LEEP Actions – Additional Resources

The tables below provides links to additional resources – tools, guidelines, case studies – for actions identified by the Laboratory Energy Efficiency Profiler (LEEP) tool

Ventilation Actions

Action Title	Links to Resources
Optimize (reduce) lab exhaust ventilation rate to minimum	Optimize Ventilation Guide Room Air Change Rates Ventilation System Overview Metrics and Benchmarks for Energy Efficiency in Laboratories
Optimize (reduce) exhaust ventilation rate to minimum during unoccupied periods	Optimize Ventilation BPG1 Room Air Change Rates DG1 Ventilation System Overview DG2 Occupancy Based Controls DG3 Occupancy Sensors DG4 VFDs and Airflow Rates DG5 VAV Systems DG6 Labs21 Energy Analysis DG7 Economizer Case Study DG8 Simulation Strategies DG9
Optimize (reduce) lab supply ventilation rate	Optimize Ventilation BPG1 Room Air Change Rates DG1 Ventilation System Overview DG2 Airflow Tracking Control DG10 Pressure Sensing Control DG11 Metrics and Benchmarks for Energy Efficiency in Laboratories Chilled Beams Guide

Action Title	Links to Resources
Optimize (reduce) number or size of hoods, i.e. decommission some hoods.	Retro-Commissioning Laboratories for Energy Efficiency Metrics and Benchmarks for Energy Efficiency in Laboratories Commissioning Ventilated Containment Systems in the Laboratory
Install direct digital control (DDC) system.	Direct Digital Control
Install variable volume fume hoods	Variable Volume Hoods VAV Systems Air Systems VAV Hood Retrofits Life-cycle Cost Study
Install low-flow fume hoods	Fume Hood Commissioning Case Study: National Renewable Energy Laboratory, Science and Technology Facility, Golden, Colorado
Improve fume hood sash management	User Training Fred Hutch Case Study
Install fume hood occupancy sensor-based flow setback	Occupancy-based Control Optimize Ventilation User Training
Install automatic fume hood sash closing devices	Lab Demonstrations Sash Closure Device User Training
Implement supply duct static pressure setback	Duct Pressure Reset Metrics and Benchmarks for Energy Efficiency in Laboratories Retro-Commissioning Laboratories for Energy Efficiency
Consider dynamic supply duct static-pressure reset	Sequence of Operation Duct static pressure control Duct Pressure Control Retro-Commissioning Laboratories for Energy Efficiency

Action Title	Links to Resources
Implement exhaust duct static pressure setback	Duct Pressure Reset Sequence of Operation Duct static pressure control Duct Pressure Control Commissioning Ventilated Containment Systems in the Laboratory
Consider dynamic exhaust duct static-pressure reset	Sequence of Operation Duct static pressure control Duct Pressure Control Commissioning Ventilated Containment Systems in the Laboratory Retro-Commissioning Laboratories for Energy Efficiency
Optimize maintaining lab differential pressure	Lab Pressure Control Objectives VAV Lab Pressure Control Room Pressure Control Combined Room Pressure Control Air Balancing Retro-Commissioning Laboratories for Energy Efficiency Metrics and Benchmarks for Energy Efficiency in Laboratories
Reduce supply AHU pressure drop by removing obstructions.	Low-Pressure-Drop HVAC Design Low-velocity Duct Design Duct Fittings Duct Fittings and Economics
Reduce exhaust system pressure drop by removing obstructions.	Low-Pressure-Drop HVAC Design Low-velocity Duct Design Duct Fittings Duct Fittings and Economics

