snowflake
ski basin

Sustainability at Snowflake Ski Basin *

Introduction

You have just become the first sustainability officer at a medium-sized Colorado ski resort, **Snowflake Ski Basin**. Snowflake has a new owner, Ramona Prescott, who is committed to making the ski area more sustainable. Not only is this a personal issue for Ms. Prescott, but Snowflake received a very low grade from the Ski Area Citizens' Coalition, which reflects poorly on the ski area and its management and is personally embarrassing for her. Ms. Prescott would like to make some highly visible changes particularly related to climate change. She is concerned not only about the ski area's sustainability, but about the ski industry's long-term viability in a warming world. Currently the ski area does very little in the sustainability realm other than having a few recycle bins in the cafeteria and most offices.

Ms. Prescott has asked you to develop a sustainability plan with several short-term and several long-term recommendations. In addition to your salary, she is allocating about $200,000 a year to this project. If there is an excellent project that exceeds this budget she will consider making the investment. She wants actions that make a strong statement about being more socially and environmentally conscious. She would like to be able to go to the nearby community and the national ski area association and show that the ski area is making real strides toward becoming sustainable. Eventually, she would like to be seen as a sustainability leader in the industry.

During the several conversations that you have had with Ms. Prescott she has mentioned several things that she is interested in seeing done, though they don't necessarily need to be done immediately. She mentioned she was surprised that the ski area's webpage had no information about its sustainability efforts. Though on second thought she said that there wasn't really much to report, so maybe that was okay. She also mentioned that she was intrigued by science-based target setting particularly for carbon emissions.

You have spent the first weeks on the job getting the lay of the land - meeting people, finding out who supports sustainability, asking questions, finding out what has been done (not much) and collecting data. Now it is time to put the pieces together, do some analysis and make some recommendations.

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* This case was developed by John Byrd for classroom use. Snowflake Ski Basin is a hypothetical company. Version 4, October 2019.

About Snowflake Ski Basin

Snowflake Ski Basin is considered a mid-sized ski area. It has seven chair lifts servicing 102 ski trails with about 1,600 acres of skiable terrain, which is leased from the US Forest Service. There are four restaurants (one cafeteria and one full-service restaurant at each location), a ski equipment rental shop and several other small shops at the base area. The ski area is located about 25 minutes (19 miles) from a small city (population 12,000) where most employees live. Lodging at the ski area is limited, so most visiting skiers (75%-85%) stay in the town and make the drive each day.

At the base area are several sets of housing units – 82 two and three-bedroom condominiums. These are 'ski-in, ski-out' condominiums, which means that renters can ski or walk to the chair lifts to begin their ski day, ski back for lunch, etc. During the winter these are either rented out or their owners are using them, with about an 75% occupancy rate. Real estate sales of condos like these is one of the ways that ski areas make money. In fact, for many ski areas the real estate side of the business is much more profitable than the skiing side.

The ski area has five departments: Real estate, Marketing, Base Area Operations, Mountain Operations and General Management. The general management area houses human resources, accounting and finance. The Chief Financial Officer, Gary Strand, has been with the resort for 14 years and seen it through several up-and-down financial cycles. While some people at the ski area say he is just a numbers guy, most people see him as fair and wanting to do what's best for the company over the long-run. The numbers guy criticism is partially true; he wants to see quantitative analyses of proposed investments. For smaller investments, under about $3,000, department heads need to submit just a one-page explanation of how the investment helps their department. Larger investments require a thorough financial analysis that demonstrates that they will benefit the ski areas' bottom line. He is personally concerned about environmental and social issues and recognizes that improving the ski area's reputation in those areas has some value, but is more concerned about the company's financial viability.

The real estate group is small, just three people. They manage the condominiums, which are often rented out when the owners are not present. They are also developing another small housing development – 12 single family homes and 32 condos – close to the base area but not ski-in, ski-out. Rick Conlon heads the group. Rick is concerned with energy costs of the rentals he manages since the ski area pays all utility costs. The prices of homes/condos in new development will be fairly high. The initial planning includes a number of energy savings features – upgraded wall insulation, triple pane windows on north walls, low-flow toilets - and the 3 homes will have small PV solar arrays installed.

