Energy Manager
Phone: (925) 422-0756
eMail: karin.king@nnsa.doe.gov

**U.S. Department of Energy
DOE Sustainability Dashboard
Energy Consuming Excluded Facilities List in Accordance with
Section 543(c)(3) of the National Energy Conservation Policy Act as amended by the Energy Policy Act of 2005**

Fiscal Year: 2018

Property Program Office	Property Name	Property ID	Real Property Unique ID	Property Type	Ownership	Gross SqFt	Excluded Facilities SqFt	Exclusion Part	Exclusion Justification Comment
NNSA	Computer Center	115	89549	Building	DOE Owned (O)	17140	17140	G - Separately Metered Intensive Load(s)	The building is a computing facility that is driven by mission and operational requirements, not necessarily buildings and not influenced by conventional building energy
NNSA	Computer Center	112	203771	Building	DOE Owned (O)	45512	45511	G - Separately Metered Intensive Load(s)	The building is a computing facility that is driven by mission and operational requirements, not necessarily buildings and not influenced by conventional building energy.
NNSA	EPD/RHWM Liquid Waste Processing	695	140676	Building	DOE Owned (O)	46504	46503	G - Separately Metered Intensive Load(s)	The building supports a Nuclear Facilities whose energy use is driven by mission and operational requirements, not necessarily buildings and not influenced by conventional.
NNSA	EPD/RHWM Waste Storage	693	90044	Building	DOE Owned (O)	12000	11999	G - Separately Metered Intensive Load(s)	The building supports a Nuclear Facilities whose energy use is driven by mission and operational requirements, not necessarily buildings and not influenced by conventional.
NNSA	GS / Central Plant /DPRF/NTTC	133	89563	Building	DOE Owned (O)	5631	5630	G - Separately Metered Intensive Load(s)	The building is a central utility station that is driven by mission and operational requirements, not necessarily buildings and not influenced by conventional building.

NNSA	HETB	334	89803	Building	DOE Owned (O)	10668	10667	G - Separately Metered Intensive Load(s)	The building supports a Nuclear Facilities whose energy use is driven by mission and operational requirements, not necessarily buildings and not influenced by conventional.
NNSA	LCW Control Support	U325	90078	Building	DOE Owned (O)	5072	5071	G - Separately Metered Intensive Load(s)	The building is a central utility station that is driven by mission and operational requirements, not necessarily buildings and not influenced by conventional building.
NNSA	LCW Station	U291	90074	Building	DOE Owned (O)	8631	8631	G - Separately Metered Intensive Load(s)	The building is a central utility station that is driven by mission and operational requirements, not necessarily buildings and not influenced by conventional building.
NNSA	LLNL National Security Computing Center	117	89551	Building	DOE Owned (O)	11370	11369	G - Separately Metered Intensive Load(s)	The building is a computing facility that is driven by mission and operational requirements, not necessarily buildings and not influenced by conventional building energy.
NNSA	Mocho Potable Pumping Station (HH)	U6042	136630	Building	DOE Owned (O)	354	353	G - Separately Metered Intensive Load(s)	The building is a central pumping station that is driven by mission and operational requirements, not necessarily buildings and not influenced by conventional building.
NNSA	Optics Assembly Facility	681	137350	Building	DOE Owned (O)	46818	46818	G - Separately Metered Intensive Load(s)	Electric power and natural gas consumption by these facilities is excluded, placed into the Metered Process category for these facilities. The building areas have also been placed into the Metered Process category as lighting and HVAC energy use are not
NNSA	Plutonium Facility	332	89802	Building	DOE Owned (O)	104787	104786	G - Separately Metered Intensive Load(s)	The building's energy use is driven by mission and operational requirements, not necessarily buildings and not influenced by conventional building energy conservation.

NNSA	Regional Dispatch Center	313	89770	Building	DOE Owned (O)	4352	4351	G - Separately Metered Intensive Load(s)	The building's energy use is driven by mission and operational requirements, not necessarily buildings and not influenced by conventional building energy conservation.
NNSA	Restroom Trailer	3304	143411	Trailer	DOE Owned (O)	128	128	H - Impracticability	the toilet trailer is shutdown pending D&D
NNSA	RHWM TRU Waste Storage	696	135831	Building	DOE Owned (O)	21381	21380	G - Separately Metered Intensive Load(s)	The building supports a Nuclear Facilities whose energy use is driven by mission and operational requirements, not necessarily buildings and not influenced by conventional.
NNSA	Support Facility	335	89804	Building	DOE Owned (O)	11988	11987	G - Separately Metered Intensive Load(s)	The building supports a Nuclear Facilities whose energy use is driven by mission and operational requirements, not necessarily buildings and not influenced by conventional.
NNSA	Telecom Node #1	256	89727	Building	DOE Owned (O)	5937	5936	G - Separately Metered Intensive Load(s)	The building's energy use is driven by mission and operational requirements, not necessarily buildings and not influenced by conventional building energy conservation.
NNSA	The National Ignition Facility	581	140320	Building	DOE Owned (O)	700907	697111	G - Separately Metered Intensive Load(s)	Electric power and natural gas consumption by these facilities is excluded, placed into the Metered Process category for these facilities. The building areas have also been placed into the Metered Process category as lighting and HVAC energy use are not
NNSA	Tritium Facility	331	89801	Building	DOE Owned (O)	30484	30483	G - Separately Metered Intensive Load(s)	The building's energy use is driven by mission and operational requirements, not necessarily buildings and not influenced by conventional building energy conservation.

NNSA	WCI Livermore Computing Facility	451	89922	Building	DOE Owned (O)	51398	22221	G - Separately Metered Intensive Load(s)	Electric metered data has been identified via review of 1-line diagrams and coordination with the facility management team and reports from dedicated electric meter reports prepared by PE / Site Utilities Division / Electric Utilities Group using the MV-9
NNSA	WCI Livermore Computing Facility	439	89908	Building	DOE Owned (O)	12055	12054	G - Separately Metered Intensive Load(s)	The building is a computing facility that is driven by mission and operational requirements, not necessarily buildings and not influenced by conventional building energy.
NNSA	WCI Livermore Computing Facility	453	200806	Building	DOE Owned (O)	240598	48000	G - Separately Metered Intensive Load(s)	TSF facilities include B453 and OS 454. Electric metered data has been identified via review of 1-line diagrams and coordination with dedicated electric meter reports prepared by PE / Site Utilities Division / Electric Utilities Group using the MV-90 dat