



Renewable Energy in Tourism Initiative

Best Practices in the Ski Resort Sector



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EXECUTIVE SUMMARY

It can easily be argued that the ski resort industry has the most vested interests in the impacts of climate change. Meteorological changes, whether atmospheric or weather-related, can alter the whole environment of a ski resort.

The slightest change in temperature can dictate if snow is natural or man-made, the opening and closing dates of the resort, and safety issues. New technology and a better understanding of climate change are favoring the ski resort industry. As can be witnessed throughout the case studies that follow in this best practices manual, the ski industry is embracing the need for change and setting the pathway for future developments addressing renewable energy and energy efficiency.

Reduction of their carbon footprint is the predominant factor addressed by the industry. Several initiatives have been introduced and can be considered as common practice now. As evidenced, modifications to motor fleets, building retrofits, improved snowmaking devices and practices, and concerted efforts to change the behaviors of both employees and visitors are the norm.

It should be noted that this change has not been necessarily easy or always cost-effective. Many of the actions adopted have come about from trial and error. Others stem from more proactive decisions and extensive research to find the best way to reduce environmental impact. The return on investment is most often experienced over the longer time period. Also, the ski resort industry has had to educate the consumer that their efforts towards climatic accountability are not just self-serving.

Important to note is that the ski resort industry is multi-faceted, involving similar challenges faced by the accommodations sector, public land agencies, and tour operators. Visitors to these sites are all seeking the optimal experience; and they want the 'biggest bang for their buck.'

Considered non-traditional power sources, photovoltaic systems and hydroelectric systems are predominant. LEEDS building standards are commonplace and current practices may, over time, lead to the development of new standards. It is exciting to witness the difference that the ski resort industry is making towards climate change and also to renewable energy initiatives.

This **March 2008** edition of the Renewable Energy Tourism Initiative (RETI) *Best Practices in the Ski Resort Sector* draws upon the experiences, insights, and resources provided by Aspen Ski Company (ASC), Grand Targhee Resort (GTR), Vail Resorts, Inc. (VRI), and Whistler Blackcomb (WB). Additional input is expected from these and other ski resorts in the coming months.

Researchers reviewed information published on- and off- line, including media reports and information supplied by these lodging providers and conducted telephone interviews, when possible. Independent verification of claims made was not available to the researchers. Difficulties and challenges in implementing renewable energy practices plus return on investment information may also be currently incomplete. This publication is a work in progress and information will continue to be refined and distilled to enable a quick comparison of renewable energy options in future editions.

Nine major areas of renewable energy investment emerged from this research, each falling into one of two general categories. The first highlights short term efficiency projects that require modest capital investment. The second addresses long term initiatives that involve more structural changes, green building construction technologies, and renewable energy resources.

In all the areas identified below, management focus and staff buy-in are critical. Perhaps the best example of this concept is from the case study that features the



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conflict over lighting that arose between the restaurant manager and the management personnel.

The full Best Practice document provides additional detail and links to resources on each of the outlined best practices.

Ski Resort Best Practices at a Glance

Short-term Initiatives

1. **Building Retrofits** – When done over time, the capital needed to complete retrofits is modest in that a return on the action is realized immediately. One example is the resort that replaced its roofing material with a higher R-value rated material.
2. **Installation of Sensors** - Installed vending machines that have motion sensors to activate them on an “as needed” basis is one method of energy efficiency. Also, the use of motion sensors to control the lighting and heating sources is beneficial, particularly in areas that are not constantly populated.
3. **Modification of Fleet Vehicles** – After the initial investment, this action can yield a high return on environmental and economic measurements. Cleaner burning and increased energy efficiency can parlay into sound policy.
4. **Environmental Programs and Directives** – This type of initiative is proven to enhance the bottom line. Whether the ski resort devises its own or adopts a standardized program, the educational purposes of such a program benefit both the site personnel and the visitor.

Long-term Initiatives

1. **Installation of Photovoltaic (PV) Systems** – The sun will shine. With this simple statement lies an important source of clean energy and one that is extremely beneficial to ski resorts as it is virtually

pollutant-free. Although the cost can be a major expense, ski resort industry members recognize the long term gains.

2. **Hydro-Power Systems** – Three ski resorts found that implementing hydroelectric systems outweighed the costs entailed. The water resource needed for such a system is readily available, for example, snow melt-off. As with PV systems, the excess energy created can be credited during the off-season.
3. **Purchase of Renewable Wind Credits** – When used as an off-set program, this provides an option for energy savings. In most cases, the ski resort is in the process of examining other viable means of producing clean, renewable energy.
4. **Use of Alternative Fuels for Heating Systems and Equipment** – Several of the companies highlighted in the case studies discovered that these measures offered them optional usage of by-products and a cleaner, more energy efficient source of power for snow moving equipment. A trickle down effect presents itself as the visitor sees that alternative fuels are practical.
5. **LEEDS Certification** – Two of the companies highlighted in the case study section are embracing LEEDS Certification, and leading the way for others to do the same. Although the associated costs can be high, the long term benefit of this technology is a positive motivator. Also, as the visitor becomes savvier in their knowledge of sustainable issues and initiatives, research shows that companies need to incorporate these measurements.



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Further Questions & Concerns

1. Quality Information – Many of the practices presented in this draft do not contain Return on Investment or other critical metrics to allow rigorous comparison of renewable energy options. Without this type of information or a method of independent, objective assessment it is difficult to distinguish ‘PR’ speak from substantive progress.

Q: Are there mechanisms to provide third-party assessments of renewable energy practices within the tourism industry?

2. Carbon Offset Verification – There is no independent verification of carbon offset programs. This includes verification of the calculations of the cost of offsets and the certification that funds are being invested as promised and having the desired effect of offsetting, reducing, or otherwise mitigating CO2 emissions.

Q: Are independent standards and verification necessary for a robust carbon offset program?

3. Technical Information - Many of the suggested best practices require complex technical and operational information for implementation. There is currently no easy way to share and access the information in these best practices, distinguishing important areas of co-operation from legitimate areas of competitive advantage.

Q: How does the industry address the issue of information sharing?



(Photo courtesy of Whistler Blackcomb)



BACKGROUND

RETI Best Practice Manuals

The Renewable Energy in Tourism Initiative (RETI) was developed to feature industry leaders that have adopted best practices in renewable energy and energy efficiency, and to provide information and guidance to businesses interested in realizing these benefits. The best practice manuals were designed for tourism businesses of all sizes. Through the use of case studies, each manual highlights and outlines renewable energy adoption and adaptation strategies that maximize energy efficiency, minimize environmental impacts, and result in cost savings or increased profitability across six tourism sectors: accommodations, airlines, cruise lines, public lands agencies, ski resorts, and tour operators.

These best practice manuals are intended to serve as an inspiration and guide to other businesses interested in realizing the benefits of adopting renewable energy initiatives and supporting a healthy planet. RETI is part of a broader objective of creating a comprehensive set of best sustainable business practices in each designated tourism sector.