Action Title	Links to Resources
Optimize HVAC filters with minimum pressure drop	Energy Efficiency & Air Filtration Air Filter Pressure Drop Metrics and Benchmarks for Energy Efficiency in Laboratories
Increase supply fan efficiency (motors, belts, drives)	Motor & Drive Efficiency Labs21 Energy Analysis PETL Case Study
Increase exhaust fan efficiency (motors, belts, drives)	Motor & Drive Efficiency Labs21 Energy Analysis PETL Case Study
Seal Ducts	Lab Duct Sealing Ductwork Air Leakage Duct Construction and Leakage Duct Leakage & Laboratory Isolation
Retrofit exhaust system to a manifolded system	Manifolding Exhaust Ductwork Manifolding & Energy Recovery Manifolding Versus Individual Ducts
Implement static pressure reset in the manifold exhaust system	Duct Pressure Reset Sequence of Operation Duct static pressure control Duct Pressure Control
Optimize exhaust stack discharge velocity	Exit velocity Wind modeling Effluent Dispersion Modeling Exhaust Dispersion Metrics and Benchmarks for Energy Efficiency in Laboratories
Optimize ventilation control sequences	Sequence of Operation Performance Measurement Sequence implementation Diversity analyses

Action Title	Links to Resources
Install demand control on canopy hoods	**Occupancy-based controls** **Sequence of Operation** **Control strategy overview**
Replace Inlet vanes or dampers with variable frequency drives	**Variable frequency drive application** **Case Study: Process and Environmental Technology Laboratory at Sandia National Lab**
Reduce exhaust air volume with variable speed drive	**Variable frequency drive application** **Manifolded Exhaust** **VAV technology research center** **Analytical chemical laboratory example** Modeling Exhaust Dispersion for Specifying Acceptable Exhaust/Intake Designs

Heating and Cooling Actions

Action Title	Links to Resources
Optimize heating temperature set point	**Temperature control considerations** **Global zone control** **Sequence of Operation** **VAV technology research center** **The Energy-Efficient Design Process**
Optimize cooling temperature set point	**Temperature control considerations** **Global zone control** **Sequence of Operation** **VAV technology research center** **The Energy-Efficient Design Process**

Action Title	Links to Resources
Optimize humidity set point	Temperature control considerations Global zone control Sequence of Operation VAV technology research center The Energy-Efficient Design Process
Optimize heating temperature span	Temperature control considerations Global zone control Sequence of Operation VAV technology research center The Energy-Efficient Design Process
Optimize cooling temperature span	Temperature control considerations Global zone control Sequence of Operation VAV technology research center The Energy-Efficient Design Process
Optimize humidity span	Temperature control considerations Global zone control Sequence of Operation VAV technology research center The Energy-Efficient Design Process
Implement temperature setback and set up during unoccupied periods	Occupancy-based controls Sequence of Operation VAV systems Labs21: Energy Analysis Case study: Fred Hutchinson Cancer Research Center Case Study: Louis Stokes Laboratories, NIH
Minimize reheat energy use	Minimizing Reheat Energy Use in Laboratories Retro-Commissioning Laboratories for Energy Efficiency Chilled Beams Guide

Action Title	Links to Resources
Replace chillers with energy efficient models	VSD Chillers Cooling tower capacity Case study: Fred Hutchinson Cancer Research Center Case Study: Process and Environmental Technology Laboratory at Sandia National Lab
Replace boilers with energy efficient models	Boiler Efficiency Modularized Plant Devices Tech. Bulletin: Modular Boiler Systems in Laboratory Facilities
Install variable frequency drives on boiler pumps	Variable speed pumping Pumping Systems Primary/secondary/tertiary loops Labs21: Energy Analysis Case Study: Variable speed pumping Case Study: Process and Environmental Technology Laboratory at Sandia National Lab
Install energy efficient boiler pump motors	MotorMaster sizing software
Install variable frequency drives on chilled water pumps	All-Variable speed pumping All-Variable Speed Chiller Plants Primary/secondary/tertiary loops Pumping Systems
Install energy efficient chilled water pump motors	MotorMaster sizing software
Optimize chiller and boiler plant controls	Temperature control considerations Global zone control Control strategy overview Sequence of Operation
Consider installing water-side economizer	Labs21: Energy Analysis Evaporative cooling Tower water isolation

