DACUM Research Chart for High Performance Building Operations Professional

Produced for

BEST
Building Efficiency for a Sustainable Tomorrow

NSF

DACUM Facilitator
John Moser
The Ohio State University

DACUM Recorder
Pam Wallace
BEST Center Director—Laney College

Observers
Peter Crabtree, BEST Center Principal Investigator and Dean-Career Technical Education—Laney College
Chuck Frost, ECT Faculty Member—Laney College and Co-PI—BEST Center
Hadley Hartshorn, ECT (Environmental Control Technology) Faculty—Laney College
Carlos Santamaria, Principal, CEES-Advisors—BOMA (Building Owners & Managers Assn.) California Energy Chair

Produced by

The Ohio State University
College of Education and Human Ecology
DACUM International Training Center
Columbus, OH

DACUM Panel
Wayne D. Alldredge, Associate Director
VCA Green
Orange, CA

Wayne Bader, Energy Manager
Sutter Health
Folsom, CA

Jeffrey A. Bear, Sr. Maintenance Coordinator
Lawrence Livermore Nat'l Lab
Livermore, CA

Joe Bradley, Chief Building Engineer
Ascentia Engineering Services
Crestline, CA

Rob Fannin, Office Building Manager III
Dept. of General Services/Facility Mgt.
Citrus Heights, CA

Maria Garcia-Alvarez, Asset Manager
UC Berkeley
Berkeley, CA

Uzomo Okoro, Director of Engineering
ABM
Carmichael, CA

Steven Powell, Chief Engineer
ABM/City National Plaza
Los Angeles, CA

David Prara, Chief Engineer
ABM/Corporate Center Pasadena
Pasadena, CA

Eric R. Ramirez, Chief Facility Engineer
Kaiser Permanente
Napa, CA

April 7-8, 2016
<table>
<thead>
<tr>
<th>DUTIES</th>
<th>TASKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Analyze Building Operations</td>
<td>A.1 Review building documentation (e.g., SOPs, BMS, MEP)</td>
</tr>
<tr>
<td></td>
<td>A.10 Trend building occupancy/production</td>
</tr>
<tr>
<td>B. Maintain Building Operating Efficiency</td>
<td>B.1 Identify BAS discrepancies</td>
</tr>
<tr>
<td></td>
<td>B.10 Review VFD settings</td>
</tr>
<tr>
<td>C. Audit Building Operational Performance*</td>
<td>C.1 Review maintenance and repair log</td>
</tr>
<tr>
<td></td>
<td>C.10 Perform lighting audit</td>
</tr>
<tr>
<td></td>
<td>C.19 Perform life cycle analysis</td>
</tr>
<tr>
<td>D. Create High Performance Building Plans</td>
<td>D.1 Obtain payback analysis</td>
</tr>
<tr>
<td></td>
<td>D.10 Optimize equipment sequence of operations</td>
</tr>
<tr>
<td></td>
<td>D.19 Develop tenant engagement programs</td>
</tr>
</tbody>
</table>

