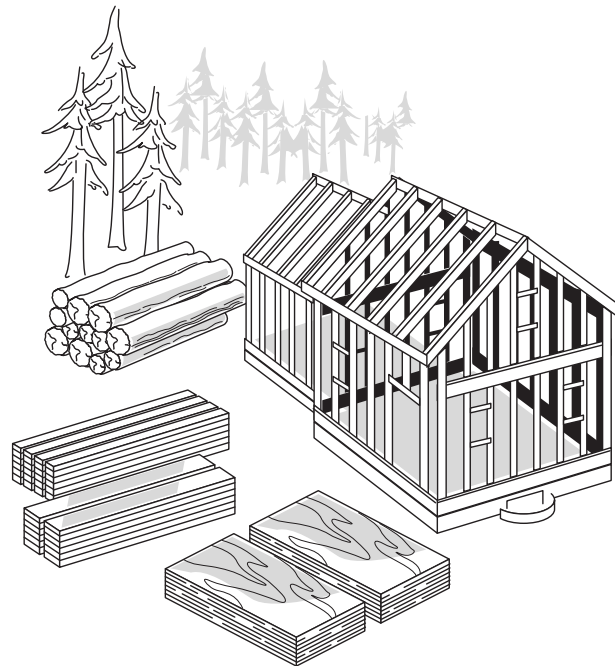


Reduce Energy Use at Lumber & Wood Processing Facilities

- Machinery
- Heating
- Compressed Air
- Motors
- Lighting

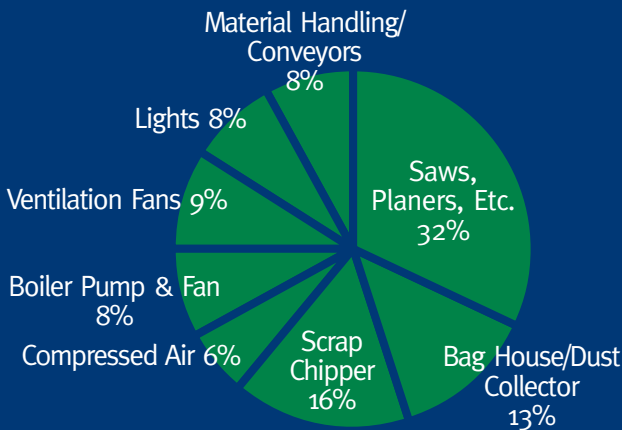
This publication will help you identify cost-saving opportunities in your lumber or wood processing facility and guide you in undertaking a program to improve your bottom line through energy-efficient upgrades.



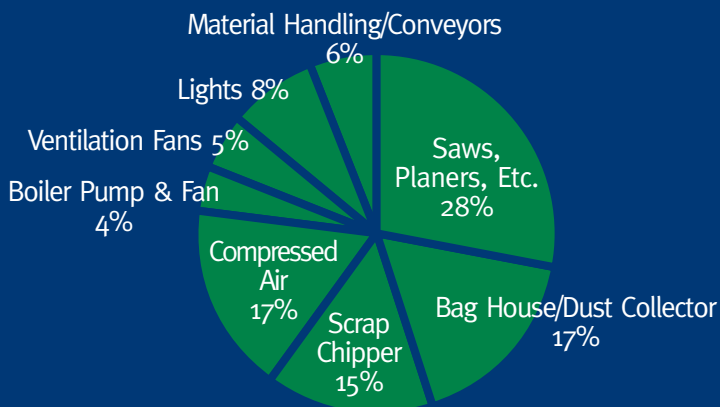
The lumber and wood processing industries are important to Vermont. These plants typically have considerable energy costs, which means they have opportunities to benefit from improved efficiency. One furniture manufacturer recently installed a variable frequency drive on a wood planer, reducing annual electricity costs by \$9,700. The facility invested about \$11,000 and Efficiency Vermont contributed about \$1,800 to the project cost. The project yielded a 75% internal rate of return and has enabled the facility to increase its finished product with lower energy use.