The marketing group takes care of all advertising – print, web-based and social media. It establishes partnerships with hotels in the nearby town and packages group trips with housing,

equipment rentals and ski passes. It also can add other activities for non-skiers traveling with the group. It carries out a number of promotions each ski season. Some target the local population (some locals complain that skiing has gotten too expensive) and others promotions are part of industry-wide efforts to attract more people to skiing. It also handles all of the resort's charity efforts. The VP of Marketing is Meg Wilder. She has been in the job for four years, after an almost ten-year stint in various marketing positions at a major ski resort (think Aspen or Vail), which was very highly rated for its sustainability efforts. Colleagues describe her as high-energy, positive and willing to try new ideas. She is very supportive of green initiatives that she can add to marketing materials. She has assembled a team of younger, enthusiastic employees and given them some freedom to do their jobs as they see fit. Her team has been pushing for more sustainability initiatives.

An area that Ms. Wilder is very particular about is the ski area's webpage. She believes that it is the face of the area to potential new visitors, so wants it to portray the area in a very certain way – fun, accessible, and friendly. Any suggestions of changes to the website would need to have a mock-up of the proposed change and a rationale for the change. Approval is not assured.

Base area operations oversee restaurants, shops, equipment rental and the ski school. This department also manages parking and transportation. Everything that affects a visitor's experience, other than the actual skiing, is managed by this department. Colleen McClure heads this department. She has a background in restaurant management and retail. Her units are mostly profit centers since they generate revenue. Even parking has a revenue component: valet parking is offered at $25 per day which allows visitors to drop their vehicles at the closest possible point to the ski lifts and have it delivered to them at the end of the day. Her pay, and that of her primary managers is based partially on profits, so she is very interested in finding ways to enhance revenue and reduce costs. Recently a couple of her ideas have not been very successful so new investments are being scrutinized particularly carefully. As described below, parking can be a headache and complaints reflect badly on Colleen. She would be very receptive to ideas that reduce those complaints.

Mountain operations takes care of all the on-snow aspects of the resort. This ranges from snow-making, grooming the ski runs, operating the ski lifts, maintaining all equipment, having a ski patrol for safety, and working in the summer and fall to prepare the area for skiing. This involves cutting out fallen trees and removing brush. It also runs the ski area's on-mountain summer activities – a zip-line, a climbing wall and some other attractions. The head of mountain operations is Don Pouderuse. He has been at the ski area for almost 30 years, moving from ski patrolman, to driving large grooming equipment, to heading snowmaking, and finally being in charge of all mountain operations. He is gruff, takes no-nonsense, and is under a huge amount of stress all winter to have perfect skiing every day. He constantly fights for additional budget dollars to improve the skier experience. He will support initiatives that improve skiing and save

him money, but ridicules feel-good efforts or anything that might affect his team of patrolmen and groomers. If a project has his support then Gary Strand, the finance director, almost always supports it. Most of the mountain operations employees have worked at the area for 10 or more years, and are incredibly loyal to Don and proud of the job they do. Most are also former ski racers or ski bums so working at the ski area (and skiing almost daily for free) is a life style choice.

Snowflake Ski Basin parking and transportation

Snowflake Ski Basin had 314,275 skier visits in the 2017/18 season and 332,193 skier visits in the 2018/19 season. The ski season stretches from mid-November through mid-April, with about 145 days of skiing depending on weather. The higher number in 2018/19 was due to a slightly longer ski season because of earlier cold temperatures that aided snowmaking and late winter storms that extended the season about a week. Data from a few years ago showed that over the 25 days with the highest skier days (Christmas-New Year, President's Weekend, and school spring holidays in March) an average of 4,290 skiers were on the mountain each day, and they arrived in about 1,500 vehicles (about 2.86 people per vehicle). During non-peak periods there are more single skiers. On the 120 non-peak days the ski area averages 1,670 skiers who arrive in 860 different vehicles (1.93 people per vehicle).

