

## 2.0 Energy Conservation and Use Opportunities

Ski areas consume large amounts of energy to make snow, operate lifts, pump snowmaking water, and operate vehicles. Ski area buildings such as lodges, rental shops, administrative buildings, restaurants, ticket sales, and retail shops consume significant amounts of energy for illumination, heating, cooling and ventilation. Consequently, energy use can be among a ski area’s largest regular expenses. Ski areas that focus on energy conservation opportunities can significantly reduce monthly operating costs and greenhouse gas emissions.

### Developing an Energy Master Plan

Developing an energy master plan involves integrating energy management into every aspect of your organization—from goal setting to training, tracking and reporting. To be successful, an energy master plan should not only consider energy efficient equipment, but also consider the way the equipment is used and maintained as well as the energy use habits of employees and guests. It is also important to communicate your energy savings and greenhouse gas emission reductions, and to look for opportunities to increase the use of renewable energy sources; to document and communicate your energy savings; and, reduce greenhouse gas emissions and contribute to a safer, healthier environment.






Energy management techniques generally fall into four categories:

1. Eliminating waste by turning it off, turning it down or controlling it (for example, turning off lights when not in use, setting back thermostats at night)
2. Reducing the amount of energy used by equipment or maintenance processes (for example, purchase energy efficient equipment)
3. Recovering energy that would otherwise be lost (for example, heat recovery on refrigeration and other equipment)
4. Purchasing renewable forms of energy (for example, ethanol blended gasoline, wind generated electricity)

Among a ski area’s operating costs, energy utilities are one of the most controllable. In most cases, a successful energy master plan will require some basic changes in the way equipment is used, the way employees and guests use energy, and the way internal policies or procedures are set. The greatest benefits of such a plan will be realized only when you have senior management support and implement the following changes concurrently throughout your entire operation.

### (A) On-hill Operations

Does this apply to my facility?	Already in place at my facility	Sub topic:	Energy Use for Snowmaking, Lifts and Lighting		Ease of implementation (easy ●, intermediate ■, expert ◆)	Resulting savings (see legend)	
		Applicable Sustainable Slopes Principle(s):	Considerations:	Useful Resources:			
<input type="checkbox"/>	<input type="checkbox"/>		<ul style="list-style-type: none"> <li>● Reduce energy use in snowmaking operations</li> <li>● Use cleaner energy in snowmaking operations where possible</li> <li>● Reduce energy use in lift operations</li> <li>● Use cleaner energy in lift operations where possible</li> </ul>	<ul style="list-style-type: none"> <li>● “Snowmaking is an art and a science”</li> <li>● Lighting for night skiing</li> </ul>	Please refer to snow/lift equipment manufacturer’s guidelines for guidance on operating efficiencies.		
<input type="checkbox"/>	<input type="checkbox"/>	Develop a snowmaking plan that includes most efficient methods for each set of weather conditions.				●	
<input type="checkbox"/>	<input type="checkbox"/>	Use most efficient equipment first, adding less efficient equipment as the need to increase capacity rises. This applies to pumps, air compressors and lifts.				●	
<input type="checkbox"/>	<input type="checkbox"/>	Optimize the performance of air compressor systems used for snowmaking – finding and eliminating leaks, choosing the best operating pressure, designing efficient piping systems, etc.				●	
<input type="checkbox"/>	<input type="checkbox"/>	Install new high efficiency snowmaking guns or retrofit/recondition older guns with new nozzles to further reduce snowmaking water and energy consumption. Maximize the use of most efficient snowmaking guns.				■	
<input type="checkbox"/>	<input type="checkbox"/>	Install a water cooling system to cool the water supplied to snowmaking systems. Reducing the temperature of the water increases the efficiency of the snowmaking process by reducing evaporative losses when the water is released to the atmosphere.				■	
<input type="checkbox"/>	<input type="checkbox"/>	Install a system control automation to increase efficiency of the snowmaking system. Will allow snowmaker to accurately modify the snowmaking systems by using computer controls to quickly respond to changing conditions on the slopes and avoid pumping excess water. Consider wet bulb and dry bulb temperature to determine when to make snow and maximize snowmaking efficiency.				■	
<input type="checkbox"/>	<input type="checkbox"/>	Purchase new, energy efficient motors. Rewinding commonly yields motors with poorer energy performance than prior to rewinding, and multiple rewinding typically reduces performance further.				■	
<input type="checkbox"/>	<input type="checkbox"/>	Reduce peak energy demand. For example, when some ski lifts are closed down, start snowmaking activities.				●	
<input type="checkbox"/>	<input type="checkbox"/>	Install timers on all electric heaters used to provide heat for lift related structures, so that heaters operate only when needed, i.e. 9 hours per day.				●	