What wood processing equipment uses the most energy at different facilities?

Typical Wood Processing: Electric Use for a Sawmill



Typical Wood Processing: Electric Use for a Furniture Manufacturer



Electricity Users

Wood cutting and shaping machinery (saws, molders, planers) and dust and scrap processing represent the major electricity uses in most sawmills. In facilities where finished consumer products are manufactured and assembled, compressed air generation represents another major electric end use.

While energy usage profiles vary from plant to plant, the charts to the left show typical breakdowns of electric use in a sawmill that processes logs or cants into planed dimensional lumber and for a furniture manufacturing facility. Production of plywood or hardwood veneer has a profile similar to that of a sawmill.

Fuel Users

Wood processors are unique in that the scrap created in the process can be burned to serve the facility's heating needs, for both process heating and space heating. The main heating requirement in wood processing facilities is the kiln, where green wood is dried in a controlled atmosphere to achieve the desired moisture content. A typical arrangement is that scrap wood is chipped and burned to fuel the steam boiler. The steam is used to provide heat in the kiln.

In the absence of a wood chip-fired boiler, heating oil or natural gas may be used as a heat source, with additional fossil fuel used for space heating in areas not near the kiln. Opportunities may exist to reduce fuel use by recovering heat from the kiln's exhaust air.

An example of how a Vermont facility is REDUCING COSTS FOR A RIP SAWING OPERATION

Conditions: The plant uses a circular saw with a 3/16" thick blade to cut dimensional lumber. The saw is driven by a 30 hp motor and runs 2,000 hours per year.

Improvement: Reduce the kerf of the saw blade by 0.035", a 19% reduction. Energy costs are reduced proportionately.

Benefits: Plant electric bills are reduced by \$533 per year. Less sawdust is produced, and yield increases.

Costs and Savings

Annual electricity savings	6,266 kWh
Electricity cost savings	\$533
Installation cost	\$1,000
Incentive from Efficiency Vermont	\$250
Net installation cost	\$750
Payback period	1.4 years

Machinery

1. Take advantage of heat recovery

A significant amount of kiln waste heat can be reclaimed for other uses, such as water heating, makeup air heating, space heating and process heating. Air-cooled air compressors offer a simple means of heat recovery. In the winter, you can duct compressor cooling air indoors to heat other areas of the plant. In the summer, manually reposition a damper to duct the waste heat outside.

2. Use narrow kerf or band sawing technology

Compared to standard kerf circular saws, narrow kerf circular saws and band saws can reduce the energy used in cutting, as well as increase yield and reduce the amount of sawdust produced by the process. The energy required to make the cut is directly proportional to the width of the cut, so a 15% reduction in blade kerf can reduce cutting energy by the same amount. The increased yield of the sawing operation may be even more valuable to the mill owner than the energy savings.

3. Switch off motors that are not in use

Many applications in wood processing require electric motors, which may run continuously even when the product passes through intermittently. Automatic controls may be installed to shut off motors when they are not in use, or improvements in material handling may allow for the continuous use of motors.

4. Install synchronous (toothed) drive belts

Belt-driven machinery is typically equipped with V-belts. Synchronous belts with toothed faces are up to 98% efficient, compared to around 93% for V-belts, mainly because belt slip is eliminated. Conversion from V-belts is not difficult; many different sizes of sheaves, pulleys and belts are available.

Compressed Air

Facilities in the wood processing industry typically use 6% to 17% of their total electricity requirements to make compressed air. Because electricity is responsible for upward of 75% of the lifetime operating cost of an air compressor, typical compressed air improvements provide quick payback on investments while reducing operating costs. Several cost-effective improvements are described below, ranked in order of typical payback time.

