

# Applying the Labs21 Environmental Performance Criteria to a New Laboratory Building

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The RMH Group and RNL Design  
Members of the U.S. Green Building Council



# Agenda

- LEED and the Labs 21 Environmental Performance Criteria
  - Background
- Case Study: Colorado Springs Utilities Lab
  - Requirements, results, recommendations
- Conclusions





# Labs 21 EPC

- ✦ Released October 2002
- ✦ Draft of Application guide for LEED for Labs to be released in 2004
- ✦ Combines LEED for new buildings with specific lab-related issues
- ✦ More emphasis on energy and water, lab and process ventilation and safety

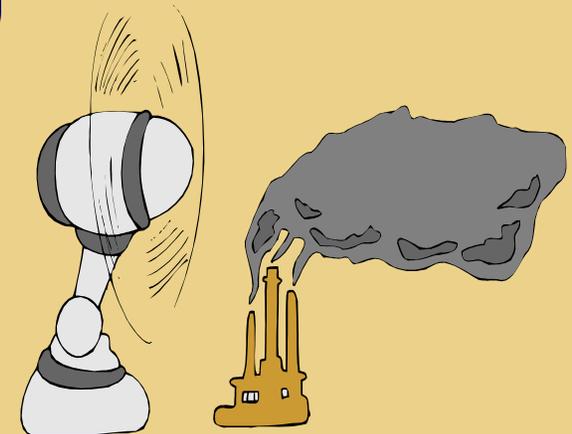
# Labs21-EPC

## Points

LABS FOR THE 21ST CENTURY



- ☀ Labs21-EPC adds some prerequisites...
  - ✳ Lab equipment water usage
  - ✳ Assessing minimum ventilation requirements
  - ✳ Hazardous materials handling
  - ✳ Laboratory ventilation
  - ✳ Exterior door notification system



# Labs21-EPC

## Points

LABS FOR THE 21ST CENTURY



- ☀ Labs21-EPC adds some criteria....
  - ☀ Safety and risk management
  - ☀ Process water efficiency and 20% reduction
  - ☀ Improving lab equipment efficiency
  - ☀ Right size equipment load
  - ☀ Chemical resource management
  - ☀ Indoor environmental safety: airflow modeling, fume hood commissioning, and alarm systems



# Labs21-EPC Points

LABS FOR THE 21ST CENTURY



- ★ Labs21-EPC changes some criteria...
  - ★ Prerequisite 2 for minimum energy performance
  - ★ Optimizing energy performance
  - ★ Renewable energy
  - ★ Controllability of systems



# Labs21-EPC Case Study

## CSU Laboratory, Colorado Springs

### ☀ Project Description

- ☀ About the owner
- ☀ Lab functions
- ☀ Location
- ☀ Size



# Labs21-EPC Case Study

## CSU Laboratory, Colorado Springs

### Overall Site Strategies

- Building orientation
- Native landscape
- Non-potable irrigation
- Water treatment



# Labs21-EPC Case Study

## CSU Laboratory, Colorado Springs

### Overall Building Strategies

- Daylighting
- Glazing
- Local materials
- Recycled materials



# Labs21-EPC Case Study

## CSU Laboratory, Colorado Springs

### Overall Lab Design Strategies

- Low-flow fume hoods
- Casework
- Efficient glass-wash equipment
- Elimination of single pass cooling

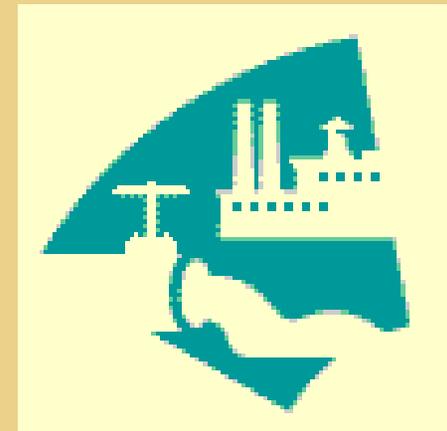


# Labs21-EPC

CSU Laboratory, Colorado Springs

## ☀ Sustainable Sites

- ☀ 9.1 Safety and Risk Management, Air Effluent
- ☀ 9.2 Safety and Risk Management, Water Effluent