Particularly on the peak use days parking is a major problem. Close-in parking lots can accommodate about 1,100 vehicles, but almost 200 spaces are used by employees and company cars and trucks. This is fine during non-peak periods, but during holidays when skier numbers increase an auxiliary parking lot about one-half-mile from the base area has to be opened. Skiers using this lot are shuttled to the base area by several buses. A one-way trip, from the auxiliary lot to the base area, on the shuttle bus, takes about 15 minutes depending on demand. There are two shuttles running continuously throughout the day when the auxiliary lot is open. This is the one issue that visiting skiers during peak periods complain about more than any other. Solving the problem is difficult. There is no land for any more close-in parking. It isn't clear whether the parking problem discourages people coming to the ski area. If more parking was available on peak-use days it might make the ski slopes so crowded that another problem would be created. An upside of the parking problem has been an increased use of valet parking at $25 per day.

Several years ago, a bus service from the nearby town to the ski area was offered at $5.00 each way, but demand was low. With stops to took between 35 and 50 minutes one-way, compared to about 25 to 30 minutes by personal vehicle. Because the schedule was limited it wasn't convenient for many people. The consensus seemed to be that skiers liked to come and go on their own schedule, and the cost was more than driving a car with 2 people. Employees have been encouraged to carpool but the results haven't been good.

Ms. McClure looked into shuttle vans. A 24-passenger van costs $80,000. These vans get about 10 miles per gallon of gasoline and could make one round-trip every one-and-a-half hours. Creating employee transportation is tricky because people live in different areas of the town and there is no free park-and-ride lot that could be used as a single pick-up location.

Snowflake Ski Basin Snowmaking

The ski area uses snowmaking to assure snow coverage on several runs early in the season and at the base area. Snowflake upgraded some of its snowmaking equipment several years ago. The current mix of upgraded compressors and nozzles uses 2.6 KWH per cubic meter of snow produced, and can produce about 17 cubic meters of snow an hour under favorable conditions. Early in the season the area uses snow cannons which use 3.4 KWH per cubic meter of snow, but can produce snow much faster than the nozzle or emitter-type of snow making equipment. Over the course of the winter the ski area will make about 250,000 cubic meters of snow. About 25% is from snow cannons at the beginning of the season. The rest is from more efficient nozzles-type equipment. Recent advances in snowmaking now have nozzles that use just 1.3 KWH of electricity per cubic meter of snow produced and can produce 20 cubic meters of snow per hour.

Replacing the 120 old-style nozzles with the new snowmaking equipment would cost about $350 per nozzle. This includes new parts, adapters and labor. The change would reduce electricity demand for the entire snowmaking system from 2.8 KWH per cubic meter of snow to about 1.8 KWH. The average would not be the 1.3 KWH of the new nozzles because snow cannons would still be used early in the ski season to get coverage of ski slopes. The new nozzles would last 4 years, then have to be replaced. A 6% discount rate is appropriate.

Snowmaking Energy Use	Cubic Meters of Snow Made	KWH Electricity	Water used (gallons)
2017/18	278,988	729,850	38,890,858
2018/19	223,776	580,530	31,048,920

The decrease from the 2017/18 to the 2018/19 ski season was due to early snow fall that made some snowmaking unnecessary. Don Pouderuse expects to make 250,000 to 280,000 cubic meters of snow most years.

Some critics of ski areas complain about the amount of water used to make snow. The NSAA (National Ski Areas Association) argues that is not a consumptive use of water with about 80% of the water returned to the watershed. The other 20% is presumably lost to evaporation or sublimation, so enters the hydrologic cycle. This is from the NSAA's Facts about Snowmaking. The NSAA also publishes an annual Sustainable Slopes report that gives brief updates on what

some ski areas are doing to reduce their environmental impact and has links to the sustainability reports or websites of ski areas if available. These URLs are given in the Resources section.