* Audit reports include recommendations for improvement
<table>
<thead>
<tr>
<th>A.5 Benchmark building performance</th>
<th>A.6 Develop building performance goals (e.g., energy, IEQ, water)</th>
<th>A.7 Identify environmental requirements (e.g., temperature, lighting, ventilation)</th>
<th>A.8 Trend service calls</th>
<th>A.9 Trend utility usage and cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>B.5 Calibrate air distribution systems (e.g., economizers, VAV, air handlers)</td>
<td>B.6 Calibrate central cooling systems (e.g., temperature resets, flow, pressure)</td>
<td>B.7 Calibrate central heating systems (e.g., temperature resets, flow, pressure)</td>
<td>B.8 Calibrate evaporative cooling systems (e.g., cooling towers, filtration, free cooling)</td>
<td>B.9 Optimize pump performance</td>
</tr>
<tr>
<td>B.14 Optimize operating set points</td>
<td>B.15 Develop key performance indicators (e.g., reset schedule, KW/sq. ft., peak load)</td>
<td>B.16 Conduct regular building performance meetings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C.5 Perform Energy Star® review</td>
<td>C.6 Perform green building certification review</td>
<td>C.7 Review building occupancy plan</td>
<td>C.8 Quantify greenhouse gas emissions</td>
<td>C.9 Perform waste audit (e.g., hazardous, landfill, recycling)</td>
</tr>
<tr>
<td>C.14 Review building occupant survey results</td>
<td>C.15 Review system alarm history</td>
<td>C.16 Test combustion equipment efficiencies</td>
<td>C.17 Perform water treatment audit</td>
<td>C.18 Determine need for energy consultant</td>
</tr>
<tr>
<td>D.5 Develop energy plan</td>
<td>D.6 Determine load shedding opportunities</td>
<td>D.7 Develop zero waste plan</td>
<td>D.8 Optimize SOPs</td>
<td>D.9 Update maintenance &amp; repair plan</td>
</tr>
<tr>
<td>D.14 Develop building occupancy policy</td>
<td>D.15 Identify alternative energy opportunities</td>
<td>D.16 Develop zero net energy plan</td>
<td>D.17 Develop control system plan (e.g., enhanced data points, trends, data analysis)</td>
<td>D.18 Develop system integration plan</td>
</tr>
<tr>
<td>D.23 Develop proposals for management</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DUTIES</td>
<td>TASKS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------------</td>
<td>----------------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E. Implement Continuous Improvement</td>
<td>E.1 Present facility improvement plan to management</td>
<td>E.2 Manage vendor contracts (e.g., RFP, proposals, awards)</td>
<td>E.3 Review engineering budget (e.g., operating, capital)</td>
<td>E.4 Perform routine inspections (e.g., equipment, systems, controls)</td>
</tr>
<tr>
<td></td>
<td>E.10 Implement zero net energy plan</td>
<td>E.11 Implement system integration plan</td>
<td>E.12 Optimize control system (e.g., enhance data points, trends, data analysis)</td>
<td>E.13 Implement predictive maintenance plan</td>
</tr>
<tr>
<td>F. Manage Building Systems</td>
<td>F.1 Track utility costs &amp; consumption</td>
<td>F.2 Evaluate energy savings</td>
<td>F.3 Track equipment performance</td>
<td>F.4 Track service calls</td>
</tr>
<tr>
<td>G. Perform Administrative Tasks</td>
<td>G.1 Review test equipment and tools</td>
<td>G.2 Manage operating budget</td>
<td>G.3 Prepare monthly reports for management (e.g., energy, labor, activity)</td>
<td>G.4 Manage building energy efficiency standards</td>
</tr>
<tr>
<td></td>
<td>G.10 Assess vendor's high performance qualifications</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H. Participate in Professional Development Activities</td>
<td>H.1 Develop staff succession plan</td>
<td>H.2 Conduct staff evaluations</td>
<td>H.3 Conduct high performance job training</td>
<td>H.4 Facilitate problem solving meetings</td>
</tr>
<tr>
<td></td>
<td>H.10 Participate in conferences and trade shows</td>
<td>H.11 Participate in code update training (e.g., energy efficiency, building codes, local ordinances)</td>
<td>H.12 Share best practices (e.g., peer-to-peer, online, conferences)</td>
<td>H.13 Obtain professional certifications (e.g., CXA, LEED, BOC)</td>
</tr>
<tr>
<td>Task Description</td>
<td>Task Description</td>
<td>Task Description</td>
<td>Task Description</td>
<td>Task Description</td>
</tr>
<tr>
<td>-------------------------------------------------------</td>
<td>-------------------------------------------------------</td>
<td>-------------------------------------------------------</td>
<td>-------------------------------------------------------</td>
<td>-------------------------------------------------------</td>
</tr>
<tr>
<td>E.5 Implement high performance energy plan</td>
<td>E.6 Implement load shedding measures</td>
<td>E.7 Implement zero waste plan</td>
<td>E.8 Implement commissioning plan</td>
<td>E.9 Adjust equipment settings per occupancy plan</td>
</tr>
<tr>
<td>E.14 Review measurement &amp; verification plan</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F.5 Determine need for systems balance</td>
<td>F.6 Track maintenance and repairs</td>
<td>F.7 Track predictive maintenance</td>
<td>F.8 Review measurement &amp; verification reports</td>
<td>F.9 Monitor staff performance (e.g., service calls, preventive maintenance, rounds)</td>
</tr>
<tr>
<td>G.5 Research new technology</td>
<td>G.6 Establish staff performance goals</td>
<td>G.7 Develop green procurement policy</td>
<td>G.8 Facilitate energy efficiency meetings (e.g., staff, management, vendors)</td>
<td>G.9 Develop staff training program</td>
</tr>
<tr>
<td>H.5 Identify staff professional development activities</td>
<td>H.6 Develop vendor shadowing program</td>
<td>H.7 Develop staff training on new equipment technologies</td>
<td>H.8 Create employee engagement programs</td>
<td>H.9 Participate in professional organizations</td>
</tr>
<tr>
<td>H.14 Participate in continuing education classes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
General Knowledge and Skills

