Farm Energy IQ

Farm Energy Audits

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Energy Audit

• An energy audit is the process of determining energy consumption of a building or facility (Source: U.S. DOE – EERE)
• The purpose of an energy audit is to quantify energy use in a facility or operation and to prioritize opportunities for reducing energy use

Agricultural Energy Audit - Definition

• “...to determine and document current energy usage, and to provide an estimation of energy savings from alternatives in the cultivation, protection, harvesting, processing and storage of agricultural commodities and in the feeding, housing and processing of farm animals and animal products.”

Source: American Society of Agricultural and Biological Engineers Standard S612

Questions an Energy Audit Should Answer

• How much energy does the operation use?
• What are the major uses of energy?
• Why?
• What steps will reduce energy consumption?

Conducting Energy Audits

• NRCS certifies Technical Service Providers (TSPs) to conduct agricultural audits.
• NRCS provides funding for agricultural audits based on a fee structure related to size and type of operation
• ASABE S612 discusses qualifications for audit professionals
• Not only is agriculture different from commercial and industrial operations, but different sectors within agriculture use energy in very different ways

Components of an Audit

• Compilation of utility bills
• Visual inspection
• Characterization of equipment and systems
• Interviews
• On-site measurement and testing
  • Blower door
  • Power measurement
  • IR imaging
  • Hours of operation - lights and motors
• Simulation modeling
Slide 1

JS2  None of the other presentations have authorship. We should discuss whether or not we'll have a contact slide for ASPs.
     Jeannie Sikora, 1/5/2015

Slide 6

JS1  How often would this be used in agricultural audit? Might be off topic.
     Jeannie Sikora, 1/5/2015

T1  Because of the very wide diversity of agricultural operations there are certainly occasions when a blower door would help identify significant energy losses. It wouldn't be frequent, but probably worth mentioning.
     Tom, 1/14/2015
Building A:
Use: Product sales, storage, food preparation.
Area: 600 square feet

Heating: Natural gas hot air furnace
- Coleman G8T13020UHD11A furnace, 130,000 Btu/hr input,
  104,000 Btu/hr output, 80% efficient
- Ventilation: Range hood

Cooling: Coil in furnace ductwork
- Zone 1: Trane RAUC C20 20 ton air conditioner with Trane
  air handler (total of 4 hp)

Controls: 7 day thermostat
- Hot water (Natural Gas):
  - Bradford White M50036FBN 50 gallon 40,000 Btu/hr, 78%
    efficient

Facility Summary and Status
- Overview of the operation
- Building summary
  - Area
  - Use
  - Construction details
- Infrastructure summary
  - Electric supply
  - Fuels
  - Major systems

What to Expect from an Audit
- Facility summary and status
- Summary of use by application or location
- Characterization of equipment and systems
- Identification of trends
- Interviews
- Summary of energy use by energy resource
- Summary of energy costs
- Identification of peak demands
- Compilation of energy use per unit
- Inventory of equipment and systems
- Energy conservation opportunities

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Summary of Use by Application or Location

- Lighting
- Ventilation
- Refrigeration
- Milk harvesting
- Controllers
- Other motors and pumps
- Water heating
- Air heating/building environment
- Drying
- Waste handling
- Air cooling
- Cultural practices
- Storage

Summary of Use by Application (ASABE SGI12)

- Waste handling
- Air cooling
- Cultural practices
- Storage
- Water management
- Material handling
- Irrigation

Energy Cost by Location

<table>
<thead>
<tr>
<th>Year</th>
<th>Office</th>
<th>Storage Barn</th>
<th>Machinery Barn</th>
<th>Irrigation Pump</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>$2,500</td>
<td>$3,000</td>
<td>$1,500</td>
<td>$2,000</td>
</tr>
<tr>
<td>2002</td>
<td>$3,000</td>
<td>$2,500</td>
<td>$2,000</td>
<td>$1,500</td>
</tr>
<tr>
<td>2003</td>
<td>$3,500</td>
<td>$3,000</td>
<td>$2,500</td>
<td>$2,000</td>
</tr>
<tr>
<td>2004</td>
<td>$4,000</td>
<td>$3,500</td>
<td>$3,000</td>
<td>$2,500</td>
</tr>
<tr>
<td>2005</td>
<td>$4,500</td>
<td>$4,000</td>
<td>$3,500</td>
<td>$3,000</td>
</tr>
<tr>
<td>2006</td>
<td>$5,000</td>
<td>$4,500</td>
<td>$4,000</td>
<td>$3,500</td>
</tr>
</tbody>
</table>

Breakdown of Electricity Use

- Air Conditioning: 38%
- Equipment: 17%
- Chiller: 15%
- Lights: 7%
- Other: 22%

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Electrical Use by Month (2012-2014) (kWh-Hours)