Snowflake Ski Basin Mountain Operations Energy use

Lift operations uses slightly more than half of all electricity at the ski area (data is provided in the Data section below). Grooming the slopes requires 5 to 7 large machines running from 5:00 PM through the night. The machines, Snowflake has a fleet of 8 Piston Bully groomers of various ages, use about 5 to 7 gallons of diesel fuel per hour of operation. There are also about a dozen smaller machines used by the ski patrol to adjust signage, padding around lift towers, and for emergency transport if a skier is injured. Food delivery to the on-mountain restaurants is also done with these smaller machines.

Piston Bully has just introduced a hybrid groomer, the 600 E+, that uses an electric motor assist to reduce fuel use. The electric-assist reduces diesel fuel consumption (and thereby CO2 emissions) by about 25%. The price of one of these machines is almost $500,000.

New GIS-based systems that optimize grooming and snowmaking efforts are beginning to appear. These systems have high initial costs because they require that the ski area be carefully mapped by a GIS consultant using a drone or helicopter. A casual estimate for Snowflake Ski Resort was $150,000 for mapping, then an annual charge of about $15,000 for the software to direct the groomers and snowmakers. Areas that have adopted them show a savings in grooming fuel costs and reductions of 10% to 15% in snowmaking costs. Gary Strand suggested that Don Pouderuse look into acquiring one of these systems. After getting some estimates and talking to his crew, he decided that he would stick to the old-fashioned method. A central concern was whether his crew of mavericks and cowboys would really follow the recommendations of the computer. He also believes that there is an art to great grooming, and that the skill takes years of experience to acquire. He told Gary Strand that if cost savings were really an issue, maybe leaving some ski runs ungroomed was the easiest solution. With over 100 ski trails, about 80% are groomed every night. About 10% are groomed less frequently and the rest left largely ungroomed. The ungroomed trails are either very steep or are narrow glades through forested areas, making grooming difficult. Expert skiers like these trails and can deal with ungroomed conditions.

A little bit of grooming expense is for a sledding hill and a Nordic Ski Center with 15 kilometers of trails for cross-country skiing. The sledding hill is a fun activity for non-skiers or visitors taking a break from skiing. The Nordic Center offers visitors another alternative activity but is mostly used by locals.

Snowflake Ski Basin base area energy use

The base area is where people arrive, rent skis, buy lift tickets, and get on the main lift that goes to the top of the ski area and from which skiers disperse in several directions to other lifts. The base area has two restaurants and a number of shops. During sunny weather chairs are set out so visitors can have a snack and drink and watch people ski down the slopes leading to the main lift.

The main offices of the ski area are here as is a small clinic to treat non-life-threatening injuries. The ski school meets its classes near the main lift. The real estate sales office is also located in the base area.

During the summer the area hosts concerts, and a variety of biking, running and hiking activities. The restaurants are open as are most of the shops, though the merchandise in the shops changes seasonally. The 'ski-in, ski-out' condominiums are rented at about a 40% occupancy rate. During late fall and late spring, the so-called shoulder season or mud season, most of the condos are vacant.

There is no detailed breakdown of energy use for the base area facilities. There is information about the restaurants, but it includes the on-mountain restaurants. The base area electricity use includes the electricity used in the 82 condominiums.

Most of the base area facilities received a slight energy update about four years ago. Some insulation was added to walls, older windows were replaced with double-pane gas-filled windows, and some lighting systems were upgraded to compact fluorescent bulbs. There was a noticeable, but largely unmeasured reduction in electricity use after this.

