



Snow Machines, Inc.
 1512 North Rockwell Dr.
 Midland, MI 48642

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Customer Successes

Vail, CO

vail.snow.com

Adding 28 Full Auto Super PoleCat
 Snowtowers and Snowmaker
 New Fully Automatic Pumping Station
 All Controlled by SmartSnow



Winterplace, WV

winterplace.com

Adding 57 PoleCat Snowtowers and
 Conversion Kits in both manual and full
 Automation along with a SmartSnow
 control and weather system



Aspen, CO

aspensnowmass.com

Adding Super PoleCat Fully
 Automated Towers and Portables to the
 Fleet at the four Aspen Mountains



SNOWMAKING AT ELM CREEK, MINNESOTA

Olympic Successes

2010 VANCOUVER

Whistler-Blackcomb

whistlerblackcomb.com

SMI fully automated fan technology will
 be a big factor in covering the alpine
 slopes at Whistler. SMI has a 20+
 year relationship with Whistler.



Cypress Mountain

cypressmountain.com

Using 35 fully automatic Super
 PoleCats to cover the snowboard and
 freestyle events, 100% with SMI Snow.



2014 SOCHI

Rosa Khutor Resort

rosaski.com

SMI is very pleased to announce
 with our local Russian partner Skado
 that the Alpine venue at Rosa Khutor
 Resort will be covered by a very large
 fully automated 12,000 gpm (45,000
 lpm) Super PoleCat system.



SUPER POLECATS AT HUNTER MOUNTAIN, NEW YORK

Snow News

FALL 2009

FOR OWNERS AND OPERATORS OF SNOWMAKING EQUIPMENT WORLDWIDE

snowmakers.com

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Editorial

SMI has recently completed our two best sales years over the past two winters. Over 1000 fans and 300 sticks in each of the past two years. So many thanks go out to our customers and employees who made this strong success happen.

In these uncertain economic times, SMI is advising resorts to focus on areas that can be controlled. The weather, economy, media, energy costs and other factors are difficult to influence. However, costs can be controlled and influenced. Snowmaking costs typically represent the largest energy loads and one of the highest cost areas for most resorts.

Energy and labor are the big snowmaking costs.

Industry trends continue towards more fixed position snowguns, increased water capacities and increased quantities of snowguns running at one time. The trends are moving away from fossil fuels like diesel compressors and huge energy invoices.

SMI is anticipating these tougher economic times to put pressure on the number of snowmaking companies in the market. As you ponder your snowmaking improvements, consider product scope and depth, financial stability, and ability to change as you evaluate vendors. SMI's fan, lowE and mediumE sticks, automation, engineering and construction capabilities are the best and most flexible in the industry.

We thank you for your support and helping us be successful. We will continue to work hard, listen and change to meet your dynamic snowmaking requirements.

Silent PoleCat

Quiet Snowmaking continues to be a factor in snowgun selection. With expensive accommodations and hotels in base areas and mountain villages, night time noise is a serious problem for many resorts.

SMI recently introduced the Silent PoleCat to meet the need of the quietest snowgun in the world that can actually make good snow! The Silent PoleCat is our simple nozzle snowmaker with dampened noise levels yet still delivers excellent fan production for a range of weather conditions expected from PoleCat technology. The Silent PoleCat uses a special fan barrel and compressor house to significantly reduce noise levels much lower than the already quiet fans.

The Silent PoleCat is offered in a variety of carriage and tower mounts. It is powered by a 15 HP (11 Kw) fan and 5 HP (4 Kw) compressor. The Silent PoleCat uses SMI's patented simple nozzle peripheral simple nozzle spray manifold and center nucleation. The Silent PoleCat is reliable, simple to operate, maintain and a great all around performer.

Call SMI today for more details or visit our website at snowmakers.com.



SILENT POLECAT



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Technology of Snowmaking

Understand Existing Snowgun Flow Rates, Positives and Negatives

Inventory your existing snowgun fleet and know exactly what you own and where each snowgun is used around the mountain.

Understand existing snowgun flow rates at 28°F, 24°F and 20°F wet bulb, and do not just believe the manufacturers. Go out and measure water and air flows with flowmeters. And check snow quality and snow density.