Knowledge:
Root cause analysis
Basic algebra
Basic geometry
Fluid dynamics
Thermodynamics
Mechanical systems
Lighting systems
Building construction
Systems thinking
HVAC cycle
DDC controls
Basic finance
Real estate finance
Insurance & liability
Codes and standards
Air & water balance
Psychrometrics
Plumbing systems
Electrical systems
Design intent
Building loads
Building science
Engineering ethics
Sustainability principles
Environmental impact
Available certifications

Skills:
Communication
Tool operation
Report writing
Blueprint reading
System diagrams
Single line diagrams
Flow charting
Troubleshooting
Analytical
Leadership
Negotiation
Prioritizing
Selling
Presentation
Conflict resolution
Mentoring
Managerial
Problem solving

Behaviors
Team player
Accountable
Confident
Multitasker
Analytical
Persistent
Punctual
Trainable
Passionate
Open minded
Physically fit
Innovative
Knowledgeable
Able to follow directions
Inquisitive
Precise
Safety oriented
Mechanically inclined
Self starter
Forward thinking
Solution driven

Acronyms

VFD Variable Frequency Drive
PPE Personal Protective Equipment
LED Light Emitting Diode
RFP Request for Proposal
SOP Standard Operating Procedure
BMS Building Management System
PM Preventive Maintenance
MEP Mechanical Electrical Plumbing
IEQ Indoor Environmental Quality
BAS Building Automation System
DDC Direct Digital Controls
CXA Certified Commissioning Authority
LEED Leadership in Energy & Environmental Design
BOC Building Operator Certification
Tools, Equipment, Supplies and Materials

- Light meter
- pH meter
- Tachometer
- Computer
- Calculator
- Basic hand tools
- Digital camera
- Infrared camera
- PPE
- Ladders
- Basic office supplies
- Megger
- Multimeter
- Cell phone
- Internet/Intranet
- Flash drives
- Flashlights
- Carbon dioxide meter
- Anemometer
- Manometer
- Power meter
- Temperature meter
- Flow hood
- Oxygen sensor
- Data logger
- Combustion analyzer
- Building automation system
- Lockout/tagout tags
- Man lifts
- Particulate counter
- Water quality testing equipment
- Software:
  * HOBO
  * Universal Translator
  * Microsoft Office
  * Microsoft Project
  * DOE programs
  * Visio
  * Energy Plus
- Network access to:
  * BAS
  * Tenant interface
  * PM program
  * Work order program
  * Energy dashboard
  * Google Docs
  * File sharing
- Vibration analysis
- Ultrasonic microphone
- Ultrasonic meter

Future Trends and Concerns

Trend toward:
* zero net energy
* zero waste
* on site energy generation
* use of direct digital controls
* carbon footprint reduction
* lighting controls
* big data/Internet of things
* building certifications
* variable refrigerant flow
* water conservation
* increased occupancy density
* consolidating data centers
* sub metering
* electric vehicle charging stations
* onsite energy shortage
* micro grids
* utility demand response
* smart meters
* wireless systems
* carbon dioxide monitoring
* electronic data gathering
* integration of systems

Proliferation of data centers
- Cloud data storage
- Workforce shortages
- LED lighting