Best Practice by Definition

A best practice is a process, technique, or innovative use of resources – such as technology, equipment, personnel, and data – that has resulted in outstanding and measurable improvement in the operation or performance of a tourism business. Each best practice will have demonstrated success by significantly and measurably improving outcomes in one or more of the following three areas of business performance:

- Operational factors;
- Financial objectives; and
- Marketing objectives

In addition to business outcomes, the best practices outlined in the RETI manuals help to eliminate, minimize, or mitigate the environmental impact of the business through pollution prevention, carbon emissions reductions, and/or carbon offsets, etc.

Content Acquisition and Validation

Sustainable Travel International (STI) was responsible for acquiring and validating the content included in this document. To identify industry leaders in each segment, STI made public announcements via its E-newsletter, other online outlets, and through word of mouth, then accepted nominations from various stakeholders and completed a due diligence process. Interviews were then conducted with representatives from each company or organization identified, representatives were asked to review each applicable best practice document, verify the information contained therein, and provide constructive feedback. No on-site verification of researched activities was involved, though many of these activities have been verified through other procedures. (These documents will soon be placed in a Wiki web environment so that STI can invite public comment and so that each individual document can be continuously updated and improved upon over time.)

Industry Overview and Sustainability Initiatives

Changes in temperature by as little as one degree can make or break ski conditions at resorts across the world. For this reason alone, and perhaps more so than in any other sector of the tourism industry, ski resorts have a vested interest in mitigating the effects of climate change. Many have demonstrated their commitment to the environment by adopting new snowmaking techniques, increasing facility-related energy efficiencies, and installing renewable energy systems, for example. Ski resorts have to overcome the very real challenges related to financial return on investment (ROI) of capital intensive renewable energy solutions versus returns from investing elsewhere. Much success to date has been the result of trial and error, as solutions can be unique to environmental and operational conditions of each ski resort. They also have to balance their actions against public opinion since their response to global climate change may be perceived as self-preserving, as the effects of even the



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most minute temperature change could be devastating to the skiing industry.

Case Study Participants

The best practices case studies discussed below include Aspen Ski Company (ASC), Grand Targhee Resort (GTR), Vail Resorts, Inc. (VRI), and Whistler Blackcomb (WB).

Some of the most effective initiatives include:

- Creation of new sustainability planning directive (GT)
- Purchase of renewable wind credits to offset all electricity use (ASC, VRI, GT)
- Modifications to vehicle fleets and procedures (all)
- Building modifications, particularly in the area of lighting (all)
- New LEED facilities (VRI, ASC)
- Research and installation of on-site renewable energy projects to offset electricity use
 - Installation of hydroelectric systems of all sizes (WB, VRI, ASC)
 - Installation of small PV systems (GT, ASC)
 - Research on possible fuel sources for a Hydrogen Fuel Cell project (GT)



(Photo courtesy of Whistler Blackcomb)



BEST PRACTICE CASE STUDIES

Case Study: Aspen Skiing Company

Aspen Skiing Company (ASC) hosts 1.4 million skiers annually on its four mountains (Aspen, Highlands, Buttermilk, and Snowmass), golf course, its two hotels, and 15 restaurants. They employ 3,400 people in winter, and have been in operation for over 60 years. ASC is widely regarded across the globe as a very prominent ski resort company, and is recognized as an industry leader in addressing climate issues.¹

ASC's self-financed environmental program was established in 1997. Their environmental management program, GREENTRACK, focuses primarily on energy use and climate change, followed closely by other priorities such as public education, construction, water use and policy, waste management, and wildlife habitat and land use management.

A sampling of ASC's most effective energy initiatives include:

- Purchasing wind credits equivalent to their total energy use (a ski industry first)
- Using biodiesel in their snowcats, the bulldozer-sized machines used for slope-grooming
- Partially heating the resort's vehicle shops with used motor oil from the vehicles, which is poured directly from the drain pans into a furnace fuel tank
- 20 vending machines running on motion sensors (VendingMisers), so that the compressors do not run all night. The bottom item is kept cool in case of use
- LEED Silver certified Snowmass Golf Clubhouse – heated and cooled by the pond on the 18th hole
- Other green, highly energy efficient buildings include the Highlands Patrol Headquarters, the Sanctuary Condos, the Sundeck, and every new building in the pipeline

- A 115-kilowatt (kW) micro-hydroelectric plant on Snowmass Mountain, generating 250,000 kW annually, enough to power 40 homes while preventing the emission of half a million pounds of carbon dioxide
- The largest solar photovoltaic (PV) system in ski industry. The 2.3kW array is part of Aspen Highland's patrol headquarters at the top of the Loge lift. It provides enough energy annually to run an average home for half a year. In the summer, when the building is unoccupied, the system runs the electric meter backwards, creating a credit for the following year. As of February 2008, ASC installed an additional 10.5 kW array and will complete another 4.5 kW array and an incredible 150kW (!) in the spring of 2008.

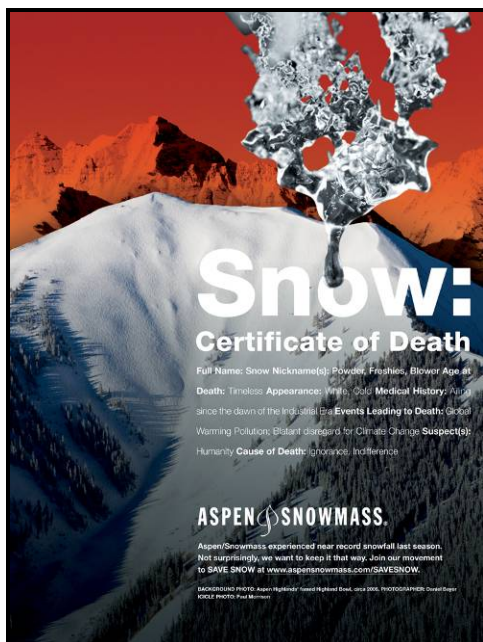


Aspen solar panels (Photo courtesy of ASC)



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- Lighting retrofit in parking garage under Little Nell Hotel.ⁱⁱ This update saves 300,000 lbs of CO₂ annually and a similar back-of-house retrofit in the same hotels saves an equal amount.
- Snow-making - an almost invisible speck of dust is used to seed each artificial snowflake. This method is becoming popular at many resorts because it consumes less water and energy to produce and is only slightly more expensive than using just water.
- Save Snow Campaign (www.savesnow.com) – launched in the fall of 2006, Aspen features a series of full page ads that run as part of ASC’s winter advertising campaign. These ads are designed to provide information about Global Climate Change and to encourage people to act.