1. Repair leaks

In industrial facilities that do not have regular leak detection and repair programs, as much as 30% of the

compressed air used in the plant can be attributed to leaks. A properly implemented leak detection and correction program with regular follow-up can reduce a facility's compressed air demand 5-10%. Efficiency Vermont can assist you with an initial leak detection and repair effort, which usually pays for itself in a matter of months with reduced energy bills. Because old leaks come back and new ones occur, it is essential to check for leaks regularly to capture the savings. However, once a leak correction program is in place, the cost of ongoing leak maintenance is low and well worth the effort. An additional benefit for facilities with high leakage rates is that fixing existing leaks and reducing inappropriate uses of compressed air can often eliminate the need for purchasing additional compressors, even when new production equipment is being installed. If you are planning to purchase a new compressor, it makes sense to institute a leak detection and correction program beforehand. This will reduce your overall air demand, and can possibly save capital costs if you can select a smaller compressor to meet your air requirements.

2. Eliminate inappropriate end uses

Making compressed air uses about four times as much energy as the work output of any end use. Eliminating inappropriate applications of compressed air can result in quick paybacks. Examples of potentially inappropriate uses are open or unregulated blowoff, venturi vacuum pumps, diaphragm pumps and timer-controlled condensate drains. The use of engineered nozzles, cam- or timer-operated valves and regulated compressed air delivery where blowoff is required will usually pay back costs in six months to two years. An electric-driven pump uses only about 20% of the electrical input of comparable compressed air-driven equipment, providing opportunities for a cost-effective retrofit. Level-actuated condensate drains remove moisture without wasting compressed air.

3. Maintain efficient operation of pneumatic tools and accessories

In facilities where many pneumatic tools are used, proper maintenance, selection and adjustment of these tools can reduce compressed air demand, saving energy. Furniture assembly plants will often use pneumatic nailers, staplers, sanders and paint or stain spraying equipment. Operators may frequently identify low air pressure as the cause of improper equipment operation, but usually other factors, such as dirty or improperly adjusted tools, are the culprits. To ensure efficient operation, clean and adjust tools frequently, and install local pressure regulators and adjust them to the minimum pressure that allows satisfactory operation of the equipment. For equipment that

intermittently requires large volumes of compressed air, consider installing dedicated storage at the end use equipment to prevent system-wide pressure sags. Dedicated storage may also allow you to operate your entire compressed air system at a lower pressure, saving additional energy. Flexible hoses and quick-disconnect fittings that supply pneumatic tools are prime candidates for compressed air leaks. Implement a preventive maintenance plan to regularly check for and replace worn, cracked or leaky hoses and fittings. When purchasing new equipment, resist the temptation to select oversized tools that will use more air than is necessary for the job.

4. Install efficient equipment and controls

New rotary screw compressors are available with a variety of energy-saving features, including part-load controls, multiple stages of compression and automatic sequencing. On models 25 hp and larger, efficient part-load control is usually available, and is a cost-effective upgrade from standard modulating inlet valve controls, especially when compressed air demand varies. Variable speed drive (VSD), turn valve, and load/unload are three widely available examples of efficient part-load control. If the typical demand is 70% of the compressor's rated output, load/unload control with proper storage capacity can reduce energy use by 10% compared to modulating control, and VSDs and turn valve control can offer even greater savings. On compressors greater than 100 hp, two-stage machines are more efficient than single-stage alternatives. Automatic sequencing controls operate the most efficient combination of compressors to meet the load while maintaining plant pressure requirements. Depending on the installation, these types of capital equipment improvements have paybacks of three to eight years, and are the most cost effective to implement when you are already planning to make new equipment purchases.

5. Increase air storage

Additional storage capacity can help reduce inadvertent running of a trim compressor to satisfy momentary surges in demand. Properly sized air storage capacity also is essential for efficient part-load control, and will reduce the frequency of compressor unloadings, which waste compressed air. A good rule of thumb for oil-flooded compressors is to install 4 gallons of storage for every cubic feet per minute (cfm) of compressor capacity. System-wide pressure regulators, often called demand expanders, should be installed to maximize the effectiveness of storage capacity.

