Applying the Principles of Industrial Ecology to the Guest-Service Sector

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Summary

Industrial ecology (IE) has historically focused on manufacturing but could be applied more broadly, particularly to sectors of the economy not typically considered "dirty." The guest-service sector, for example, has a significant ecological footprint, often in environmentally sensitive areas, and would benefit from an IE perspective. Colorado's Aspen Skiing Company, which hosts 1.3 million skiers annually on 5,000 acres of skiable terrain, is integrating concepts of energy efficiency, feedback, life-cycle costing, nutrient cycling, renewable energy, ecosystem diversity, local sourcing, and human capital into operations at four ski areas and two hotels. An IE perspective offers the guest service sector a holistic view of its environmental impacts, a big-picture view that is missing from an industry where environmentalism has historically meant "recycling" or end-of-pipe pollution control. Many industrial ecology principles are directly applicable to resorts, but implementers will encounter a host of obstacles cultural, institutional, and economic that express themselves in unique ways in the guest service sector. Written using firsthand experiences from Aspen's ski slopes, restaurants, and a five-star hotel, this article explores what happens when the principles of industrial ecology are applied to the guest service sector, particularly what goes right, and what goes wrong.

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Introduction

When the comedian George Carlin compared American football to baseball, baseball came out looking like the sissy sport. Football, Carlin pointed out, is played on a "gridiron," baseball on a "diamond." In football you wear a helmet; baseball players wear a cap. The same comparison could be made between the manufacturing industry and the guest-service sector. Industry produces "stuff;" guest services provide "experiences." Industry is dirty, big, mechanical, scary. Services, on the other hand, evoke Boy Scouts and feather dusters. Indeed, in the field of IE, manufacturing and the upstream processes of raw material extraction and intermediate processing are the focus of the "hard science," where engineering and economics combine to analyze material flows and life-cycle impacts in a quest to imitate natural ecosystems (Fischer-Kowalski 1998; Fischer-Kowalski and Hüttler 1999; Frosch 1992; Graedel and Allenby 1995; Tibbs 1991). Services, while the subject of some discussion in the IE community (Graedel 1997), are typically viewed as a potential response to the environmental problems created by "industry" (Reiskin et al. 2000; Guile and Cohon 1997) as in the chemical management example. Alternatively, services are viewed as a way to rethink product stewardship and manufacturing, as in the example of leasing "comfort services" instead of selling air conditioners. The relative dearth of attention to the "guest-services" sector suggests that it is the "sissy sport" of industry.

Here at Aspen Skiing Company (ASC), in Aspen, Colorado, in the Rocky Mountain region of the United States, where we operate four ski mountains, a five-star hotel, and fifteen restaurants, our mission is to "renew the human spirit" and provide an exemplary snow-sliding experience. Despite the contrast with what is commonly understood as "industry," our sector, the guest-services industry, is large, uses significant amounts of energy, and generates considerable levels of pollution. The Bureau of Economic Analysis of the U.S. Department of Commerce estimates that between 3.3% and 3.5% of the U.S. gross domestic product (GDP) comes from expenditures on tourism (Kass and Sumiye 2000).[1] Guest-service businesses that operate in sensitive environments, such as ski resorts, may be among the larger contributors to the environmental burdens in their local communities. Although greening hotel services has been on the radar screen for some time,[2] IE practitioners have given little attention to the guest-services sector. How then might they apply the ideas and practices of IE to their operations? And equally important, what happens when they do?

Background: Environmental Awareness in the Ski Industry

Historically, the ski industry has not been widely subject to scrutiny from the government, the environmental community, or the public. Ski resorts generally exist in settings that are rural, pretty, and visibly green. Conventional wisdom was that they most likely have little impact given the lack of "in-your-face" smokestacks, waste piles, and toxic effluents. In addition, many of the operating inefficiencies that make the adoption of IE principles economically attractive in manufacturing either do not exist in the guest-services sector or are considered to be an integral part of a high-quality guest experience, reducing incentives to change. In the absence of conventional rationale, what might motivate a ski resort to care about environmental issues?

In the case of the ASC, the motivation arguably came from a solo trek across the Sierras. In 1964, hiking alone on the 211 mile (mi) John Muir Trail in California, ASC's president and CEO, Pat O'Donnell, developed a lifelong commitment to environmentalism. He went on to become a Yosemite climber, ascend the summit of Mt. McKinley twice, make the first American attempt on Annapurna, run the Yosemite National Institutes (an environmental education organization), and serve as the CEO of Patagonia, a leading green business, in the late 1980s.[3] When O'Donnell came on as the CEO of ASC in 1996, he asked the company to develop a set of "guiding principles" that would be agreed upon by employees, ownership, and management. One of those principles was environmental stewardship (ASC 2002b).

O'Donnell also insisted on creating the ski industry's first environmental affairs department in 1997, as part of the senior management team, and the unique Environment Foundation, funded by employee payroll deductions matched by ASC and the Aspen Valley Community Foundation as a way to further protect the local environment. O'Donnell argued that these actions are not public relations, marketing, or anticipated profit; rather, ASC's environmental program exists because it is "the right thing to do" (Schendler 2002, 28). O'Donnell's creation of the environmental affairs department soon appeared prescient, although no one could have anticipated what happened next.