Save Snow Campaign cover ad (Image courtesy of ASC)

Background Information on Best Practice – Micro-hydro System

ASC’s micro-hydro system at Snowmass Ski Area demonstrates an innovative secondary use of their existing snowmaking facilities to produce an impressive amount of renewable energy. As Auden Schendler, Director of Environmental Affairs at ASC, notes, “The biggest expense of most micro-hydro systems is the

“penstock,” or pipe, that runs from high elevation to low, creating pressurized water that can spin the Pelton wheel. The economics of installing a penstock can often kill a project. Installing a basic hydroelectric system on Snowmass Mountain would have required building a retention pond (at a cost of about US\$1 million), and burying 4,000 feet (1,220 m) of 10-inch (25 cm) steel pipe.” Instead of starting from scratch, ASC opted to utilize their preexisting snowmaking facilities, which include the necessary pond and piping, in the creation of their micro-hydro system. The system also acts as a unique educational opportunity for guests since it can be directly viewed from one of the primary lifts at Snowmass. If intrigued by the informative sign at the lift, skiers can then ski down to the building and learn more on site.ⁱⁱⁱ

Resources Required

This particular micro-hydro system is estimated to have a seven-year return on investment.

Location: Fanny Hill, Snowmass Ski Area, Snowmass, CO, USA
 Head: 746 feet (227 m)
 Pipeline length: 4,103 feet (1,251 m)
 Static pressure at turbine: 323 psi
 Average flow: 1,100 gpm (2.45 cfs)
 Turbine: Single-nozzle Pelton turbine from Canyon Hydro, 18.5-inch pitch diameter
 Generator: 175 hp, 480 V, 3 phase, 60 Hz, 115 KW
 Annual generation: 250,000 KWH, estimated

Equipment Costs:

Turbine and switch gear – US\$65,610
 Structure and foundation – US\$48,957
 Excavation, pipe connection, and associated fees – US\$7,500
 Consulting fees US\$7,240
 Flow meter – US\$6,000
 Electrician – US\$5,200
 Utility interface – US\$5,000
 Shipping – US\$3,000
 Installation and crane – US\$2,000
Permits – US\$1,500
Total Costs: US\$152,007



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Grants:

CORE/REMP/Ruth Brown Foundation – US\$20,000
 OEMC – US\$15,000
 StEPP – US\$10,080
 Holy Cross – US\$5,000
Town of Snowmass Village – US\$5,000
Total Grants: US\$55,080

Grand total: US\$96,927^{iv}



*Micro-hydro systems transform snowmakers into energy producers
 (Photo courtesy of ASC)*

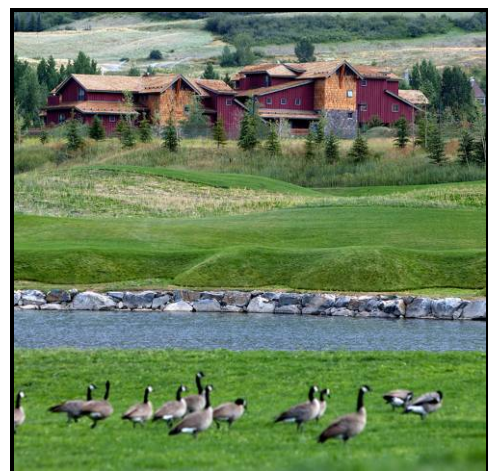
Background Information on Best Practice – Lighting Retrofit

Another lesson to be learned from ASC's experience in going green is the value of admitting failures and learning from them. One of the best examples of this was their attempt at retrofitting the lighting in the one of ASC's restaurants. The original plan was to replace the bulbs with compact fluorescents, and after the lengthy process of obtaining approval, Schendler moved forward to complete the retrofit. The restaurant manager, however, was less than pleased with the sight of the bulbs, and threw them out, replacing them with halogens. Schendler concludes, "Here's what your sustainability efforts have brought you: a wasted design and installation fee; inefficient lighting; a loss of faith in green technology by the manager; hundreds of expensive compact fluorescent bulbs that, instead of being reused (at the very least,) are now leeching mercury into the local unlined landfill; and unanticipated costs for new bulbs and installation. Welcome to the sustainability revolution."^v

The problem here, as Schendler notes, was the *perception* that compact fluorescents were of lesser quality than traditional lighting. As many have learned, small steps are sometimes the quickest way to achieving sustainability, and this case is no exception. Instead of persisting in the matter, Schendler simply admitted failure and set his sights on something more achievable: the parking garage. The lighting there was inefficient, of poor quality, and had no effect whatsoever on the hotel's five star rating, which made it the perfect testing ground to prove the viability of efficient lighting design. Schendler's solution was to replace the 110 metal halide lamps, which were recessed behind beams, with single fluorescent fixtures in plain view. The project was an undeniable success – a higher quality product with a 60 percent return on investment..^{vi}

Monitoring and Evaluation

ASC insists on third party evaluation and auditing in determining and developing transparency and legitimacy in the claims it makes. ASC has proven successful in this time and again through such efforts as gaining ISO 14001 certification, LEED's green building certification, and in becoming the first company in the hospitality industry to join the Chicago Climate Exchange (CCX), which commits ASC to legally binding annual reductions in its CO2 emissions..^{vii}



*Pond used for heating & cooling of LEED Silver certified Clubhouse
 (Photo courtesy of ASC)*



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The 115-kW micro-hydroelectric plant on Snowmass Mountain generates 150,000 kW annually, enough to power 20 homes while at the same time preventing the emission of half a million pounds of carbon dioxide.

In the parking garage under the Little Nell Hotel, light quality has improved greatly, increasing visibility for valets, and the energy savings have been significant. The cost of the retrofit was US\$19,000, and it pays back US\$11,500 annually, including both energy savings and labor reduction. This yields a 60 percent return on investment. The Nell also keeps 300,000 pounds of CO₂ out of the atmosphere annually.^{viii}

Replicability

"Think about the possibilities," Schendler proposes. "Hundreds of ski resorts in America have snowmaking systems. On our four mountains alone, we have half a dozen more good opportunities for hydro. If we had five or ten turbines running, we'd be generating an enormous amount of renewable energy— enough for say, 200 homes—contributing to clean air, stable climate, and the long-term sustainability of the ski industry and the town. Any ski resort with a snowmaking system should look into installing a turbine."^{ix}



Turbine and generator (Photo courtesy of ASC)

ASC's success in implementing industry firsts has paved the way for them to not only become an industry catalyst, but also to develop new business opportunities by acting in an advisory capacity for other ski resorts

wanting to replicate their successes. For example, ASC became the first ski resort to fuel all of its snowcats on B20 biodiesel, a mixture comprised of 20 percent biodiesel and 80 percent conventional diesel, which reduces black tailpipe smoke and cuts hydrocarbon emissions. Other ski resorts have followed the lead and converted their own snowcats.

Success Factors and Benefits

While Schendler says ASC has been proactive because "it's the right thing to do," he acknowledges that there are major business benefits as well. Among the benefits are savings from reduced energy consumption; better building and mechanical system performance through green building and commissioning programs; enhanced reputation through positive news coverage; the widely-held perception that Aspen is the "greenest ski resort" in the industry; and reduced risk in knowing that they are in no danger of being fined for hazardous waste since ASC has nearly eliminated it.