A quick survey of lighting systems showed that the average wattage of bulbs in surveyed areas was about 45 watts. The person doing the survey estimates that there are about 650 bulbs that could be replaced with low-wattage LEDs with no effect on brightness, and in some cases an improvement in light quality. The average wattage of the LEDs would be 12 watts. The bulbs vary in terms of their use – some are on all day and into the evenings, others only a few hours a day – so a reasonable average would be 7 hours a day 365-days a year. The cost of replacement would be about $4.00 per bulb, installed. Her best guess was that all of the current bulbs would have to be replaced in the next 5 to 7 years, so replacing them now would capture about 6 years of extra electricity savings. A 6% discount rate is appropriate for such projects.

An area that is a problem are the old freezers and refrigerators in the restaurants and some older air conditioning units (used in the summer in the condos). These were recharged last year with HCFC-22, which has a global Warming potential of 1,500 or 1,500 times that of carbon

dioxide. Older equipment tends to develop leaks, which allows the refrigerant emissions to occur. When the 25 pounds of coolant was added to the equipment the technician warned the restaurant manager that this would be a regular occurrence given the state of the equipment. Replacing these units with state-of-the-art equipment would cost about $90,000. This would avoid refrigerator recharge costs of about $1,500 per year for the next ten years. The new equipment would also use about 40% less electricity, though the units being considered for replacement only use about 80,000 KWH of electricity annually. A 6% discount rate and $0.13 per KWH price for electricity would be appropriate for this investment analysis.

Water use at the base area, unlike snow making, is consumptive. About 504,000 gallons are used each year. The waste water is treated in the ski area's water treatment facility and returned to a small lake where it can be used for snow making. The water treatment facility uses about 6,000 KWH of energy a year. This is included in Buildings electricity usage.

Other GHG Emissions Sources

Every year employees attend various industry conferences and travel by air to regional travel expositions. Total air travel by all employees averages about 120,000 miles, almost all on medium haul flights.

Clearing trails in the summer requires cutting trees, most of which are dead. Some of these are burned, some bucked up and cut into fireplace lengths for use in the lodge and condominiums. There is about 20 cords of wood burned in fireplaces every winter. Decaying branches release methane very slowly as they decompose, but it isn't clear which strategy – burning the wood or letting it decay- is better or worse. Burning wood in fireplaces is mostly decorative, so doesn't reduce energy required to heat the buildings.

Renewable Energy Options

The ski area has enormous solar energy potential. Even in winter, between storms, there are many sunny days. There is effectively no wind or micro-hydro energy generation potential, so solar is the best renewable opportunity.

Photovoltaic Energy Generation: The ski area has many places where photovoltaic panels that generate electricity could be situated. The ideal location is for the panel array to face due south at a 37° angle. The table shows the cost and predicted energy production of several sizes of PV solar arrays. The costs include equipment, installation and all inspections.

System Size	Number of PV Panels	Annual Electricity Produced (KWH)	Cost (after rebates and tax effects)
4,000 watt	8	6,625	$6,000
8,000 watt	16	12,250	$11,500
16,000 watt	32	24,500	$18,000

The cost for other configurations can be estimated from the costs shown in the table. Given the space requirements, systems larger than 32 panels would not be feasible. All systems last for at least 20 years and have annual maintenance costs of about $250.00. The cost of electricity for the ski area is currently 13¢ per KWH. A 6% discount rate is appropriate for energy projects like this one.

Solar Water Heating: About 25% of the restaurant electricity consumption is for heating water. This is about 70,000 KWH per year. A consultant put together a proposal for a solar water heating system that would reduce electricity use for heating water by 40%. The system consists of four panels and a 300-gallon auxiliary storage tank for the solar-heated water. The pre-heated water from the auxiliary tank feeds into the existing water heaters to be brought up to the final temperature. The system costs $12,000 installed after all rebates and tax credits. It will last a minimum of 15 years and requires about $150 per year of annual maintenance. The 6% discount rate and 13¢ per KWH electricity costs apply for the analysis of this investment.

Sustainability Reporting and Measuring Progress

Most large ski areas have sustainability information posted on their webpages or available in the report that can be downloaded. The reports cover the standard issues of community, energy and the environment. Since ski areas use large areas of forest or mountainsides the environmental section is usually fairly detailed.