An example of how a Vermont facility is REDUCING BOILER FEEDWATER PUMP COSTS

Conditions: A wood-fired boiler using a 40 hp feedwater pump provides steam to a kiln. The pump runs whenever the boiler operates, and flow is controlled by a modulating valve at the discharge of the pump. The boiler is estimated to run 4,000 hours per year, and the average load is 75%.

Improvements: Install a variable speed drive on the feedwater pump, and control pump speed to maintain boiler water level.

Benefit: Plant electric bills are reduced by \$2,845 per year.

Costs and Savings

Annual electricity savings	33,467 kWh
Electricity cost savings	\$2,845
Installation cost	\$13,500
Incentive from Efficiency Vermont	\$3,375
Net installation cost	\$10,125
Payback period	3.6 years

An example of how a Vermont facility is REDUCING DUST COLLECTION COSTS

Conditions: The plant uses a centralized dust collection system that serves 10 pieces of equipment. The operation runs 4,000 hours per year. The blower is served by a 75 hp motor. The fan runs at 80% of nameplate power. Investigation of the system reveals that the blower is sized for 10% more flow than is actually required for all 10 machines. On average only 8 of the 10 machines run at one time.

Improvement: Optimize the operation of the blower with a variable speed drive (VSD) and automatic slide gates at each machine. Because the equipment is oversized, blower speed can be reduced by 10% even if 10 machines are running. When fewer machines are in operation, a static pressure sensor installed in the main ductwork will further reduce motor speed. The average blower airflow is reduced to 73% of the initial value.

Benefit: Plant electric bills are reduced by \$5,780 per year.

Costs and Savings

Annual electricity savings	67,996 kWh
Electricity cost savings	\$5,780
Installation cost	\$21,500
Incentive from Efficiency Vermont	\$5,375
Net installation cost	\$16,125
Payback period	2.8 years

Motors

National Electrical Manufacturers Association (NEMA) premium energy-efficient motors should be purchased when replacing or upgrading any continuous-duty motors in the facility. An improvement in energy efficiency from baseline to premium can result in an annual electrical savings. The range of savings will depend on motor size, runtime and type. Some examples of motor savings for Totally Enclosed Fan Cooled (TEFC) continuous-duty motors are listed here:

Efficiencies	Motor Size	Annual Electricity Savings*	Incentives
Baseline Premium			
90% 92%	10 hp	\$120	\$100
92% 94%	30 hp	\$350	\$150
94.5% 95.8%	100 hp	\$725	\$400

*\$.1034 per kWh

Lighting

Recommended light levels for wood processing vary between 10 and 200 footcandles (fc), depending on the use of the space. Product inspection and quality control areas usually require the highest light levels, whereas warehouse areas and other processing areas use lower levels.

Manufacturing facilities are often lit to provide a constant light level throughout. This approach wastes energy in overlit spaces and may result in underlighting of critical task areas, potentially reducing productivity and affecting quality assurance. Lighting system upgrades can reduce overall lighting usage to less than 1 watt per square foot in many manufacturing facilities.

New lighting technologies make it cost effective for you to retrofit or replace existing fixtures and bulbs with energy-efficient models. For example, a one-for-one replacement of standard 4-foot T-12 fluorescent lamps and ballasts with new T-8 lamps and electronic ballasts will reduce energy use by as much as 25%, while providing equivalent light output. New 320-watt pulse-start metal halide fixtures provide light output equal to that of 400-watt metal halides. This retrofit can reduce fixture energy use (including ballast energy) by 20%.

You can further reduce lighting power use with proper lighting design. Reduce or eliminate lighting demands in certain areas by incorporating daylight into new and renovated buildings and by using photosensors that automatically control lighting fixtures in response to natural sunlight. Occupancy sensors can automatically turn off or dim lights in intermittently occupied areas, such as warehouse aisles.