ASC's environmental efforts have garnered the company high praise in the ski industry. In 2006, ASC was awarded the prestigious Golden Eagle award for overall environmental excellence at a ski resort for an unprecedented 5th time.^x

Challenges and Pitfalls

The reality is that eco-innovation can be extremely difficult to make a corporate priority. Even at Aspen, conservation competes for attention and resources. Schendler recalls the restaurant manager who rejected condiment pumps in favor of throwaway plastic packets and the five years it took to get a US\$20,000 lighting retrofit in the Little Nell valet parking garage, despite a payback period of two years. "I was arguing against the culture," he says. "In a place like Aspen, at the Little Nell, if I'm the manager and I have US\$20,000 to spend, I'm going to spend it stocking the wine cellar, or on new sheets and towels, spend it replacing leather furniture in the guest rooms." This also speaks to the challenge of changing the public's (and management's) perceptions of fluorescent lighting being appropriate for offices, grocery stores, even prisons – but not for five-star



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hotels. In order for efficiency and luxury to go hand in hand, these perceptions must change.

Another challenge that should be noted, which ASC discovered, is that people who are on vacation do not want to be browbeaten into political activism. The risk is that they will not become activists; they will just pick a different mountain.^{xi}

Lessons Learned

Schendler explains: “To assume an efficiency project with a better than 60 percent return on investment is a no-brainer for management to support. Even projects like the Nell garage retrofit can be difficult for businesses not used to making money through savings. Given the substantial obstacles, it’s a miracle the retrofit actually occurred. Our key to success? Pure doggedness, not the inherent value of the idea, and a US\$5,000 grant from a local non-profit interested in encouraging efficiency projects. Sustainability is cool and *avant garde*, but it won’t happen without two stodgy and staid partners: cash incentives (if available) and grit.”^{xii}

Case Study: Grand Targhee Resort

Located in Wyoming, Grand Targhee Resort's name elicits references to both Grand Teton Mountain and Chief Targhee, a local chief about whom little is known other than he maintained peace between white men and his tribesmen. A National Forest, a mountain pass, a creek and their ski and summer resort commemorate Chief Targhee's integrity and the memory of the Native American contribution to this country. The local folks of Teton Valley were instrumental in establishing the resort, which opened on December 26, 1969.^{xiii}

Grand Targhee Resort (GTR) is working on a number of initiatives to minimize their energy use and carbon footprint. One of the greatest accomplishments to date has been the creation of their Sustainability Operations Department, which has enabled them to systematize their efforts, making them more efficient and effective.



Plenty of sunshine at Grand Targhee (www.unpluggedliving.com)

Under this initiative, their energy conservation strategies include:

- Facilities management practices, including energy efficiency measures;
- Renewable energy development efforts internally and the purchase of renewable energy credits; and
- Alternative transportation initiatives.

Background Information on Best Practice – Facilities Management

Through GTR’s Sustainability Operations Initiative, 95 percent of the Resort’s lighting has been retrofitted with compact fluorescent lamps for increased energy efficiency. Another effort included in this initiative requires off-season heating sources to be either turned down or turned off. Further efficiency measures include purchasing only Energy Star-rated appliances, “tightening” 90 percent of entryways to alleviate any leakages, and replacing two main roofs at the Grand Targhee Base area, which will significantly increase the R-values and save on associated energy costs and emissions. Another effort includes retrofitting old propane boilers with more efficient units.



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Background Information on Best Practice – Internal RE Initiatives and Purchase of RE Credits

GTR is providing onsite renewable energy to power its lifts via a **660-watt** solar photovoltaic (PV) system. At the time of this research, GTR shared that they are working with a hydrogen fuel cell company to assess options for harnessing methane from an onsite waste water treatment facility and converting it to usable electricity. This project is in the early stages, and GTR estimates that at least two years of planning will be required before it can be implemented. For other energy related climate impacts, GTR is purchasing renewable energy credits to offset 100 percent of the resort's annual electrical power use. As a temporary solution, they have committed to Bonneville Environmental Foundation to purchase 10,500 megawatt-hours of renewable energy over the next three years while reducing impacts internally. Participating in this program helps avoid approximately 4.8 million pounds of carbon dioxide (CO₂) emissions per year.

Background Information on Best Practice – Alternative Transportation Initiatives:

GTR is involved in developing incentive based, alternative transportation programs, including employee incentives to carpool or ride their bikes, whereby the resort pays participants every time they engage in these activities. The company also provides a shuttle bus for employees from surrounding areas, and an on-request van service from vacation properties in the area in addition to working with the Teton Valley Transportation Authority to provide park and ride services.^{xiv}



Biodiesel shuttle at Grand Targhee (www.grandtarghee.com)

Steps in Implementation

GTR began its venture into sustainability by hiring an Environmental Consultant. This person assisted the management team in developing GTR's sustainability Charter and creating a job description and hiring a Director of Sustainable Operations. Once hired, this person's first task was to create an overarching tracking system that would incorporate department-specific progress into a coherent resort-wide picture. This introduced the creation of a "sustainability matrix" for each department that called for the Director and managers of each department to create goals for reducing energy use. The Director's next responsibilities were tripartite in nature – to create the expectation for change among employees, to improve both internal and external communications, and to enable the implementation of change to be more efficient and effective. Finally, GTR sought out partners and took advantage of existing programs to help them achieve sustainability, including the United States Environmental Protection Agency GreenPower and WasteWise programs, the Yellowstone Business Partnership's UnCommon Sense program, National Ski Areas Association's (NSAA) Sustainable Slopes program, and The Ski Area Citizens' Coalition. These partnerships have enhanced peer support and networking opportunities while providing readily available experts for consultation that have proven beneficial in meeting deadlines.^{xv}

Resources Required

- Hiring of Environmental Consultant: US\$30,000
- 10,500 Megawatt Hours of Renewable Energy Credits purchased through Bonneville Environmental Foundation: US\$61,500
- Employee Carpool Program: US\$12,000 since December '07

Monitoring and Evaluation

Under the direction of the Sustainable Operations Department, each manager is responsible for updating progress on their department's matrix (goals and initiatives) on a bi-monthly basis. Deadlines have been



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established and are expected to be met. The Resort's General Manager is supportive of the Resort's Matrix and holds managers responsible to the matrix through job performance evaluations. Following is a list of progress made in the Resort's Sustainability Charter "areas of focus" from 2006 to current.

