Drive Down Your Electric Bill With Energy Efficiency.

Presenter: Rick Thibodeau
Efficiency Vermont
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• This is an energy intensive industry and it will always be energy intensive.

• It is tough to make payroll, maintain your equipment, compete in today’s market and stay current with new technologies.

• There are cost effective steps that you can take to reduce your fixed energy costs.
• You can reduce your fixed costs!

• I invite you to listen, ask questions and think how you can apply these energy efficiency measures to your operation.

• This workshop presentation will cover the most cost effective measures.
Today's Workshop

1. Brief look at rate structures, demand charges, energy charges and power factor penalties.

2. Variable Frequency Drives (VFD’s).
   - Applications
   - Misapplications

3. Compressed air systems.
   - Compressors and system components.
   - Air Dryers
   - Leak repair

4. Lighting
   - Federal regulation changes
   - Retrofits
   - Controls
   - New Technologies.

5. Motors
   1. Efficient motor opportunities

   - Envelope
   - EVT HPF incentives.
Rate Structures

• Small usage customers pay per kWh. Time of day makes no difference.

• Large usage pay additional demand charge for kW peak.
  • Single shift operations. This may be significant portion of total cost.

• Large users rates change by time of use.

• Large loads may also be subject to power factor penalty.
Demand Rate Structures.

- KW demand is calculated on a 15 minute Average.
- Peak demands are never set during motor start-up.

200 hp motor

Soft start

20 secs total start time.

Time in Seconds
Demand Reduction Strategies.

1. Efficiency measures that reduce kW, on essential equipment and thus on during plant operation, always reduces demand and save energy.
   - Lighting is the best example.
   - Efficient motor.
   - Efficient transformer.
   - Any permanent kW reduction that normally runs when the peak demand is set.
Demand Reduction Strategies.

2. Efficiency measures that modulate equipment more efficiently can save significant energy and may reduce demand. Very equipment and time dependent.

- Air compressor controls.
- VFD’s.
- Lighting controls.
- HVAC controls.
Demand Reduction Strategies.

3. Load shifting to off peak hours will reduce demand. May not save energy.

- Storing scrap and running chipper when plant is off.
- Delaying any operation to off peak hours.
- Limiting demand by shedding load.

Load Duration Histogram

$20,000 annual savings by shedding load for 45 hours total. Worse day was 6 hours.

Peak 1420 kW

above 1300 kW

total 45 hours
Recovering cost through demand response contract.

- Demand response companies will pay end users to shed load when required.

- If you have the ability to shed a reasonable size load consider checking into one of these contracts.
Power Factor Penalties.

- If you have a power factor penalty charge on your utility bill.
- Contact your utility representative.
- There is generally a one year payback for correcting this.
- Power factor correction does not save energy. Efficiency Vermont does not offer incentives of power factor correction.
Variable Frequency Drives.

VFD’s do one thing.

- Only saves energy when the motor load is slowed.

- Energy savings are best when applied to centrifugal fans or centrifugal pumps.
VFD in Sawmill Head Saw Carriage.

Load duration histogram of hydraulic carriage drive.

This system consumed 93 kW when not moving. Annual energy consumption 217,000 kWh. Regenerative drive VFD was installed. Estimated savings 200,000 kWh with 94 kW demand reduction. Efficiency Vermont provided custom analysis and incentives.
Dust Collection Systems.

Typical low-pressure pneumatic conveying (blower) system
VFD in Sawmill Boiler fans and kiln fans.

- **Good energy savings in boiler fan controls.**
  - Efficiency Vermont would supply custom analysis and incentives.
  - Saving on boiler feed pump are limited due to high header pressure.

- **VFD on kiln Fans.**
  - Savings are dependent on type of kiln and type of product.
  - Can be significant on hardwood kilns. (Varies with Species)
  - Custom Efficiency Vermont analysis and incentives.
Some Efficiency Vermont Prescriptive Rebates.