<input type="checkbox"/>	<input type="checkbox"/>	Schedule lighting for night skiing to optimize daylight hours. Consider adding photocells and/or timers for additional savings.	●	 
<input type="checkbox"/>	<input type="checkbox"/>	Replace high-pressure sodium lamps used for night skiing with metal halide fixtures. Fit lamps with hoods to minimize light pollution (i.e. indirect light to woods and sky).	■	 
<input type="checkbox"/>	<input type="checkbox"/>	Purchase green power, such as wind-generated power, from energy providers.	◆	

**Success Story #1: Keystone Resort, Colorado**











The resort decreased night-light pollution by approximately 50 percent by replacing 300 high-pressure sodium lamps with 600 visor-fitted metal halide lamps. The results are a 50 percent reduction in ambient light pollution, improved efficiency, protection of the night sky, and better safety and visibility for night skiing.

















As part of a resort-wide lighting upgrade, Keystone replaced 130 lighting fixture ballasts (T12 technology) with higher efficiency components (T8 technology) and compatible 32-watt lamps. This upgrade yields an energy savings of 63 kWh per fixture each year, with a 1998 savings of 8 190 kWh. Additional benefits include reduced maintenance and higher quality lighting.

**Success Story #2: Snow Valley Ski Resort, Ontario**

In 2004 purchased 30 new portable high efficiency snow guns. The Resort has made a shift from incandescent lamps to compact fluorescents starting with the interior lighting at the tubing chalet (60 units). The Resort also uses sensors and timers in their parking lot lighting.

**(B) In Facilities**



















Does this apply to my Facility?	Already in place at my facility	Sub topic:	Energy Use in Facilities	Ease of implementation (easy ●, intermediate ■, expert ◆)	Resulting savings (see legend)
		Applicable Sustainable Slopes Principle(s):	<ul style="list-style-type: none"> <li>Reduce overall energy use in ski area facilities</li> <li>Use cleaner or renewable energy in ski area facilities where possible</li> <li>Meet or exceed energy standards in new or retrofit projects</li> <li>Develop outreach that enhances the relationship between the ski area and stakeholders and ultimately benefits the environment</li> </ul>		
		Considerations/Scope:	<ul style="list-style-type: none"> <li>Hotel/lodging</li> <li>Kitchen Activities</li> <li>Laundry Activities</li> <li>Building Operations</li> </ul> <b>Resources:</b> Audubon Green Leaf™ Eco-Rating Program <a href="http://www.terrachoice.ca/hotelwebsite/indexcanada.htm">http://www.terrachoice.ca/hotelwebsite/indexcanada.htm</a>  EnergyStar program <a href="http://oee.nrcan.gc.ca/energystar/">http://oee.nrcan.gc.ca/energystar/</a>  Saving Energy Dollars in Hotels, Motels and Restaurants: <a href="http://oee.nrcan.gc.ca/publications/infosource/pub/hospitality_sector/english/">http://oee.nrcan.gc.ca/publications/infosource/pub/hospitality_sector/english/</a>  Keep Winter Cool Campaign <a href="http://www.nsaa.org/nsaa2002/ environmental_charter.asp">http://www.nsaa.org/nsaa2002/ environmental_charter.asp</a>		
<input type="checkbox"/>	<input type="checkbox"/>		Conduct energy use audits throughout facility. Keep careful records of energy use, and review monthly utility charges with departments to identify energy saving opportunities.	●	
<input type="checkbox"/>	<input type="checkbox"/>		Remind employees and visitors to conserve energy. Make energy use figures known to employees.	●	
<input type="checkbox"/>	<input type="checkbox"/>		Participate in Sustainable Slopes Outreach Day on February 26 <sup>th</sup> , 2005 by communicating the “Keep Winter Cool” message to skiers and snowboarders through table tents at resort lodges and cafeterias and through your ski area’s website.	●	
<input type="checkbox"/>	<input type="checkbox"/>		Shut down office equipment, such as photocopiers and computer monitors, when not in use.	●	
<input type="checkbox"/>	<input type="checkbox"/>		Place tent cards and decals in guest rooms to offer specific energy efficiency suggestions for guests. For example: turning off lights, changing temperature when they are leaving the room.	●	
<input type="checkbox"/>	<input type="checkbox"/>		Train staff to always keep curtains in guest rooms closed during the summer.	●	
<input type="checkbox"/>	<input type="checkbox"/>		Fill hotel rooms on the north side of a building first (and south side last) decreases air conditioning loads. Similarly, filing on the south side first in the winter reduces heating loads.	●	 
<input type="checkbox"/>	<input type="checkbox"/>		Reduce energy needed for illumination. Convert incandescent lighting to compact fluorescent. Convert incandescent exit lights to LED. Upgrade fluorescent tubes to T8 or newer, and ballasts from magnetic to electronic.	■	 