1. Facilities Management

- Replaced 80% of the shower heads in its lodging units to low-flow
- Replaced 100% of the water faucets with low-flow units
- Installed waterless urinals in 20% of public bathrooms stalls
- Replaced 10% of carpet in lodging units with recycled carpet
- Tightened 75% of entranceways to reduce heating needs
- Replaced two roofs on main lodges, cold roofs with significantly increased r-values
- Replaced approximately 20% of base area patio wood with recycled wood
- Replaced 100% of Resort's lighting with CFL bulbs. Retrofits saved the Resort approximately US\$20,000 in 2007
- Replacing 50% of hot water heaters with on-demand systems

2. Renewable Energy

- Signed 3-year contract with Bonneville Environmental Foundation to purchase 10,500 Megawatt-hours of renewable energy credits to offset 100% of our energy use
- Offset 4.8 Million pounds of CO2

3. Intelligent Transportation

- Creation of EPA Award-winning carpool program that pays employees to carpool and ride Resort mass transportation
- Established front-row preferred parking program for guests
- Established shuttle system from Valley to Resort for all large events, such as music festivals and holidays
- Reduced 2007 trips from nearest community by 25% and saved 50 tons of CO2

4. Preferred Purchasing & Waste Management

- Replaced 95% of disposable flatware, condiments, and cups with reusables. Reduced Resort's total waste stream by approximately 3%. Where operation was using disposables, all were made from bio-based, compostable PLA "plastics" made of corn-starch.
 - Saved the Resort approximately US\$24,000 annually
- Reduced its total waste stream by 4% from 2006 to 2007
- GTR partnered with Fall River Electric to hold a Household Hazardous Waste collection day and collected 350 gallons of liquid, flammable materials, 100 pounds of solid hazardous and electronic waste, 10 gallons of used motor oil and 2 gallons of used anti-freeze. The Resort gave away 500 CFL bulbs to employees and collected approximately 20pounds of used CFLs for recycling
- Food & Beverage operation partnered with a local farm to collect food scraps for animal feed.
 - Reduced GTR's food waste by 1,000 pounds
- Recycled approximately 200 pounds of e-waste



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- GTR's disposable paper products are made from at least 50% post-consumer product, most using 100%. The Resort established a paper use tracking program by department. Each department is required to reduce its yearly use by 10%.
- GTR saved 26.22 tons of CO₂ through reduction and recycling and 15% in fuel costs from reduced trips to the landfill.

The above projects saved approximately 50 tons of CO₂ (40-year life cycle average for 40 acres of preservation).



Solar panels at Grand Targhee (www.grandtarghee.com)

Replicability

GTR addressed the necessity of having a clearly defined charter, a plan for moving forward, and action items that were clearly identified. Since the owner of GTR was fully supportive of the company's efforts, the challenge of getting buy-in from management and leadership was lessened but may require a process of culture change, education, patience and persistence in other organizations. Opportunities for open dialogue around the issues and the concept of sustainability have a great impact on setting into motion organizational change.^{xvi}

Success Factors and Benefits

The economic benefits of GTR's program are evidenced in reduced costs for energy, water, and materials, as well as increased visibility and support from

environmentally conscious potential employees and guests. Employees and guests also have a greater awareness, whether theoretical or empirical of their individual impact on the environment, and they spread that culture of awareness to their friends and family. They also have the capacity to not only carry out their roles in relation to the resort, but also enhance the resort's operations.^{xvii}

Challenges and Pitfalls

Some practices that are considered to be 'green' may not appear to work very well or be applicable within the confines of GTR, thus decreasing the confidence of people who may have been reluctant to make the changes in the first place. Christina Thomure, Director of Sustainable Operations, says that this can be overcome by open dialogue about the over-arching goals of any particular initiative, and brainstorming relating to how to alternately achieve these stated goals without following that particular 'green' practice. This may, in turn, lead to finding other possible solutions. Thomure always asks employees to never use the phrase "we can't do that because...," but instead say "we can do that IF we..."^{xviii}

Lessons Learned

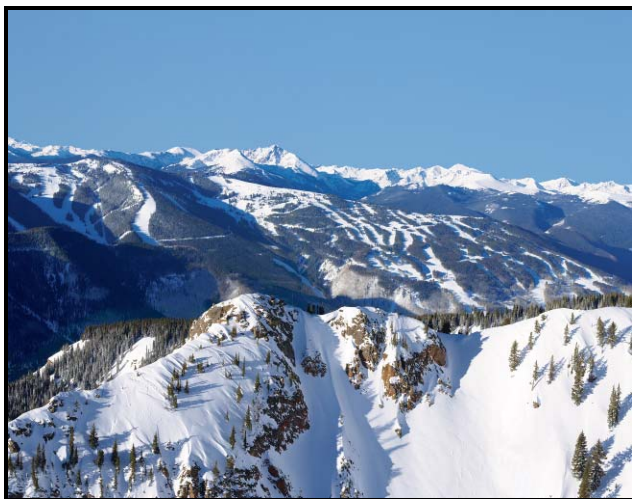
GTR's leadership learned that patience and persistence are essential keys to creating culture change and awareness of their sustainability initiative. They also learned that when employees are well-trained, educated, and able to have dialogue around the issues, they are much more likely to embrace the initiative. There is also a process of trial and error that has to occur before the best solutions that fit a company's needs is found, and for this reason, Thomure says there is not much she would do differently. GTR strives to be a leader for sustainability; therefore, they are committed to a continual process of learning and improvement through imagination, experimentation, and implementation.^{xix}



Best Practices in the Ski Resort Sector

Case Study: Vail Resorts, Inc.

The ski resort segment of Vail Resorts, Inc. (VRI) owns and operates five ski areas - Vail, Beaver Creek, Breckenridge, and Keystone in Colorado, and Heavenly that spans California and Nevada. Vail Pass, and the ensuing resort and town, were named after Charles Vail, the chief engineer for the State of Colorado in the 1930's who developed hundreds of miles of roads that connected the state's mountain communities. Vail Resort, the company's namesake, opened in December of 1962, and is now the largest single ski area in North America, with 3,000 year-round employees and approximately 15,000 employees during the peak of the high season.^{xx}



Vail's vast terrain (Photo courtesy of VRI @ Jack Affleck. Vail, Colo.)

VRI is engaging in a significant number of activities to reduce their emissions and energy consumption. In November of 2007, Colorado Governor Bill Ritter released his Climate Action Plan, which aims to reduce greenhouse gas emissions 20 percent by 2020 and 80 percent by 2050. VRI has committed to adopt these goals as well, and is employing a variety of initiatives to accomplish these goals through the following:

- Green purchasing guidelines
- Facilities Management practices, including energy efficiency measures
- Purchase of Renewable Energy Credits (RECs) to offset electricity consumption
- Green building practices and certification

- Alternative transportation initiatives
- Vehicle management, upgrade and replacement programs

Background Information on Best Practice – Green Purchasing Guidelines

VRI's purchasing department is in the process of incorporating green purchasing guidelines into all future vendor contracts. This includes green cleaning products, sustainable paper and printing purchases, building supplies, lighting and equipment, all of which have GHG implications relative to manufacturing and transportation. Although the authors were not able to assess these guidelines or cite specific examples from VRI, other industry examples along these lines for a company with some 42,000 vendors propose the effects of such a policy could be far-reaching. In many cases, efforts are focused on education and awareness. As companywide initiatives unfold, a combination of capital and operating expenses will be necessary to convert equipment and facilities.