Action Title	Links to Resources
Consider installing energy recovery system	Energy Recovery Best Practice Guide: Energy Recovery for Ventilation Air in Laboratories
Check and optimize operational effectiveness of energy recovery system	Energy Recovery Best Practice Guide: Energy Recovery for Ventilation Air in Laboratories
Improve turndown ratio of chiller plant to meet variable load	Match Variable Load with an Adjustable System Determine Potential Load Variability Labs21: Energy Analysis Integrated System Design: Right-Sizing for Energy Efficiency Chillers
Improve turndown ratio of boiler plant to meet variable load	Match Variable Load with an Adjustable System Determine Potential Load Variability Labs21: Energy Analysis Integrated System Design: Right-Sizing for Energy Efficiency
Implement supply air temperature reset	Labs21: Energy Analysis Case Study: Fred Hutchinson Cancer Research Center, Seattle, Washington Sequence of Operation
Implement chilled water temperature reset	Free cooling Control strategy overview VFD cooling tower operation Blended tower water Labs21: Energy Analysis Sequence of Operation
Implement heating water temperature reset	Control strategy overview Labs21: Energy Analysis Sequence of Operation

Action Title	Links to Resources
Optimize temperature control sequences	Sequence of Operation Control strategy overview Optimum start Energy Efficiency and Direct Digital Control Case Study: Process and Environmental Technology Laboratory at Sandia National Lab

Process Action Items

Action Title	Links to Resources
Turn off unused or optional process equipment.	Measured Peak Equipment Loads in Laboratories Right-Sizing Laboratory Equipment Loads Metrics and Benchmarks for Energy Efficiency in Laboratories
Replace computers, monitors, and printers with EnergyStar models.	ENERGY STAR
Replace refrigerators and freezers with EnergyStar models	Energy-Efficient Laboratory Equipment Wiki ENERGY STAR Room Temperature Storage of Biological Samples
Consolidate refrigerators and freezers, ice machines in dedicated space(s) with wider temperature spans	Measured Peak Equipment Loads in Laboratories Right-Sizing Laboratory Equipment Loads Metrics and Benchmarks for Energy Efficiency in Laboratories Case Study: Fred Hutchinson Cancer Research Center, Seattle, Washington Room Temperature Storage of Biological Samples
Locate centralized air compressors and vacuum pumps in mechanical spaces with wider temperature spans	Measured Peak Equipment Loads in Laboratories Right-Sizing Laboratory Equipment Loads Metrics and Benchmarks for Energy Efficiency in Laboratories Case Study: Fred Hutchinson Cancer Research Center, Seattle, Washington

Action Title	Links to Resources
Fix leaks in compressed air and vacuum systems	Minimize Compressed Air Leaks Improving Compressed Air System Performance Implementing a Compressed Air System Leak Management Compressed Air Tip Sheets
Consider using decentralized point-of-use compressed air and vacuum systems	Improving Compressed Air System Performance Compressed Air Tip Sheets
Replace or upgrade compressed air or vacuum pumps	Improving Compressed Air System Performance Compressed Air Tip Sheets
Use dedicated chiller for process cooling	Measured Peak Equipment Loads in Laboratories Right-Sizing Laboratory Equipment Loads Metrics and Benchmarks for Energy Efficiency in Laboratories

Lighting Action Items

Action Title	Links to Resources
Upgrade to higher-efficiency lamps and ballasts	High-Efficiency Lighting Components Efficient Electric Lighting in Laboratories Daylighting in Laboratories
Upgrade to direct-indirect fixture configuration	High-Efficiency Lighting Components Efficient Electric Lighting in Laboratories Remote Lighting Systems
De-lamp to right-size illuminance levels	Efficient Electric Lighting in Laboratories
Use task lighting and reduce ambient lighting levels	Efficient Electric Lighting in Laboratories
Use daylight sensors for laboratory lighting control	Lighting Control Daylighting in Laboratories Efficient Electric Lighting in Laboratories Lighting Design

Action Title	Links to Resources
Use occupancy-sensor for laboratory lighting control	**Lighting Control** **Efficient Electric Lighting in Laboratories** **Lighting Design**