<table>
<thead>
<tr>
<th>Form Section #</th>
<th>Standard Rebates – Heating, Ventilation &amp; Air Conditioning (HVAC)</th>
<th>Customer Rebate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Unitary Air Conditioning &amp; Split Systems</td>
<td>$50 - $100/ton</td>
</tr>
<tr>
<td>2</td>
<td>Integrated Dual Enthalpy Economizer Controls</td>
<td>$250/controller</td>
</tr>
<tr>
<td>3</td>
<td>Water Source Heat Pumps</td>
<td>$60/ton</td>
</tr>
<tr>
<td>4</td>
<td>Ventilation Fans</td>
<td>$35 - $60/fan</td>
</tr>
<tr>
<td>5</td>
<td>Variable Frequency Drives (VFDs)</td>
<td>$500 - $1,200/VFD</td>
</tr>
<tr>
<td>6</td>
<td>Boilers (Liquid Propane &amp; #2 Fuel Oil Only)</td>
<td>$2/MBh</td>
</tr>
<tr>
<td>7</td>
<td>Furnaces (Liquid Propane &amp; #2 Fuel Oil Only)</td>
<td>$2/MBh $100/ECM (All Fuels)</td>
</tr>
<tr>
<td>8</td>
<td>Furnace Fan Motors (Residential Install Only)</td>
<td>$100/motor</td>
</tr>
</tbody>
</table>

VFD’s in HVAC systems. Products must meet our efficiency requirements.
Misapplications of VFD's.

• **Motor soft-starters.**
  - VFD’s consume 2 to 3% of the total motor rating.
  - If used solely for soft-start then install bypass relays.

• **Motor loads that do not vary over time and cannot be slowed down.**

• **Pumping applications with high static head pressure.**

For more information visit [http://www.cee1.org/](http://www.cee1.org/)
For More information on VFD’s visit.

**ASDMaster software**

A description and ordering information for the software on U.S. DOE’s Industries of the Future BestPractices website (scroll down to the ASDMaster entry under Software).

http://www.oit.doe.gov/bestpractices/just_need/motors.shtml


This website contains tip sheets, case studies, and technical reports on motors and drives efficiency practices.

http://www.oit.doe.gov/bestpractices/just_need/motors.shtml
Compressed Air Systems.

**TYPICAL COMPRESSED AIR SYSTEM**

1. **COMPRESSOR**
   - Variable frequency drive (VFD) compressors are the most efficient option for variable loads below 90% capacity, using less energy than modulating compressors. Reciprocating compressors often come mounted on a tank (as shown on bottom).

2. **FILTER**
   - Low-pressure-drop filters save energy by allowing a lower pressure set point at the compressors.

3. **DRYER**
   - Cycling refrigerated dryers run as determined by the airflow instead of operating continuously.

4. **RECEIVER/STORAGE TANK**
   - A properly-sized receiver/storage tank saves energy when coupled with a load/no-load compressor. It also enables a VFD compressor to provide more stable system pressure.

5. **MAIN PLANT MANIFOLD**
   - The manifold and piping should be properly designed and sized so as not to restrict air flow or cause an excessive drop in pressure.

6. **AIRHOS & NOZZLE**
   - Air-entraining air nozzles use less air to do the same amount of work as standard nozzles.

7. **Quick Disconnect**
   - High-quality disconnects reduce air leaks.

8. **NO-LOSS DRAINS**
   - No-loss drains throughout the system only allow condensate to escape—not valuable compressed air.
Efficiency Vermont Incentives.

<table>
<thead>
<tr>
<th>Form Section #</th>
<th>Standard Rebates - Compressed Air Systems View the Compressed Air Systems Rebate Form for details, qualifying efficiency specifications &amp; terms.</th>
<th>Customer Rebate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Variable Frequency Drive (VFD) Screw Compressors</td>
<td>$1,400 - $3,200 (depending on HP)</td>
</tr>
<tr>
<td>2</td>
<td>Air Receiver Tanks for Load/No-Load Screw Compressors</td>
<td>$350 - $1,300 (depending on HP/Tank Size)</td>
</tr>
<tr>
<td>3</td>
<td>Cycling Refrigerated Thermal Dryers</td>
<td>$100 - $350 (depending on CFM)</td>
</tr>
<tr>
<td>4</td>
<td>No-Loss Drains &amp; Air-Entraining Air Nozzles</td>
<td>$100/drain or $5/nozzle</td>
</tr>
</tbody>
</table>

Products must be on our eligible products list. Call or visit our Website. We also have custom incentives.
Compressed air system operation.

• Set system header pressure at minimum possible.
  • Every 2 PSI reduction saves 1% of system energy.

• Keep leaks to a minimum.
  • Repairing leaks can solve pressure drop issues which would allow header pressure reduction.

• Do not dry air more than required.
  • Air dryers are often set below the required dew point.

• For one shift operations over 100 hp.
  • Efficiency Vermont will cost share a compressed air audit on a 50% basis. This requires pre-approval. Call before committing to an audit.
Changes to Lighting Regulations.