Background Information on Best Practice – Facilities Management Practices, Including Energy Efficiency Measures

At some of its resorts, VRI has made significant upgrades to its snowmaking systems. At Keystone, 62 low energy guns for snowmaking have resulted in greater output capacity, better snow quality, and an overall 25 percent increase in efficiency. This upgrade resulted in an estimated 3 million kWh reduction in electricity consumption each snowmaking season. In addition, installation of EPA Energy Star rated appliances, electronics, and other service equipment is becoming common practice throughout all of VRI properties. Some resorts also feature automated energy management systems, including timers and motion sensors to power down in-room heating and ventilation and cooling systems. In addition, lighting retrofits are currently being implemented in all back-of-house service areas.



Best Practices in the Ski Resort Sector

Summary of VRI’s facilities management initiatives:

Vail

- 3% reduction in lift and facility electrical usage in 2007 -371,131 kWh-358 tons of Carbon Dioxide

Beaver Creek

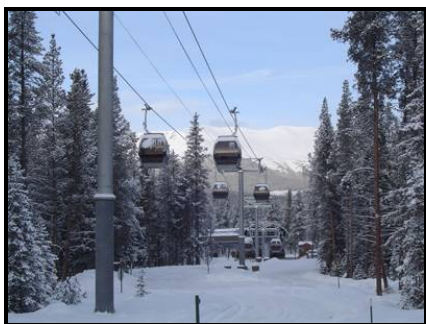
- Purchased Occupancy Sensors for many on mountain operations
- Installation of energy-efficient T8 fluorescent tube lighting and 23 watt compact fluorescents

Keystone

- Keystone Lodge: over 1,000 incandescent bulbs replaced with CFLs in rooms and in common areas. Expected to save 175,000 kWh per year
- Snowmaking pipe replacements to reduce leaks and improve overall efficiency
- Variable-Frequency Drive AC motor for the new conveyor lift at Adventure Point tubing hill, which increases the motor’s efficiency by 30 percent over the replaced DC drive

Breckenridge

- Variable-Frequency Drive AC motor on one new magic carpet that uses 30% less electricity than it would if it had a DC drive
- Variable-Frequency Drive AC motor on BreckConnect Gondola that uses 30% less electricity than it would if it had a DC drive. The VFD is unaffected by fluctuations in power, allowing for more efficient use of electricity



BreckConnect Gondola (www.ropeways.net)

- The reduced bus usage made possible by the BreckConnect Gondola resulted in 2,200 gallons of diesel saved in November and December 2007

compared to the same period last year. Most of this savings came in December, meaning the expected reduction in fuel for the entire season is likely to be close to 10,000 gallons.

Background Information on Best Practice – Purchase of Renewable Energy Credits to Offset Electricity Consumption

100 percent of the company’s electricity use is offset by the purchase of wind credits equivalent to approximately 152,000 megawatts. This practice has made VRI the second largest corporate purchaser of wind credits in the United States at the time of publication. This purchase removes 211 million pounds of carbon dioxide emissions every year, which is equivalent to taking 18,000 cars off the road or planting over 27,000 acres of trees (source: US Environmental Protection Agency).

Background Information on Best Practice – Green Building Practices and Certification

The company is focused on integrating green building standards on all new construction and major renovations, working up to either LEED or Green Globe certification when possible.

Current LEED projects include Jackson Hole Golf & Tennis Club's new 12,000-square-foot year-round clubhouse, which was designed and constructed according to the U.S. Green Building Council's Gold-level LEED for New Construction (LEED-NC) criteria. The complex emphasizes state-of-the-art strategies for sustainable site development, water savings, energy efficiency, materials selection, and indoor environmental quality.

In June 2007, the U.S. Green Building Council awarded Vail Resorts LEED for Commercial Interiors (LEED-CI) certification for the environmentally-friendly design, construction, and operation of their 56,000-square-foot corporate headquarters in Broomfield, Colorado. Among the categories defined by LEED, their offices scored credits in Water Efficiency, Energy & Atmosphere, Materials & Resources, Indoor Environmental Quality, Sustainable Sites, and



Best Practices in the Ski Resort Sector

Innovation in Design Process. This square footage is expanding as Vail Resorts adds additional floors to its corporate office footprint.

The Chateau at Heavenly Village, a US\$420 million 11.53-acre hotel resort redevelopment has been registered with the U.S. Green Building Council for LEED certification by the project's developer, Lake Tahoe Development Company, LLC. In addition to two sustainable-built luxury condo hotels, plans include LEED certification of a 16,000-square-foot RockResorts Spa, a 50,000-square-foot convention center with 21,000-square-foot pre-function area, a 1.5-acre park, and a collection of shops and restaurants. The Chateau at Heavenly Village, currently under construction and slated to open in the winter of 2009, is located at the California state line across from Heavenly Village and the Heavenly Gondola, adjacent to Harvey's Lake Tahoe Casino & Resort.



The Chateau at Heavenly Village (blog.skiheavenly.com)

In addition, planning is underway for a new signature restaurant at Heavenly, The Powderbowl Lodge. The 27,650-square-foot 950-seat facility will be designed to LEED standards, reinforcing their commitment to Lake Tahoe, one of the most beautiful areas in North America.^{xxi}

Background Information on Best Practice – EverVail, LEED Best Practice Project

In 2010, VRI will unveil EverVail, the largest LEED project for resort use in the United States. Energy-related features will be comprehensive. This includes

incorporating a geothermal process (ground source heat pumps) to harness energy that would be used for snowmelt. Coils of durable material are embedded deep into the earth below. A fluid within the coil collects heat from the earth and distributes it through surface streets and sidewalks to melt the snow. Plans also include installing small hydro micro-turbines in Gore Creek to power the outdoor streetscape lighting in public areas.

With regard to passive solar design, the project will involve orienting all buildings to maximize the natural light, thereby creating greater energy efficiency. VRI is also considering the incorporation of green roofs on several of the buildings within the project, although this option may not be feasible in such a high-alpine environment. A green roof is a system in which natural materials such as soil and indigenous grasses cover the roof structure to help reduce solar heat accumulation and storm water runoff.



The EverVail vision (www.denverpost.com)

From a transportation standpoint, EverVail will establish a flex car program to minimize vehicle emissions on the I-70 corridor between Denver International Airport and Vail. Vail Resorts would provide a fleet of cars for owners of properties in EverVail to use while in town, thereby reducing the total number of cars in the valley and encouraging owners to use shuttle service and public transportation to and from the valley.



Best Practices in the Ski Resort Sector

Background Information on Best Practice – Intelligent transportation initiatives

VRI has carpooling incentives for employees, providing a free lift ticket for every 400 miles of shared rides. They also encourage the use of “townie” bikes for employee travel in town, though the specifics of this program were not evident. The resort at Heavenly operates Lake Tahoe's largest public transportation system, serving an average of 450,000 employees and guests each season, saving nearly 1.6 million vehicle miles of travel. All Colorado mountain resorts subsidize community public transportation to encourage utilization by employees and guests.