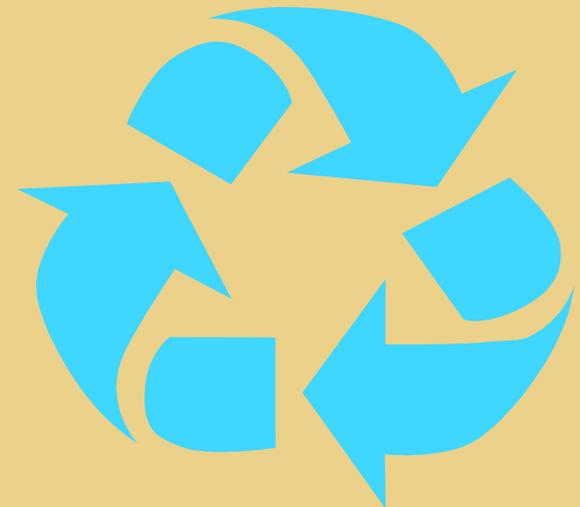


# Labs21-EPC

CSU Laboratory, Colorado Springs

## ☀ Water Efficiency

- ☀ Prerequisite 1 Lab Equipment Water Use
- ☀ 4.1 Process Water Efficiency, Document Baseline
- ☀ 4.2 Process Water Efficiency, 20% Reduction



# Labs21-EPC

CSU Laboratory, Colorado Springs

## ☀ Energy & Atmosphere

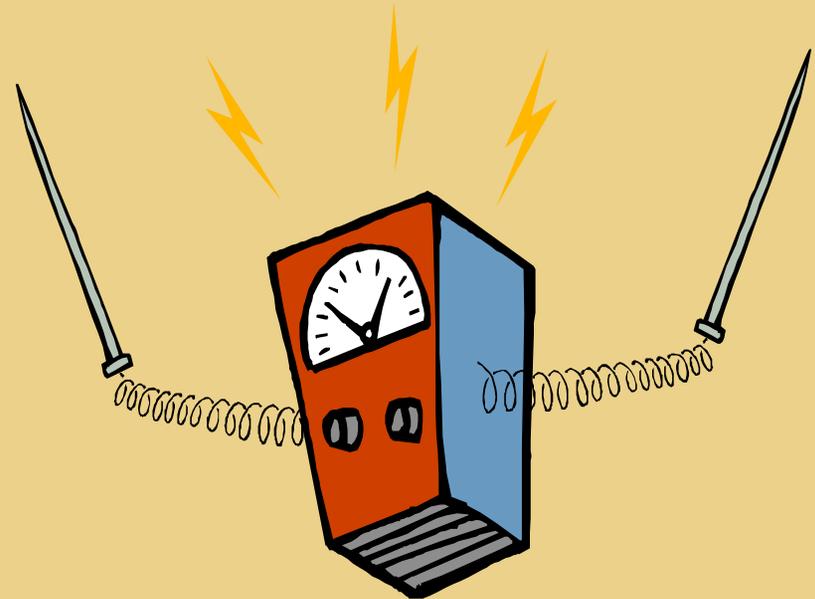
- ☀ Prerequisite 4 Assess Minimum Ventilation Requirements
- ☀ 7.1-7.5 Energy Supply Efficiency, 10%-50%
- ☀ 8.1 Improve Lab Equipment Efficiency



# Labs21-EPC

CSU Laboratory, Colorado Springs

- ☀ Energy & Atmosphere (*continued*)
  - ☀ 9.1 Right-size Lab Equipment Load, Measure Comparable Lab
  - ☀ 9.2 Right-size Lab Equipment Load, Metering Provision