- Now is the best time to replace outdated lighting systems.

The U.S. Department of Energy passed regulations that ban the manufacture of T12 fluorescent lamps for sale in the U.S. after July 14, 2012. As a result, conventional replacement T12 lamps will no longer be available for purchase, and businesses using T12 lighting systems will need to upgrade to a more efficient lighting system at some point after July 14, 2012. Efficiency Vermont is offering increased rebates to replace these lighting systems through December 1, 2011.
Current Rebates at Efficiency Vermont. Offer ends December 1, 2011.

- Replace old lighting systems now and take advantage of this offer from Efficiency Vermont. Through the newLIGHT program, businesses can:
  - Receive significantly enhanced rebates on eligible efficiency upgrades.
  - Reduce lighting energy costs by saving 25 to 50% or more in energy use for each upgraded fixture.
- Projects eligible for the newLIGHT Enhanced Rebates Program include:
  - T12 Upgrades and Controls
  - HID High-Bay Upgrades and Controls
  - Exit Sign Upgrades
## LED Rebates

<table>
<thead>
<tr>
<th>Form Section #</th>
<th>Rebates - LED Lighting</th>
<th>Premium Rebate / Bulb</th>
<th>Standard Rebate / Bulb</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1</td>
<td>LED Screw- &amp; Pin- Based Bulbs</td>
<td>$20 - $40</td>
<td>$16 - $32</td>
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<tr>
<td>5.2</td>
<td>LED Recessed &amp; Surface/Pendant-Mounted Downlight Fixtures</td>
<td>$50</td>
<td>$40</td>
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<tr>
<td>5.3</td>
<td>LED Track Lighting Fixtures</td>
<td>$75</td>
<td>$60</td>
</tr>
<tr>
<td>5.4</td>
<td>LED Wall-Wash Light Fixtures</td>
<td>$30</td>
<td>$24</td>
</tr>
<tr>
<td>5.5</td>
<td>LED Portable Desk/Task Light Fixtures</td>
<td>$25</td>
<td>$20</td>
</tr>
<tr>
<td>5.6</td>
<td>LED Undercabinet Shelf-Mounted Task Light Fixtures</td>
<td>$15/foot</td>
<td>$12/foot</td>
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<tr>
<td>5.7</td>
<td>LED Outdoor Pole/Arm-Mounted Parking &amp; Roadway Fixtures</td>
<td>$100 - $300</td>
<td>$80 - $240</td>
</tr>
<tr>
<td>5.8</td>
<td>LED Outdoor Pole/Arm-Mounted Decorative Parking &amp; Roadway Fixtures</td>
<td>$100 - $300</td>
<td>$80 - $240</td>
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<tr>
<td>5.9</td>
<td>LED Parking Garage &amp; Canopy Fixtures</td>
<td>$100 - $300</td>
<td>$80 - $240</td>
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<tr>
<td>5.10</td>
<td>LED Outdoor Wall-Mounted Area Fixtures (Wall Packs)</td>
<td>$100 - $200</td>
<td>$80 - $160</td>
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<tr>
<td>5.11</td>
<td>LED Bollard Fixtures</td>
<td>$100 - $200</td>
<td>$80 - $160</td>
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<tr>
<td>5.12</td>
<td>LED Refrigerated Case Light Fixtures</td>
<td>$25/foot</td>
<td>$20/foot</td>
</tr>
</tbody>
</table>

*View the [Commercial Lighting Rebate Form](#) for details, qualifying efficiency specifications & terms.*
Don’t Buy Just Any LED

Efficiency Vermont premium rebates are available for high-performing LED products qualified through ENERGY STAR® or the DesignLights ConsortiumTM (DLC).

Additionally, many LED products are eligible for standard rebates – those meeting the Efficiency Vermont performance criteria and listed with Lighting Facts.

Check the LED Commercial Eligible Products Guide below the table for eligible products.
Lighting Systems operation.

- The best way to save lighting energy is to turn it off when not needed.

- Install occupancy sensors in appropriate locations. Should control at least 75 Watts to make in cost effective.
Efficient Motors

- In December 2010 federal regulations made premium efficient motors a manufacturing requirement.
  - This applied to Class A or B, foot mounted 1hp to 200 hp.
  - There are motors that exceed these efficiencies.