Background Information on Best Practice – Vehicle Management, Upgrade and Replacement Programs

- VRI uses best available technology to modernize shuttle bus fleets, snowcats, and snowmobiles to reduce emissions. For example, all of Heavenly's snowcats are Tier 3 engines which are more efficient and all snowmobiles are outfitted with 4-stroke engines. VRI is replacing all 2-stroke snowmobiles with the more efficient 4-stroke vehicles across the board. On Vail Mountain, 92% of snowmobile fleet operates on four-stroke fuel efficient technology, amounting to a reduction of 3215 gallons of gasoline and 31 tons of CO₂.
- In Keystone, three Webasto Blue Heat engine heaters put in vehicles to warm the engine, reduce idling, and improve efficiency.
- Breckenridge added five new snow cats for the 2007-2008 season, all with engines that meet the EPA's Tier III requirements.
- Heavenly purchased five new vehicles that utilize clean fuel technology, including:
 - Two new full-sized 44-passenger buses, which are fueled by low-sulfur diesel
 - Three new 22-passenger shuttle vehicles, which are fueled by compressed natural gas (CNG)

- VRI has a new vehicle management program called *Idlewise*, which calls for no vehicle to idle longer than five minutes.
- Alternative fuels are currently being researched for expanded use at all VRI resorts.

Background Information on Best Practice – Idlewise

First launched at Beaver Creek, VRI is currently working on a company-wide policy for its *Idlewise* program. The program was initiated as a fleet management measure, dictating that no vehicle should idle for longer than five minutes. Though a tiny step in the journey toward fleet efficiency, it addresses one of the most difficult factors policy-makers face: modifying human behavior. Ultimately, the success or failure of this program lies in the hands of the vehicles' drivers, who are used to keeping engines running for the benefit of both themselves and their guests. In order to induce change, VRI initially took a strong hard-line approach—communicating that those who failed to comply with the program were subject to disciplinary action. They later implemented a number of friendly reminders, such as posters and dashboard magnets. Now they plan to advertise the program on everyday, useful items such as ice scrapers. Guests are also included in this initiative; educated in the *Idlewise* message within guest communications so that they, too, will be encouraged to turn off vehicle motors.

Julie Klein, Director of Environmental Affairs, notes, “It’s a pretty simple policy, but it does take a long time to change behaviors. One of the main differences from the past is that now our CEO is really paying attention to initiatives like this. We’re going to have the Executive Committee sign the memos that go out to our employees, so it won’t just be the Environmental Managers saying, ‘Come on guys.’ It’ll be coming straight from the top.”^{xxii} Employee involvement is the key to success in all areas; they are our greatest asset in the effectiveness of our environmental programs.

- ★ *In December 2007 alone, the Idlewise program saved 2,178 miles, or roughly 2,500 lbs of CO₂!*



Best Practices in the Ski Resort Sector

Steps in Implementation

This work is supported by several resort-specific environmental managers and a hospitality division environmental affairs director. Many independent efforts are in motion, but all VRI environmental team members collaborate on energy conservation, procurement, and working on standardization for metrics and data collection.

Efforts also include collaborating with developers and subcontractors as well as supporting and participating in a variety of voluntary environmental programs including the EPA Green Energy Partnership, the Colorado Environmental Leadership Program, and the National Ski Areas Association's (NSAA) Sustainable Slopes program.

Resources Required

Most efforts are coordinated in partnership with the purchasing department. In some cases we look to our strategic partners to implement programs

Replicability

The above referenced programs, as well as the myriad of conservation efforts listed on VRI's Web site can be easily replicated in many industry sectors. They recommend to others that the larger efforts that are tied more to financial investments be layered with significant conservation efforts – both are important to the energy management and global warming strategy.^{xxiii}

Klein also notes the importance of starting out small. "There are a lot of things that you can do that won't cost a lot of money, such as educational initiatives that teach people the effects of their habits, and examining fuel and energy usage in your core operations. The other piece of it is how you're buying things; we all need to be looking at procurement closer to home."^{xxiv}

Success Factors and Benefits

VRI employs more than 13,000 employees at peak operations from across the world; therefore, the ability to educate and advocate behaviors is significant. They

couple these actions with other strategies that support the communities where they live and operate. PR value and marketing advantages have also experienced significant benefits. More than a year after announcing wind credits, VRI is still receiving PR value and a significant number of emails from both patrons and employees thanking them for their initiatives.

Challenges and Pitfalls

One of the things to take into consideration is safety, and this can be at odds with efforts toward efficiency. "For example," says Klein, "one of the more controversial things we do in regard to energy conservation involves our snowmelt system around our hotels and base area operations. Although it is an energy-intensive practice, it is difficult to keep the pathways clear and safe without it and in some instances the community requires it as a building ordinance. We're trying to do the best we can with it, and we've implemented photo sensors in some areas, so that the systems only come on when there's a certain amount of snow on the ground. We continue to experiment with technology, because it allows us to keep our obligations to the community and at the same time presents an opportunity to conserve energy."^{xxv}

Case Study: Whistler Blackcomb

Whistler Mountain Ski Resort in Whistler, BC Canada is named in honor of a local alpine marmot that "whistles" when it communicates, officially opened to the public in February 1966. Boasting the biggest vertical drop in North America and a ski season that stretches from early November until late May, Whistler Mountain virtually re-invented the modern ski experience. When neighboring Blackcomb Mountain opened for business on December 6, 1980, it featured five triple chairs and an additional 1,240 vertical meters (4067ft) of skiing. Whistler responded by developing a whole new network of runs on its north flank. Meanwhile, a modern, new community, Whistler Village, sprung up on the bench between the two areas. In March 1997, Whistler Mountain Ski Corporation (which owned Whistler) merged with Intrawest Corporation (who owned Blackcomb) to create one of the biggest and



Best Practices in the Ski Resort Sector

most exciting mountain resort complexes in the world, Whistler Blackcomb (WB).^{xxvi}



Whistler Ski Resort (<http://skicanada.info>)

Energy conservation is WB's number one pursuit and it is relatively easy for them to achieve and maintain. The development of renewable energy is secondary. BC Energy (their utility company) is 90 percent hydro-powered – and the 10 percent that is “dirty” never makes it far enough up the system to reach the resort. They are interested in offsetting the resort and their overall guest footprint, and this is why they have invested in their own hydro projects.

Arthur DeJong, Mountain Planning and Environmental Resource Manager, reiterates the importance of minimizing emissions and energy consumption. “We need to do everything we possibly can in the way of mitigation. That’s our number one goal. We’re a ski resort, so it’s a no-brainer – we may be sustainable ourselves, but we’re still dependent upon the actions of others. If there’s no snow because of the amount of carbon the rest of the world is producing, we’re out of business. The more we do, the more we have a legitimacy to advocate to others to take steps in reducing their carbon footprint, and that’s one of our main goals. It’s philosophical.”^{xxvii}

For over five years, Whistler Blackcomb (WB) has been planning the installation of a new Run-of-the-River hydroelectric plant that will provide enough clean energy to offset the power needs of both Whistler and Blackcomb mountains. (This will be discussed in greater detail below.)