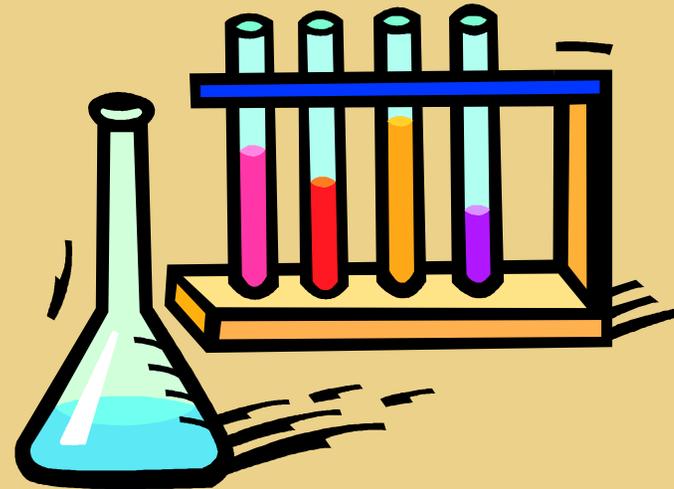


# Labs21-EPC

CSU Laboratory, Colorado Springs

## ☀ Materials & Resources

- ☀ Prerequisite 2 Hazardous Material Handling
- ☀ 8.1 Chemical Resource Management



# Labs21-EPC

CSU Laboratory, Colorado Springs

- ☀ Indoor Environmental Quality
  - ☀ Prerequisite 3 Lab Ventilation
  - ☀ Prerequisite 4 Exterior Door Notification System

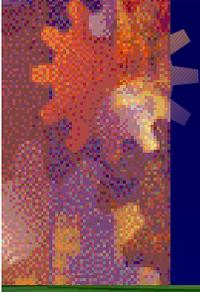




# Labs21-EPC

CSU Laboratory, Colorado Springs

- ☀ Indoor Environmental Quality (*continued*)
  - ☀ Credit 9.1 Indoor Environmental Safety, Airflow Modeling
  - ☀ Credit 9.2 Indoor Environmental Safety, Fumehood Commissioning
  - ☀ Credit 9.3 Indoor Environmental Safety, Alarm Systems



# Energy-Efficient Features

## CSU Laboratory, Colorado Springs

### ☀ Mechanical

- ☀ Efficient boiler systems
- ☀ ~~Chiller with evaporatively cooled condenser~~
- ☀ Direct evaporative cooling on air intake for lab AHU and office AHU
- ☀ Variable-air-volume laboratory system
- ☀ ~~Heat pipe heat recovery on lab exhaust~~
- ☀ Run-around coil for energy recovery on lab exhaust
- ☀ Efficient domestic hot water heaters
- ☀ Separate AHU with re-circulated air for office spaces

# Energy Efficient Features

## CSU Laboratory, Colorado Springs

### Architectural

- Light shelves and sun shades on the south side
- High-performance glazing
- White roof (TPO)
- R19 walls, R30 roof

### Electrical

- Daylighting with photosensors and continuously dimming ballasts
- High-efficiency lighting systems with compact fluorescents, task lighting, and T-5 direct/ indirect fixtures



# Energy

## CSU Laboratory, Colorado Springs

### Energy Modeling Results

|  | <i>Annual Energy Index<br/>kBtu/sf/yr</i> | <i>Annual Energy Cost<br/>\$/yr</i> | <i>Annual Energy Cost Index<br/>\$/sf/yr</i> | <i>Annual Energy Cost without Plug Loads<br/>\$/yr</i> |
|--|---|-------------------------------------|--|--|
| <b>Energy Standard Compliant Base Case</b> | 200                                       | \$88,251                            | \$1.94                                       | \$ 61,010  |
| <b>Recommended Case</b>                    | 106                                       | \$ 56,881                           | \$1.25                                       | \$ 29,640  |

- Reduction in annual energy costs by 35% or by 52% without including plug loads, which equates to 10 out of 10 possible EPC Energy points!