<input type="checkbox"/>	<input type="checkbox"/>	Use motion sensors to control lighting and HVAC in areas commonly unoccupied can minimize operating waste. Install sunlight sensors that will adjust to the amount of daylight throughout the seasons.	■	
<input type="checkbox"/>	<input type="checkbox"/>	Install programmable thermostats and use night setback for heat control in any and all areas not used at night. Time-clocks to limit HVAC operation eliminates waste.	■	
<input type="checkbox"/>	<input type="checkbox"/>	Turn off heat and air conditioning in unused areas at all times, i.e. in hotel rooms that are unoccupied.	●	
<input type="checkbox"/>	<input type="checkbox"/>	Replace your incandescent or mercury vapour lighting for your parking area with high-pressure sodium or metal halide lighting (add photocells and/or timers for additional savings).	■	
<input type="checkbox"/>	<input type="checkbox"/>	Pool covers are very effective for reducing heat losses from swimming pools. Cover pools when not in use to limit evaporation and reduce heat loss.	●	
<input type="checkbox"/>	<input type="checkbox"/>	Maintain caulking and weather stripping. Keep duct work well sealed.	●	
<input type="checkbox"/>	<input type="checkbox"/>	Dirty condensers increase energy use by as much as 50%. Clean your refrigerator and freezer condenser coils every 3 months. Clean air conditioning unit condensers at least once a year. Check and clean air conditioner filters once each month during periods of heavy use. Cover the outside of air conditioning units during the winter.	■	
<input type="checkbox"/>	<input type="checkbox"/>	Clean out dust out of registers and heat exchangers in baseboard heaters by blowing them out at least once per year; after each unit is blown out, make sure the detachable front panel is reattached properly to ensure efficient air flow.	■	
<input type="checkbox"/>	<input type="checkbox"/>	Replace an old oil or gas boiler or furnace with a high-efficiency oil or gas boiler or furnace.	■	
<input type="checkbox"/>	<input type="checkbox"/>	Minimize energy used to heat water by using low-flow showerheads, efficient laundry equipment, and linen and towel re-use programs.	■	
<input type="checkbox"/>	<input type="checkbox"/>	Refrigerators and freezers operate most efficiently when the refrigerator is set at 3.2° C (37° F) and the freezer is set between -18° C and -15° C (0° and 5° F)	●	
<input type="checkbox"/>	<input type="checkbox"/>	Use the lowest washing temperature that cleans satisfactorily. Wash only full laundry loads.	●	
<b>Purchasing</b>				
<input type="checkbox"/>	<input type="checkbox"/>	Purchase energy efficient water heaters or insulate older water heaters well. Insulate hot water pipe runs. Locate water heaters as close as possible to the primary sites of hot water use.	●	
<input type="checkbox"/>	<input type="checkbox"/>	Purchase and use energy saving equipment/appliances for kitchens and lodges (i.e. Energy Star dishwashers and clothes washers)	●	
<input type="checkbox"/>	<input type="checkbox"/>	Purchase new, energy efficient motors. Rewinding commonly yields motors with poorer energy performance than prior to rewinding, and multiple rewinding typically reduces performance further.	●	
<input type="checkbox"/>	<input type="checkbox"/>	Purchase green power, such as wind-generated power, from energy providers.	◆	

### Success Story #3 – Blue Mountain Resorts, Ontario

The recent installation of a combined heat and power system at Blue Mountain is yielding efficiencies of 85 percent by providing 30 kilowatt hours of electrical energy and 55 kilowatt hours of thermal energy, or 190 000 British thermal units per hour. At present, recovered thermal energy heats incoming water, which feeds 90 hotel rooms, laundry services, and dishwashing.