Some of Whistler’s other energy-saving initiatives include:

- Facilities Management practices, including energy efficiency measures
- Vehicle management, upgrade and alternative transportation initiatives
- Renewable energy development efforts internally

Background Information on Best Practice – Facilities Management, including Energy Efficiency Measures

WB has installed building retrofits; including timers, sensors, low-energy lighting, and a hybrid system whereby they use propane in conjunction with their hydroelectric (the propane kicks in when hydroelectric demand is at a peak). These retrofits have reduced greenhouse gas emissions by more than 850 tons and consumption by over 6000 gigajoules (equal to 1666.8 megawatt-hours). In addition, they have replaced 11,000 light bulbs with more efficient and environmentally-friendly models. Overall retrofits have reduced annual electricity consumption by 4,575,000 kWh (4580 MWh), or enough power to run 450 Canadian homes for a year.

Background Information on Best Practice – Vehicle Management, Upgrade and Alternative Transportation Initiatives

In addition to reducing fleet and vehicle size for higher efficiency, WB has purchased 39 low-emission snowmobiles, comprising half of their fleet, and they will continue to purchase low-emission replacement models. WB is piloting the use of GM hybrid technology pickup trucks, and is establishing an employee carpooling program estimated to reduce more than 617,000 kilograms of carbon dioxide emissions annually.

Background Information on Best Practice – Renewable Energy Development Internally

WB’s development of onsite renewable energy initiatives includes the installation of a 1.0-megawatt run-of-river turbine in Flute Creek to power the lights and heat in the lift hut and washrooms at the bottom of the Symphony Express Chairlift.^{xxviii}



Best Practices in the Ski Resort Sector

Steps in Implementation

This hydroelectric plant, the Fitzsimmons, is estimated to produce 32 gigawatt-hours per year, or the equivalent to 3000 Canadian homes. It will supply enough power to offset the entire mountain operations at Whistler Blackcomb, including 38 lifts, 5 lodges, snowmaking facilities, and additional operations. In the works for over five years, it will require an additional two years to build. Though not yet complete, it is worthwhile to outline the process WB has experienced thus far. The first step was to complete all the necessary assessments, both environmental and technical, to determine the feasibility of the project. WB also had to analyze how it would fit in to their own operations, as the system marries into their snowmaking facilities. The next task was to gain support of the various stakeholders, which included procuring financing, community acceptance, and the approval of the local government. The latter proved to be a bit more complicated due to the provincial licensing of water in British Columbia, making the Province the “gatekeeper” in the process.



Run-of-river hydroelectric plant (www.industcards.com)

Resources Required

There was a tremendous amount of civil engineering and geotechnical work required for the project, as well as three to four months of public process. DeJong spent much of this time convincing others that the plant was a good idea. Though WB will have spent several million dollars by the time the plant is implemented, the US\$20 million project is largely funded by LeadCore, a

construction company with a subsidiary that specializes in run-of-the-river constructions. Within WB, DeJong’s planning department is the hub of operations for the project.^{xxix}

Monitoring and Evaluation

At WB, the focus is on generating green electrons, so production is the principal metric for them. They have reduced energy consumption 10 percent by just doing all the little things, such as implementing timers, sensors, and changing 11,000 light bulbs. Their small run-of-the-river system powers the lighting and heating of one lift, and though the large hydro system is yet to be measured, it is estimated to provide the energy equivalent to the entire mountain’s operational needs.^{xxx}

Replicability

DeJong warns that the Fitzsimmons is not very replicable – it’s a US\$20M project. Run-of-the-river systems can be developed in small streams for US\$30-40,000, but they can only produce enough energy to power a house (if done correctly). For WB, it is worth the investment to have the small ones. They need projects that pay, and then they need those that make them part of an advocacy movement. These needs are evaluated project by project. It is all part of how they develop a sustainable ski experience.^{xxxi}

Success Factors:

Superior environmental and social performance acts as a recruiting tool for both employees and visitors alike, and more and more people are drawn to Whistler each year as a result.^{xxxii}

Challenges and Pitfalls

Costs are always a challenge, as is mustering the will to change quickly enough. WB has tackled these challenges by communicating, promoting, and demonstrating the vision that taking care of the environment can be profitable.



Best Practices in the Ski Resort Sector

Lessons Learned

According to Dejong, “The most important environmental objectives for a ski area should be: a) energy conservation; b) habitat protection; c) waste reduction; and, d) renewable energy production.”

- No renewable energy project is too small. Showcasing to guests even small projects are inspirational. We have an interpretive display on micro hydro right next to a lift maze. Though it’s a very small project, it has helped support a much larger one.
- Never give up on renewable energy opportunities. It has taken us five years to put together our 20 million dollar Run of River project, which will likely be announced next week! Persist! Persist!^{xxxiii}
- Take the time to screen and find the absolute best partners for a project. Always publicize any connections between the project and climate change solutions.
- No project is perfect. Be very open about the downsides but, again, connect its value to the macro issues, such as climate change or species extinction. To my critics on Run of River projects I simply state “Consider the alternative.” Conservation alone will not get us there.
- Get your utility supplier very involved.
- Assertively seek grants and research funding.
- Engage the media on your renewable energy initiatives. They are keen to write on this. They jump at the opportunity to publicize even the smallest innovations.

ADDITIONAL RESOURCES

- Aspen Ski Company 2004-2006 Sustainability Report: www.aspensnowmass.com/environment/images/SustainReportFINAL.pdf
- Canon Hydro, turbine manufacturer: www.canyonhydro.com
- Community Office for Resource Efficiency (CORE): www.aspencore.org
- Grand Targhee Resort - Sustainability Initiative: <http://www.grandtarghee.com/the-mountain/environment/>
- Grand Targhee Resort - Sustainability Matrix Information: contact Christina Thomure at cthomure@grandtarghee.com
- Holy Cross Energy: www.holycross.com
- Natural Step Framework: www.naturalstep.org/com/nyStart
- Office of Energy Management and Conservation (OEMC): www.colorado.gov/energy
- Sempa Power Systems Ltd., brand of hybrid propane/hydro system used by Whistler: www.sempapower.com
- Ski Area Citizens Coalition www.skiareacitizens.com
- Strategic Environmental Project Pipeline (StEPP) Foundation: www.steppfoundation.org
- Sustainable Slopes: www.nsa.org/nsaa/environment/sustainable_slopes
- The Town of Snowmass Village: www.tosv.com
- Vail Resorts: www.vailresorts.com
- Whistler Blackcomb: www.whistlerblackcomb.com/mountain/environment



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The authors wish to acknowledge each of these businesses' participation. In most instances, the background information and best practices highlighted were taken from direct communications with these participants or obtained from affiliated Web sites.

Credits

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The best practices are a collaborative effort, and final information reflects consensus from the editorial board and contributors. Further contributions are welcomed from all industry members, should be merit- and science-based, with participation being nonexclusive.



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