The same legislation required an increase in efficiency for other classes of motors. U-Frame motor

- design C motor, close-coupled pump motor
- footless motor
- vertical solid-shaft normal thrust motor (tested in a horizontal configuration)
- 8-pole motor (900 rpm) poly-phase motor with voltage of no more than 600 volts (other than 230 or 460 volts)
New Motors and rewinds.

- When purchasing a new motor always buy the most efficient available.
  - The differential cost is generally small and the payback can be fast.
- Retrofitting an existing 3-phase motor, with an efficient motor, can have a long payback. For a reasonable payback the motor should have 6000 annual operating hours and be heavily loaded.
- If rewind is only option be certain the rewind shop follows best practices. Ordering a rewind to be completed quickly may cause best practices to be ignored.
For more information.

• For a list of motors that exceed premium efficiency:
  http://www.cee1.org/ind/motrs/CEE_MotorsListApril2010a.xls

• For information on motors:
  http://www.eere.energy.gov/industry/bestpractices/pdfs/NN0116.pdf

• Excellent explanation on motors see Cowern Papers at:
**Eligibility Requirements | Commercial Installation Only**

- For space heating applications only.
- Liquid Propane (LP) gas and #2 fuel oil only.
- Custom incentives and savings analysis available for boilers >500 MBh and for non-space heating applications.

**Fill Out Below**

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model #</th>
<th>Fuel Type (check one)</th>
<th>Efficiency % (AFUE or ET)</th>
<th>Connected to AC? (check one)</th>
<th>A = Unit Capacity (MBh output)</th>
<th>B = Rebate/MBh</th>
<th>A x B = Rebate Amount</th>
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<tbody>
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<td>LP</td>
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<td>Yes</td>
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<td>$2</td>
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<td>Oil</td>
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</tbody>
</table>

*(For natural gas service and rebate availability, contact Vermont Gas Systems at 802-863-4511, ext. 321.)*

<table>
<thead>
<tr>
<th>Size (MBh output)</th>
<th>Minimum Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;300 MBh</td>
<td>85% AFUE</td>
</tr>
<tr>
<td>≥300 - 500 MBh</td>
<td>87% ET</td>
</tr>
</tbody>
</table>
# Furnaces

For natural gas service and rebate availability, contact Vermont Gas Systems at 802-863-4511, ext. 321.

**Eligibility Requirements | Commercial Installation Only**
- For space heating applications only.
- Liquid Propane (LP) gas and #2 fuel oil only.
- Custom incentives and savings analysis available for furnaces >500 MBh and for non-space heating applications.

ECM® Rebate (all fuel types): $100/Motor

<table>
<thead>
<tr>
<th>Fuel Type</th>
<th>Size (MBh output)</th>
<th>Minimum Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid Propane (LP)</td>
<td>&lt;225 MBh</td>
<td>90% AFUE</td>
</tr>
<tr>
<td>Liquid Propane (LP)</td>
<td>≥225 - 500 MBh</td>
<td>82% ET</td>
</tr>
<tr>
<td>#2 Fuel Oil</td>
<td>225 MBh</td>
<td>85% AFUE</td>
</tr>
<tr>
<td>#2 Fuel Oil</td>
<td>≥225 - 500 MBh</td>
<td>82% ET</td>
</tr>
</tbody>
</table>

## Fill Out Below

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Model #</th>
<th>Fuel Type (check one)</th>
<th>Efficiency % (AFUE or ET)</th>
<th>Connected to AC? (check one)</th>
<th>A = Unit Capacity (MBh output)</th>
<th>B = Rebate/MBh</th>
<th>C = $100 ECM Rebate (if applicable)</th>
<th>A x B + C = Rebate Amount</th>
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<td>Oil</td>
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</tr>
</tbody>
</table>

$2
Wood Pellet Heating Systems.

### CENTRAL WOOD PELLET BOILERS & FURNACES (≤ 300 MBH)

#### Eligibility Requirements
**Residential & Small Commercial Installations Only**

*Note: Work with your contractor to ensure that your project meets all eligibility requirements.*

<table>
<thead>
<tr>
<th>System Type</th>
<th>Unit Size (MBh output)</th>
<th>Minimum Efficiency*</th>
<th>Minimum Heat Load Covered**</th>
<th>Rebate/ System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boiler/Furnace</td>
<td>≤ 300</td>
<td>80% ET</td>
<td>70%</td>
<td>$1,000</td>
</tr>
</tbody>
</table>

*Thermal efficiency at peak load based on higher heat value method. Proof of high heat value required (see Page 5).**

**Complete and submit heat load calculation sheet on Page 4 with rebate form.
Thank You