| LEED for Lab-specific credits |          |           |  |
|-------------------------------|----------|-----------|--|
| Y                             | ?        | N         |  |
| <b>6</b>                      | <b>4</b> | <b>T</b>  | <b>Sustainable Sites</b>   |
| Y                             |          |           | Prereq 1 <b>Erosion &amp; Sedimentation Control</b> Required                         |
|                               | X        |           | Credit 1 <b>Site Selection</b> 1   |
|                               | X        |           | Credit 2 <b>Development Density</b> 1  |
|                               |          |           | Credit 3 <b>Brownfield Redevelopment</b> 1   |
|                               | X        |           | Credit 4.1 <b>Alternative Transportation, Public Transportation Access</b> 1         |
|                               |          |           | Credit 4.2 <b>Alternative Transportation, Bicycle Storage &amp; Changing Rooms</b> 1 |
|                               | X        |           | Credit 4.3 <b>Alternative Transportation, Alternative Fuel Refueling Stations</b> 1  |
|                               | X        |           | Credit 4.4 <b>Alternative Transportation, Parking Capacity</b> 1                     |
|                               | X        |           | Credit 5.1 <b>Reduced Site Disturbance, Protect or Restore Open Space</b> 1          |
|                               |          |           | Credit 5.2 <b>Reduced Site Disturbance, Development Footprint</b> 1                  |
|                               | X        |           | Credit 6.1 <b>Stormwater Management, Rate or Quantity</b> 1                          |
|                               |          |           | Credit 6.2 <b>Stormwater Management, Treatment</b> 1                                 |
|                               |          |           | Credit 7.1 <b>Landscapes &amp; Exterior Design, Non-Roof</b> 1                       |
|                               |          |           | Credit 7.2 <b>Landscapes &amp; Exterior Design, Roof</b> 1                           |
|                               | X        |           | Credit 8 <b>Light Pollution Reduction</b> 1  |
|                               | X        |           | Credit 9.1 <b>Safety and Risk Management, Air Emission</b> 1                         |
|                               |          |           | Credit 9.2 <b>Safety and Risk Management, Water Emission</b> 1                       |
| Y                             | ?        | N         |  |
| <b>6</b>                      | <b>1</b> | <b>T</b>  | <b>Water Efficiency</b>  |
| Y                             |          |           | Prereq 1 <b>Laboratory Equipment Water Use</b> Required                              |
|                               | X        |           | Credit 1.1 <b>Water Efficient Landscaping, Reduce by 50%</b> 1                       |
|                               | X        |           | Credit 1.2 <b>Water Efficient Landscaping, No Potable Use or No Irrigation</b> 1     |
|                               | X        |           | Credit 2 <b>Innovative Wastewater Technologies</b> 1                                 |
|                               | X        |           | Credit 3.1 <b>Water Use Reduction, 20% Reduction</b> 1                               |
|                               | X        |           | Credit 3.2 <b>Water Use Reduction, 30% Reduction</b> 1                               |
|                               | X        |           | Credit 4.1 <b>Process Water Efficiency, Document Baseline</b> 1                      |
|                               |          |           | Credit 4.2 <b>Process Water Efficiency, 20% Reduction</b> 1                          |
| Y                             | ?        | N         |  |
| <b>11</b>                     | <b>2</b> | <b>12</b> | <b>Energy &amp; Atmosphere</b>   |
| Y                             |          |           | Prereq 1 <b>Fundamental Building Systems Commissioning</b> Required                  |
| Y                             |          |           | Prereq 2 <b>Minimum Energy Performance</b> Required                                  |
| Y                             |          |           | Prereq 3 <b>CFE Reduction in HVAC/R Equipment</b> Required                           |
| Y                             |          |           | Prereq 4 <b>Assess Minimum Ventilation Requirements</b> Required                     |
| X                             |          |           | Credit 1.1 <b>Optimize Energy Performance, 5%</b> 1                                  |
| X                             |          |           | Credit 1.2 <b>Optimize Energy Performance, 10%</b> 1                                 |
| X                             |          |           | Credit 1.3 <b>Optimize Energy Performance, 15%</b> 1                                 |
| X                             |          |           | Credit 1.4 <b>Optimize Energy Performance, 20%</b> 1                                 |
| X                             |          |           | Credit 1.5 <b>Optimize Energy Performance, 25%</b> 1                                 |
| X                             |          |           | Credit 1.6 <b>Optimize Energy Performance, 30%</b> 1                                 |
| X                             |          |           | Credit 1.7 <b>Optimize Energy Performance, 35%</b> 1                                 |
| X                             |          |           | Credit 1.8 <b>Optimize Energy Performance, 40%</b> 1                                 |
|                               |          |           | Credit 1.9 <b>Optimize Energy Performance, 45%</b> 1                                 |
|                               |          |           | Credit 1.10 <b>Optimize Energy Performance, 50%</b> 1                                |
| X                             |          |           | Credit 2.1 <b>Renewable Energy, 2% Contribution</b> 1                                |
| X                             |          |           | Credit 2.2 <b>Renewable Energy, 5% Contribution</b> 1                                |
| X                             |          |           | Credit 2.3 <b>Renewable Energy, 10% Contribution</b> 1                               |
| X                             |          |           | Credit 3 <b>Additional Commissioning</b> 1   |
| X                             |          |           | Credit 4 <b>Ozone Depletion</b> 1  |
| X                             |          |           | Credit 5 <b>Measurement &amp; Verification</b> 1                                     |
| X                             |          |           | Credit 6 <b>Green Power</b> 1  |
| X                             |          |           | Credit 7.1 <b>Energy Supply Efficiency, 10%</b> 1                                    |
| X                             |          |           | Credit 7.2 <b>Energy Supply Efficiency, 20%</b> 1                                    |
| X                             |          |           | Credit 7.3 <b>Energy Supply Efficiency, 31%</b> 1                                    |
| X                             |          |           | Credit 7.4 <b>Energy Supply Efficiency, 40%</b> 1                                    |
| X                             |          |           | Credit 7.5 <b>Energy Supply Efficiency, 50%</b> 1                                    |
| X                             |          |           | Credit 8 <b>Improve Laboratory Equipment Efficiency</b> 1                            |
| X                             |          |           | Credit 9.1 <b>Right-size Laboratory Equipment: Measure Comparable Lab</b> 1          |
| X                             |          |           | Credit 9.2 <b>Right-size Laboratory Equipment: Metering Provision</b> 1              |