These reports give companies a chance to discuss their CSR (corporate social responsibility) or sustainability efforts and the progress they are making. To discuss improvement, they need to be able to measure their progress (or lack of progress). This requires having an initial baseline with which to compare future performance. Without a baseline changes cannot be measured and evaluated. Once a baseline has been established then the company can begin setting improvement targets.

There are a couple of approaches to target-setting. One is to pick some reasonable sounding number and use it as a target, such as, “A 10% reduction in ____ by 2025” or “Reduce _____ use by 15% over the next 5 years.” Stating targets without a number attached is not as valuable.

So, "Doing a better job using water," is much weaker than, "Reducing water use by 15% by 2025."

General guidelines about the attributes good targets should have, from the webpage by Lesley Lees referenced in the Resources section, are:

> The first thing to remember when outlining targets is to ensure they are SMART:
> - Specific - a specific goal and/or target has a better chance of being accomplished than a general one
> - Measurable – the goal/target has to be able to be measured
> - Achievable – the goal/target needs to challenge people but be achievable at the same time
> - Relevant – the goal/target should be relevant and meaningful to the change program/business needs
> - Timely - the goal/target should have a declared deadline

A second approach is to see what other companies in the ski industry are doing and copy them. This assures that your target cannot be criticized as being too soft, since it is in the range of industry peers.

The third approach, which is slowly emerging as the best approach, is setting science-based targets. This approach uses the best current science about a subject to set a budget or limit, then finds a method for allocating that budget across companies. It has been applied to carbon emissions and water use. A good resource for setting carbon emissions is the Science Based Target Initiative website at: http://sciencebasedtargets.org. There is also a note listed in the Resources section that provides a good introduction to different science-based methods and provides detailed explanations for how to calculate the various types of science-based targets.

An important input for setting a science-based target is company Gross Profit growth. Most ski areas are privately-owned so don't publish their financial statements. A proxy for financial growth might be annual skier visits. Exhibit 5 presents this data for the Rocky Mountain region.

Data

Exhibit 1: Sustainability Data			
Source	2017/18	2018/19	Units
Lift total Electricity	1,807,000	1,911,000	kwh
Snowmaking Electricity	729,850	580,530	kwh
Buildings Electricity	1,392,667	1,485,741	kwh
Restaurants Electricity	274,411	292,541	kwh
Restaurants Propane	2,619	2,785	gallons
Grooming Diesel	57,560	58,350	gallons
Gasoline Various Uses	9,650	10,850	gallons
Base area water	515,200	504,000	gallons
Waste to landfill	162,000	195,000	pounds
Number of landfill pickups	32	41	
Recycling	16,000	21,000	pounds
Number of recycling pickups	6	8	
HCFC-22 refrigerants	45	25	pounds
Employee air miles	95000	120000	
Skier Visits	314275	332193	

Exhibit 2: Snowmaking Energy and Water Consumption			
Snowmaking Energy Use	Cubic Meters of Snow Made	KWH Electricity	Water used (gallons)
2017/18	278,988	729,850	38,890,858
2018/19	223,776	580,530	31,048,920

Exhibit 3: Cost Data	
Electricity from the grid costs	$0.13 per KWH.
Diesel costs	$2.82 per gallon.
Gasoline costs	$2.65 per gallon
Propane costs	$2.15 per gallon
Each Trash or Recycling pickup costs	$625 per trip
CO2 from each pick-up	220 pounds.
Water is not purchased. It comes from the ski area's own system. Equivalent municipal drinking water (cleaner than snowmaking water) would sell for about	$6.50 per 1,000 gallons.