## (C) Vehicle Fleets

Does this apply to my Facility?	Already in place at my facility	Sub topic:	Energy Use for Vehicle Fleets		Ease of implementation (easy ●, intermediate ■, expert ◆)	Resulting savings (see legend)	
		Applicable Sustainable Slopes Principle(s):	<ul style="list-style-type: none"> <li>Reduce fuel use in vehicles used for ski area operations</li> <li>Use cleaner fuel where possible</li> </ul>				
		Considerations / Scope:	<ul style="list-style-type: none"> <li>Snowcats</li> <li>Snowmobiles</li> <li>Fleet vehicles</li> <li>Shuttles</li> </ul>	<b>Resources:</b> Transportation and businesses: reduce energy, save money <a href="http://oee.nrcan.gc.ca/english/b_transportation/index.cfm">http://oee.nrcan.gc.ca/english/b_transportation/index.cfm</a> FleetSmart <a href="http://oee.nrcan.gc.ca/fleetsmart">http://oee.nrcan.gc.ca/fleetsmart</a> The Canadian Renewable Fuels Association: <a href="http://www.greenfuels.org">http://www.greenfuels.org</a> Clean Snowmobile <a href="http://www.deq.state.mt.us/cleansnowmobile/">http://www.deq.state.mt.us/cleansnowmobile/</a> Hydraulic Line Inspection template <a href="http://peakstoprairies.org/p2bande/ski-green/">http://peakstoprairies.org/p2bande/ski-green/</a> (chapter 7)			
<input type="checkbox"/>	<input type="checkbox"/>	Train staff to eliminate unnecessary idling of vehicles, minimizing trips and reducing speed.				●	 
<input type="checkbox"/>	<input type="checkbox"/>	Implement an anti-idling campaign in the resort parking lot (e.g. by posting signs). This will not only reduce the amount of exhaust emitted but also increase fuel efficiency.				■	 
<input type="checkbox"/>	<input type="checkbox"/>	Use ethanol-blend gasoline or bio-diesel fuel wherever possible in fleet vehicles including shuttles, trucks, snowmobiles, and other pieces of equipment.				■	
<input type="checkbox"/>	<input type="checkbox"/>	Conduct regular maintenance on fleet vehicles, including monthly tire pressure checks.				●	 
<input type="checkbox"/>	<input type="checkbox"/>	Use energy efficient vehicles.				◆	 
<input type="checkbox"/>	<input type="checkbox"/>	Provide shuttles or transportation for guests and employees.				■	 
<input type="checkbox"/>	<input type="checkbox"/>	Replace two stroke engine snowmobiles with four stroke engine snowmobiles.				■	 
<input type="checkbox"/>	<input type="checkbox"/>	Use alternative lubricants (i.e. synthetic low particulate or synthetic biodegradable) in snowmobiles to reduce toxic emissions.				■	
<input type="checkbox"/>	<input type="checkbox"/>	Conduct hydraulic line preventive maintenance on snowcats. Use biodegradable hydraulic oil in snowcats to address environmental concerns associated with on-hill hydraulic line breaks if they do occur.				■	 
<input type="checkbox"/>	<input type="checkbox"/>	Practice daily trip planning to reduce the number of deliveries or pickups that are made each day. Complete pre-trip or delivery checklist to avoid doubling back. Consolidate deliveries and pickups.				●	 

### Success Story #4: Keystone Resort, Colorado

At the Keystone Resort in Colorado, 10 Bombardier snowcats were purchased with Cummins motors with electronic fuel injectors. These injectors burn 1 gallon of diesel per hour less while gaining a 25% increase in power.

## Calculate Your Lighting Paybacks

- A. Number of new units = \_\_\_\_\_ units  
B. Purchase and installation costs per unit = \$ \_\_\_\_\_  
*Multiply A x B*                      **Total cost** = \$ \_\_\_\_\_
- C. Number of new units\* = \_\_\_\_\_ units  
D. Old wattage – New wattage / 1000 = \_\_\_\_\_ kW saved  
E. Usage in hours per day = \_\_\_\_\_ hours per day  
F. Usage in days per week = \_\_\_\_\_ days per week  
G. Usage in weeks per year = \_\_\_\_\_ weeks per year  
H. Average local cost per kWh of electricity = \$ \_\_\_\_\_ (including demand charges)  
*Multiply C through H*                      **Annual Savings** = \$ \_\_\_\_\_

**Simple payback** = Total cost / Annual Savings = \_\_\_\_\_ years

\*This assumes that the number of new lights is the same as the number of old lights.

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