What happens if conditions move up or down 2°F?

Mounts for snowguns matter. Generally, the taller the tower, the better the production. Up to about 40 feet in height. Any taller and the support mechanisms become quite significant. Wind impact is also a big consideration above 40 feet.

Air flow rates have a direct cost correlation to energy costs so define air volume closely.

What is the range of performance for your snowgun fleet?

- On/off snowguns
- One valve and flow steps
- Multiple valves and flow step
- Infinite adjust of air and water

What happens to snow quality?

- How does your on/off work when it is marginal or cold?
- Sweet spot is likely about 4°F of range!

These are some areas for your team to focus on as the snowguns utilized remain the biggest predictor for costs.

POLECATS AT VAIL, COLORADO

Smarter Snow and Cost Reduction

As you continue to evaluate snowmaking at your resort, focus on the variables you can control.

1. Where to Start?

Define your operating costs today:

- Energy, labor, maintenance, depreciation, additive and transportation
- What is your grooming cost to push out the piles?
- Historical water volumes
- Historical hours of operation
- Historical average temperatures and humidities by month
- Inventory water and air systems
- Inventory hydrants and snowguns
- Inventory snowgun types and mounts

2. Work Through Start Up Scenarios

- Who is defining the opening strategy? Trails, depth, full width?
- Are you making snow on the right trails guest desire?
- Or is your focus the easy to make snow on trails?
- Do you have the correct snowguns on trails?
- Are you using lowE on 250' wide trails?
- How long does it take to change trails and startup snowguns?
- How much water can you convert to snow at 28°F wet bulb, 25°F wet bulb?

3. Evaluate Existing Snowgun Fleet

What are the water and air flows consumed at three different temperatures? (see previous article)

4. Evaluate Snowgun Options

Traditional Air/Water (HighE)

- Uses more than 200 cfm (5.67cmm) of compressed air per snowgun
- Internal mix per snowgun
- Typical short tower or portable sled mount
- High energy and noise
- Good in marginal conditions with decent snow throw

Low and Moderate Energy Towers (MediumE and LowE)

- Uses less than 180 cfm (5.0 cmm) of compressed air per snowgun
- Typical 6m to 9m tower mount or 3m to 5m sled mount
- Internal or external mix nucleation
- Good energy usage
- Possible limited marginal and cold condition production
- Possible limited throw
- SMI's Viking at 20 cfm to 180 cfm

Fans

- Simple nozzle PoleCats to multi-nozzle Wizzards
- Various carriage and tower mounts
- Excellent overall snow production
- Excellent throw
- Good energy usage and low noise levels

5. Fixed Position Various Portable

Moving from portable snowguns to fixed position snowguns can result in huge savings on primary trails. When you consider set up time, burying snowguns, digging out snowguns and the time to take down and put away or park, these costs and difficult work environment are a real challenge. The labor and lost snowmaking time generally justify a fixed snowgun on primary trails.

Now it certainly depends on winds, trail, priority, existing infrastructure, snow volume per snowgun and other factors to help determine if fixed position snowguns will be effective.

SMI has many manual customers that can start 150 fan snowguns in less than an hour with five snowmakers. The key is they are towers with the cords, hoses and orientation ready to go. Add automation and they can be started even faster.

Some larger resorts with ground air guns on sleds or tripods may make three ribbons on a 200' wide trail. In other words, they set up on the far 1/3 of the trail and make snow, then move all 50 guns over 60 feet to hit the middle third and so on. Why not just add tower fans that throw the entire width?

6. Grooming Costs

Are you using lowE towers or small throw air snowguns with little throw on 200'+ wide trails? So the snow is basically positioned in a big butterfly pile 20' to 70' from the snowgun. So grooming times are huge to push it across the trail to get to full width. So instead of 30 hours cat time to open, it may take 90 hours. At \$100/hour that is \$6,000. Using oscillating tower fans will cut time down dramatically.

7. Automation Levels

The majority of snowmaking snowgun automation is with fixed position snowguns. Consider the height of the tower and the convenience of access for service and maintenance.