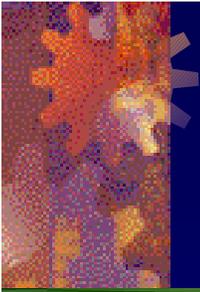
| Y        | ?        | N        |   |
|----------|----------|----------|---|
| <b>6</b> | <b>3</b> | <b>5</b> | <b>Materials &amp; Resources</b>  |
| Y        |          |          | Prereq 1 <b>Storage &amp; Collection of Recyclables</b> Required                  |
| Y        |          |          | Prereq 2 <b>Hazardous Material Handling</b> Required                              |
|          | X        |          | Credit 1.1 <b>Building Reuse, Maintain 75% of Existing Shell</b> 1                |
|          | X        |          | Credit 1.2 <b>Building Reuse, Maintain 100% of Shell</b> 1                        |
|          | X        |          | Credit 1.3 <b>Building Reuse, Maintain 100% Shell &amp; 50% Non-Shell</b> 1       |
| X        |          |          | Credit 2.1 <b>Construction Waste Management, Divert 50%</b> 1                     |
| X        |          |          | Credit 2.2 <b>Construction Waste Management, Divert 75%</b> 1                     |
|          | X        |          | Credit 3.1 <b>Resource Reuse, Specify 5%</b> 1                                    |
|          | X        |          | Credit 3.2 <b>Resource Reuse, Specify 10%</b> 1                                   |
| X        |          |          | Credit 4.1 <b>Recycled Content, Specify 5%</b> 1                                  |
| X        |          |          | Credit 4.2 <b>Recycled Content, Specify 10%</b> 1                                 |
| X        |          |          | Credit 5.1 <b>Local/Regional Materials, 20% Manufactured Locally</b> 1            |
|          |          |          | Credit 5.2 <b>Local/Regional Materials, of 20% Above, 50% Extracted Locally</b> 1 |
|          |          |          | Credit 6 <b>Rapidly Renewable Materials</b> 1                                     |
| X        |          |          | Credit 7 <b>Certified Wood</b> 1  |
| X        |          |          | Credit 8 <b>Chemical Resource Management</b> 1                                    |