Exhibit 4: CO2 conversion factors	CO2 Conversion Factor	Units	Data source
Energy			
Electricity (Colorado Grid Electricity)	1.93	pounds CO2e/KWH	www.eia.doe.gov/oiaf/1605/ee-factors.html
Natural Gas	120.6	pounds CO2e/MCF	http://www.eia.doe.gov/oiaf/1605/coefficients.html
Employee Commuting	20.3	miles per gallon	http://www.fhwa.dot.gov/policy/ohim/hs05/htm/nt6.htm
Propane	12.7	pounds CO2e/gallon	https://www.eia.gov/environment/emissions/co2_vol_mass.php
Diesel	22.4	pounds CO2e/gallon	https://www.eia.gov/environment/emissions/co2_vol_mass.php
Gasoline	19.564	pounds CO2e/gallon	http://www.eia.doe.gov/oiaf/1605/coefficients.html
Upstream CO2 for Gasoline	5.48	pounds CO2e/gallon	https://www3.epa.gov/otaq/climate/420r06003.pdf (Table 14, Page 55)
Air Travel			
Short haul <600 miles	0.64	pounds CO2e/mile	Source:
Medium Haul 600 to 2500	0.44	pounds CO2e/mile	http://www.climatepath.org/howitworks/calculatormethodology
Long Haul >2500 miles	0.40	pounds CO2e/mile	
Water and waste			
Water	0.00248	pounds CO2e/gallon	http://www.treehugger.com/files/2007/08/carbon_footprin_1.php
Waste to landfill	1999	pounds CO2e/ton	http://www.eia.doe.gov/oiaf/1605/coefficients.html
Miscellaneous			
Refrigerant – HCFC-22	1500	pounds CO2e/pound	https://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html
Recycling (Single Stream)	1000	pounds CO2e/ton	Author estimate

Exhibit 5: Skier Visits at Rocky Mountain Ski Resorts		
Season	Visits in millions	Annual Growth Rate
2018/19	24.408	17.4%
2017/18	20.792	-4.3%
2016/17	21.736	-2.5%
2015/16	22.287	7.3%
2014/15	20.768	-1.6%
2013/14	21.100	6.6%
2012/13	19.800	3.5%
2011/12	19.130	-8.5%
2010/11	20.900	2.6%
2009/10	20.378	2.0%
2008/09	19.974	-6.3%
2007/08	21.324	2.3%
2006/07	20.849	0.6%
2006/07	20.717	5.7%
2004/05	19.606	3.9%
2003/04	18.868	0.7%
2002/03	18.728	3.3%
2001/02	18.123	-6.2%
2000/01	19.324	
Average	20.117	1.1%

Data from National Ski Area Association:
http://www.nsaa.org/media/303945/visits.pdf

Resources

Byrd, A Note on Setting a Science-Based Carbon Reduction Target, 2017.

Lesley Lees, Sustainability targets and sustainability goals, 22 March 2015, at:
http://www.sustainableadvantage.com.au/blog/sustainability-targets-and-sustainability-goals

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Ski Area Citizens' Coalition (Is not currently active but has its reports archived)
http://www.skiareacitizens.org
Ranks western US ski areas based on four areas (with relative weights shown):

- Habitat Protection (104 points possible)
- Protecting Watersheds (27 points possible)
- Addressing global climate change (64 points possible)
- Environmental policies and practices (35 Points)

Full reports for the ski areas can be accessed at the website via pull-down menus.

Ski Area Citizens' Coalition Grading Criteria
(http://www.skiareacitizens.org/index.php?nav=how_we_grade)

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Sustainable Slopes (an annual report by the National Ski Areas Association)
The NSAA's Facts about Snowmaking can be found here:
http://www.nsaa.org/media/248986/snowmaking.pdf

The NSAA also publishes an annual Sustainable Slopes report that gives brief updates on what some ski areas are doing to reduce their environmental impact. The list of reports is at:
http://www.nsaa.org/environment/sustainable-slopes/
The 2019 report is at: http://www.nsaa.org/media/376891/SustainableSlopes_AR2019.pdf
Ski areas with sustainability reports: http://www.nsaa.org/environment/the-green-room/

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