Automation factors to consider are many and include starting, adjusting and stopping/drainage. Is the start full open or throttling with pressure control? Does the adjustment involve valves and pressure control? Does the snowgun shutdown and drain on fault or power loss? Is there intelligence at the snowgun? Can it run without communications or a link to the master computer? What is the flow range of the snowgun at your resort? What type of communications are used? Hardwire, fiber optic and radio modems are commonly used today in snowmaking.

Other questions should be considered: How many snowguns per weather device? Master slave options?



How do hoses drain?
 What is disconnected and removed for service?

Another big question is how many hours do you expect each snowgun to run? Only 50 hours? Your answer will greatly impact the return on investment.

Snow Quality and Snow Quantity

This topic needs a deeper understanding and debate within our industry. Questions like the following need to be discussed at your resort:

- What is snow quality?
- Do we always make dry snow?
- Do temperature and humidity play a role?
- Should we ever make base snow?
- Is tubing, racing or park snow different?
- Does time of year matter?

There are maybe more questions than answers, but here is an attempt to help your understanding of this topic.

Most people think about avalanche safety, natural snow or a snowball fight when asked about snow quality. As resort operators or snowmakers, we think about wet to dry scale, carving ability, cure time and avoiding ice at all times.

In general, snow quality means density or percentage water content as a method for definition. Density is mass per volume in kg/m³ or #/ft³. Water content per snow depth or volume of melt water within a given volume. Here are some density examples:

MATERIAL	KG/M ³
Sea Water	1030
Fresh Water	1000
Ice	920
Snow	50 – 600
Air	1.3

Ice floats on water due to lower density. In snowmaking, we often think of snow quality in terms of the classic snowball test of squeezing water out or the sleeve test on a cold jacket – does it splat or bounce?

In SMI's automation programs we use 10 snow quality setting options with one being the driest setting. Wet bulb, water temperature, water pressure and water flows are all considered in the settings.

Snow quality definitely impacts snow volume. And the nucleation and water droplet mixing absolutely impacts the snowmaking process. Hang time and cure time are also factors to consider.



POLECATS AT WINTERPLACE, WEST VIRGINIA

Here is a density summary table:

QUALITY	WATER CONTENT	DESCRIPTION
5	> 50%	Wet Snow that is Slushy
4	42%-50%	Base Snow, Wet in Marginal
3	35%-42%	Good Skiable Snow
2	25%-35%	Light & Dry, Snowballs Flake Off
1	< 25%	Very Dry, Cannot Make a Snowball

As you know, there is a big difference in cost and productivity at 29°F (-1.5°C) and 0°F (-18°C). We suggest you discuss snow quality on a regular basis throughout the time of snow production. Understand the costs and capabilities within your snowmaking system and snowgun fleet for making dry snow or base snow at a few different wet bulb conditions.

This past winter SMI was testing new nucleation technologies and nozzle types and positions. We tested in conditions between 29°F (-1.5°C) and -2°F (-19°C) with water temperatures of 34-35°F (2°C) and frozen water content between 24% and 55%. More than 75 tests were completed for over 8 hour periods.

One of the areas that we all need to be reminded about is more water through a snowgun does not directly result in more snow on the ground.

Here is a theoretical (no losses) example to consider:

- Snowgun #1:**
 33.3 gpm = 2000 gph = 267 ft³/hour
 @ 25% water content 1068 ft³/hour
 @ 50% water content 534 ft³/hour
- Snowgun #2:**
 66 gpm = 4000 gph = 534 ft³/hour
 @ 50% water content 1068 ft³/hour

Here is a real test result

- Snowgun #1:**
 16.8 gpm 45% water content
- Snowgun #2:**
 13.6 gpm 34% water content

In this example 23% more flow into the snowgun actually resulted in 6% less snow in terms of volume due to the heavier density.

In summary, snow quality should be considered in all snowmaking discussions. We all strive to make the best snow possible. But what about costs, the pressure to get open, the pressure to get a lot open, tubing snow, park snow, stockpiled snow, etc.

Snowmaking is very dynamic and very dependent on the almighty weather factor. More water is not always better. We encourage your team to measure flow rates with independent flow meters and to consider snow density and volume measurements as well.

SUPER POLECAT AT MOUNT SNOW, VERMONT