| Y         | ?        | N        |   |
|-----------|----------|----------|---|
| <b>10</b> | <b>1</b> | <b>7</b> | <b>Indoor Environmental Quality</b>                                       |
| Y         |          |          | Prereq 1 <b>Minimum IAQ Performance</b> Required                          |
| Y         |          |          | Prereq 2 <b>Environmental Tobacco Smoke (ETS) Control</b> Required        |
| Y         |          |          | Prereq 3 <b>Laboratory Ventilation</b> Required                           |
| Y         |          |          | Prereq 4 <b>Exterior Door Notification System</b> Required                |
|           | X        |          | Credit 1 <b>Carbon Dioxide (CO<sub>2</sub>) Monitoring</b> 1              |
|           | X        |          | Credit 2 <b>Increase Ventilation Effectiveness</b> 1                      |
| X         |          |          | Credit 3.1 <b>Construction IAQ Management Plan, During Construction</b> 1 |
| X         |          |          | Credit 3.2 <b>Construction IAQ Management Plan, Before Occupancy</b> 1    |
| X         |          |          | Credit 4.1 <b>Low-Emitting Materials, Adhesives &amp; Sealants</b> 1      |
| X         |          |          | Credit 4.2 <b>Low-Emitting Materials, Paints</b> 1                        |
| X         |          |          | Credit 4.3 <b>Low-Emitting Materials, Carpet</b> 1                        |
| X         |          |          | Credit 4.4 <b>Low-Emitting Materials, Composite Wood</b> 1                |
| X         |          |          | Credit 5 <b>Indoor Chemical &amp; Pollutant Source Control</b> 1          |
|           | X        |          | Credit 6.1 <b>Controllability of Systems, Perimeter</b> 1                 |
|           | X        |          | Credit 6.2 <b>Controllability of Systems, Non-Perimeter</b> 1             |
|           | X        |          | Credit 7.1 <b>Thermal Comfort, Comply with ASHRAE 55-1992</b> 1           |
|           | X        |          | Credit 7.2 <b>Thermal Comfort, Permanent Monitoring System</b> 1          |
|           | X        |          | Credit 8.1 <b>Daylight &amp; Views, Daylight 75% of Spaces</b> 1          |
|           | X        |          | Credit 8.2 <b>Daylight &amp; Views, Views for 90% of Spaces</b> 1         |
|           | X        |          | Credit 9.1 <b>Indoor Environmental Safety, Airflow Modeling</b> 1         |
|           |          |          | Credit 9.2 <b>Indoor Environmental Safety, Furniture Commissioning</b> 1  |
|           | X        |          | Credit 9.3 <b>Indoor Environmental Safety, Alarm Systems</b> 1            |

| Y        | ?        | N        |   |
|----------|----------|----------|---|
| <b>3</b> | <b>2</b> | <b>0</b> | <b>Innovation &amp; Design Process</b>  |
| X        |          |          | Credit 1.1 <b>Innovation in Design, Native plants, efficient irrigation</b> 1                 |
| X        |          |          | Credit 1.2 <b>Innovation in Design, 100% Cool Roof</b> 1                                      |
|          |          |          | Credit 1.3 <b>Innovation in Design, Utilizing EPC when not yet adopted by USGBC</b> 1         |
|          |          |          | Credit 1.4 <b>Innovation in Design, Exceeding use of Materials &amp; Resources credits?</b> 1 |
| X        |          |          | Credit 2 <b>LEED™ Accredited Professional</b> 1   |

| Y         | ?         | N         | Project Totals  |
|-----------|-----------|-----------|---|
| <b>40</b> | <b>13</b> | <b>32</b> | Certified TBD points, Silver TBD points, Gold TBD points, Platinum TBD points |

| LEED Award   | LEED for New Buildings | LEED for Labs |
|--------------|------------------------|---------------|
| Certified    | 26                     | 32            |
| Silver       | 33                     | 41            |
| Gold         | 39                     | 48            |
| Platinum     | 52                     | 64            |
| <b>Total</b> | <b>89</b>              | <b>85</b>     |



# General Recommendations

## Labs21 EPC

- ✦ Before becoming a LEED for Labs Application Guide:
  - ✦ USGBC should have a list of FAQs available from Labs21-EPC design teams
  - ✦ USGBC should have examples of some of the more complex calculations required (e.g., Energy Supply Efficiency)
  - ✦ USGBC should explain the reasoning or intent of some of the credits



# Conclusions

- Sustainable laboratories will require closer collaboration among architects, engineers, and users than typical buildings
  - Labs require more mechanical space for 100% outside air and heat recovery
  - Office space area should be completely separate from lab space
- Sustainable laboratories can be built within “market-driven” budgets.
- Quality design and operation will meet LEED for Labs requirements
- Sustainable labs are a better place to do science
- Look for Application Guide for LEED for Labs in 2004!



# *Thank You!*

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