Lighting fixture output is reduced by dust. Select fixtures that are easy to clean and install them in accessible locations to ease dust removal. Clean fixtures regularly and at minimum when changing bulbs.

REDUCE ENERGY USE

Variable Speed Drives

With a variable speed drive (VSD), you can adjust motor speeds to match the actual workload of your process. Unlike constant-speed motor starters, which operate the motor at full speed at all times, a VSD operates at speeds selected and adjusted by an operator or through automatic controls. This speed control can result in improved operation in many applications.

Energy savings with a VSD can be surprisingly high, because energy use is often proportional to the cube of the motor speed. For example, in closed-circulation systems, using a VSD to reduce motor speed to 75% reduces the motor's energy use by more than half. In open systems that require a lot of pressure, energy use is more closely proportional to motor speed.

SPECIFIC VSD APPLICATIONS INCLUDE:

Dust Collectors/Bag Houses: Centralized collectors that remove dust or chips from multiple pieces of machinery have blowers that are sized for the worst-case scenario of all machines running at the same time. This represents an opportunity for energy savings. Further, the dust collection equipment may be oversized compared with the actual maximum requirements for flow and static pressure, in which case operators can adjust the maximum allowable drive speed to achieve savings during all operating hours. When only some of the machines are running, you can use the VSDs to further reduce the blower speed while still maintaining sufficient airflow for dust removal. Automatic slide gates or dampers installed at each machine close when an individual machine is not in use.

Fan Motors: Ventilation and cooling fans are often designed for worst-case conditions, which may occur only a few hours per year. By installing a VSD, you can run the fan at all other times at slower speeds to reduce energy use while maintaining process conditions and physical comfort for the operators. Air handler motors on kilns also present excellent savings opportunities.

An example of how a Vermont facility is REDUCING DRIVE BELT LOSSES

Conditions: The mill uses a 40 hp motor to drive a circular saw with a V-belt arrangement. The motor is 80% loaded and runs for 3,000 full load hours in a year.

Improvement: Install a synchronous (toothed) belt drive to improve belt efficiency.

Benefit: Plant electric bills are reduced by \$334 per year.

Costs and Savings

Annual electricity savings	3,929 kWh
Electricity cost savings	\$334
Installation cost	\$750
Incentive from Efficiency Vermont	\$188
Net installation cost	\$562
Payback period	1.7 years

Develop Your Energy Action Plan

- 1.** Review the measures described in this brochure with your operations staff and equipment vendors. Identify opportunities for savings, define the scope of your improvement project, obtain cost estimates and establish staffing and funding availability for your project.
- 2.** If your plant hasn't instituted a leak detection and correction program for your compressed air system, sign up for Efficiency Vermont's leak detection training and the loan of a detector to help you get started with some low-cost energy savings.
- 3.** Review your motors with your plant electrician. Identify any motors that have potential for a VSD installation. Contact your motor vendor for pricing information, then contact Efficiency Vermont for an estimate of energy savings and financial incentives before proceeding. We will do an independent analysis of the savings to ensure you have accurate information about the benefits of the project. We can also provide metering in areas where the savings potential is unclear.
- 4.** Contact Efficiency Vermont for energy savings estimates, for technical assistance in identifying the most cost-effective equipment and for financial incentives before you begin installation.
- 5.** We must have a written agreement in place with the customer prior to equipment installation in order for us to provide incentives. For more information, call Efficiency Vermont toll-free: 1-888-921-5990.
- 6.** Contact Efficiency Vermont when:
 - Plans and specifications are developed for an upgrade or addition to your facility;
 - You have identified the contractors you plan to hire to implement the project(s);
 - You are improving your current operations or making additions to the facility;
 - You need help locating required equipment and identifying the leading energy-efficient processes in your business;
 - You are commissioning a project after installation to ensure proper operation of the equipment;
 - You are looking for qualified energy efficiency contractors and equipment vendors;
 - You need energy-savings and cost analysis on projects under consideration for your next budget cycle.



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