- 2012/13
- 2013/14
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Energy Use by Type

![Energy Use by Type Chart](chart)

Energy Cost by Type

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Equipment Summary

- Equipment summary by location
  - Motors, refrigeration equipment, fans, pumps, other
  - Equipment capacity, efficiency, and runtime

Lighting summary by location

- Type
- Quantities
- Hours of use

Heating Equipment Summary

<table>
<thead>
<tr>
<th>Location / Area Description</th>
<th># of Heaters</th>
<th>Type of Heater</th>
<th>Btu/hr Output</th>
<th>Make / Model</th>
<th>Fuel Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Propane Boiler</td>
<td>1</td>
<td>Gas-Fired Boiler</td>
<td>300,000</td>
<td>Slant Fin GG</td>
<td>Propane</td>
</tr>
<tr>
<td>Outdoor Furnace</td>
<td>1</td>
<td>Wood-Fired Boiler</td>
<td>300,000</td>
<td>Big Eliminator 60</td>
<td>Wood</td>
</tr>
<tr>
<td>Greenhouse #1</td>
<td>12</td>
<td>Forced Hot Air</td>
<td>180,000</td>
<td>Modine</td>
<td>Propane</td>
</tr>
<tr>
<td>Greenhouse #1</td>
<td>2</td>
<td>Forced Hot Air</td>
<td>300,000</td>
<td>Reznor UPAP300</td>
<td>Wood</td>
</tr>
<tr>
<td>Greenhouse #1</td>
<td>6</td>
<td>Forced Hot Air</td>
<td>89,000</td>
<td>Reznor W596/120</td>
<td>Wood</td>
</tr>
<tr>
<td>Greenhouse #2</td>
<td>3</td>
<td>Forced Hot Air</td>
<td>180,000</td>
<td>Modine</td>
<td>Propane</td>
</tr>
</tbody>
</table>

Lighting Summary

<table>
<thead>
<tr>
<th>Location</th>
<th>Type</th>
<th>Quantities</th>
<th>Hours of Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tasting Room</td>
<td>CFL/LED Incand.</td>
<td>1,672</td>
<td></td>
</tr>
<tr>
<td>Mezzanine</td>
<td>Incandescent</td>
<td>17</td>
<td>2,608</td>
</tr>
<tr>
<td>Exit Bar</td>
<td>LED</td>
<td>120</td>
<td>98</td>
</tr>
<tr>
<td>Exit Rope Bathroom</td>
<td>LED</td>
<td>1,381</td>
<td></td>
</tr>
<tr>
<td>Closet Office</td>
<td>LED</td>
<td>1,315</td>
<td></td>
</tr>
<tr>
<td>Winery Lab/Office</td>
<td>T8</td>
<td>1,050</td>
<td></td>
</tr>
<tr>
<td>Exterior Lighting</td>
<td>HID</td>
<td>1,870</td>
<td></td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Location</th>
<th>Recommended Measures</th>
<th>Electric Savings (kWh)</th>
<th>Propane Savings (Gal)</th>
<th>Installed Cost</th>
<th>Energy Cost Savings</th>
<th>Payback (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tasting Room</td>
<td>Replace incandescent bulbs with LEDs</td>
<td>3,403</td>
<td></td>
<td>$650</td>
<td>$851</td>
<td>0.8</td>
</tr>
<tr>
<td>Lab</td>
<td>Replace T-12 fluorescent fixtures with T-8 fixtures</td>
<td>197</td>
<td></td>
<td>$200</td>
<td>$750</td>
<td>0.8</td>
</tr>
<tr>
<td>Winery</td>
<td>Replace T-12 fluorescent fixtures with T-8 fixtures</td>
<td>1,686</td>
<td></td>
<td>$11,400</td>
<td>$11,700</td>
<td>3.6</td>
</tr>
<tr>
<td>Winery</td>
<td>Replace T-12 fluorescent fixtures with T-8 fixtures</td>
<td>1,500</td>
<td></td>
<td>$160</td>
<td>$255</td>
<td>3.9</td>
</tr>
<tr>
<td>Small Office</td>
<td>Replace refrigerator</td>
<td>450</td>
<td></td>
<td>$800</td>
<td>$355</td>
<td>7.9</td>
</tr>
<tr>
<td>Winery</td>
<td>Replace chiller</td>
<td>0.17%</td>
<td></td>
<td>$7,000</td>
<td>$12,000</td>
<td>1.6</td>
</tr>
<tr>
<td>Lab</td>
<td>Replace hot water heater with 90% efficient heater</td>
<td>54</td>
<td></td>
<td>$2,500</td>
<td>$2,850</td>
<td>12.9</td>
</tr>
</tbody>
</table>

Current vs. Proposed Propane Use

Current vs. Proposed Electricity Use

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Questions?