In the early morning of 18 October 1998, an enormous fire consumed five buildings and four lifts at the Vail ski area in Colorado. Two days later, a group called the "Earth Liberation Front" (ELF) claimed responsibility for the $12 million in damages. ELF's statement claimed that the arson was carried out "on behalf of the lynx" (a North American wildcat). "This action is just a warning," the group said, advising skiers to seek other destinations "for their own safety."[4]

This "direct action," although roundly condemned by environmentalists and community leaders, arguably marked an environmental awakening within the industry. In 2000, the U.S. National Ski Areas Association released its environmental charter, which was signed by 170 resorts, or 71% of the ski areas in the United States (NSAA 2000). Although the charter served mostly as a commitment and a cookbook for how to "green" a ski area, it was the first time the industry broadly acknowledged its environmental impact and pledged to take action.

ASC had already started on the path of addressing the environmental impacts of running a ski operation in conjunction with hotels, restaurants, and related guest services. ASC's path incorporated core concepts of IE into its environmental programs. In particular, this article explores the use of feedback, first cost versus life-cycle cost, nutrient cycling, tapping current energy income, ecosystem diversity, local sourcing, and human capital and the obstacles faced in the service sector.

Establishing IE at ASC

CEO O'Donnell's choice as the first director of environmental affairs was Chris Lane, an environmental engineer and Sierra Club activist with impeccable credentials within the local environmental community. Lane had a tough job: He was charged with establishing the Environment Foundation, revamping an almost defunct recycling program, and communicating honestly with a community ready to call "greenwash" at the first sign of disingenuousness. After a year and a half, Lane had made enormous strides (LEEDP 2002). Based on his success, he hired me from the Rocky Mountain Institute in Snowmass, Colorado. We began to apply IE principles to the company in 1999, starting with the development of one of the first LEED–certified buildings.

In 2000, after Lane left to undertake similar programs at national parks concessionaire Xanterra, ASC released its first sustainability report (ASC 2002a), an accounting of the company's environmental impacts and actions to address those impacts. Praised by the environmental community, the report included an accounting of greenhouse gas emissions per skier, total solid waste production, and total energy use.[5] ASC, which hosts 1.3 million visitors annually, uses 22.5 million kWh (81 billion kJ) of electricity annually. Combined with gasoline, diesel, propane, water use, and solid waste production, that produces 37,033 tons (33,596 metric tons) of CO_2, or 0.026 tons[6] per skier (ASC 2002a). The challenge, based on that accounting, was to start reducing the pollution associated with resort operations. The best place to start was the biggest energy user, the five-star Little Nell Hotel.

Feedback (in a Five-Star Hotel)

The Little Nell, at the foot of Aspen Mountain, provides a luxury hotel experience. In 2002, the *Conde Nast Traveler* Readers' Choice Awards ranked it the 11th best hotel in the world and 3rd best in North America (Readers' Choice Awards 2002). Guests can linger in the wine room over a plate of lobster tarragon brandade or enjoy extensive spa facilities. But in the winter of 2001, one of the hotel features they were likely to avoid was the parking garage, which smelled like sewage. Nobody knew why the garage smelled or what to do about it. It was an inconvenience for the valets, seemed inappropriate for a high-caliber hotel, and management wondered if the smell would linger in the guests' Jaguars and Land Rovers. When the Nell engineer increased the rate of ventilation, the smell got worse. The solution came from an attempt to implement two key components of IE: energy efficiency and systems feedback.

In 2000, the Nell's engineer at the time, Kris Loan, proposed a set of energy efficiency projects that would offer monetary benefits while providing exemplary service to guests. In the luxury guest-services market, a high level of service presumes significant energy use for operations such as heated garages, snow and ice melting, and extensive guest facilities. The potential energy and monetary savings would be large if the nexus between energy use and perceived level of service could be altered.

Loan realized that a modern computerized energy management system (EMS) would be a major benefit to a facility of the size and complexity of the Nell, which has 90 rooms, a restaurant, a bar, and several conference rooms. He convinced the hotel manager, based on payback alone, to install a $250,000 EMS that, once installed, revealed savings throughout the Nell's operations. It enabled the hotel to run one car-sized boiler at 135°F (57°C) to meet all hotel hot-water needs and turn off three boilers that ran at 200°F. It showed that electric snowmelt systems on patios outside the hotel rooms ran 24 hours (hrs) a day at 135°F, instead of 85°F during off-peak hours. And it highlighted the year-round operation of the electric heat tape on the roof, critical to preventing dangerous ice-damming problems during winter, but unnecessary in August. Thus, like a natural system, the technology provided the feedback needed to operate efficiently.

Whereas the feedback technology worked well, the human problems were widespread. Critical information was not communicated throughout the organization. For example, the heated sidewalk temperature was reduced to 85°F, but the move was not coordinated with the concierge staff, who hosed it down with a pressure washer at 5:30 in the morning, causing icing on cold February days. Cultural issues conflicted with efficiency. The engineering department staff responded to their loss of autonomy by hot-wiring the snowmelt system on the room balconies to remain permanently on at 135°F. Some engineering staff complained that when the handheld Blackberry devices used to record information were dropped, they broke. And there were perception issues about what high levels of service meant. The hotel manager liked a steaming pool he saw at a resort in Sun Valley, so the Nell engineers cranked the heat from 85° to 103°F, creating "Aspen's biggest hot tub" and negating much of the natural gas savings realized by the EMS.

The cultural obstacles ASC encountered at the Nell exist in manufacturing as well. But it may be easier to change industrial processes that primarily involve machines than to change habits and attitudes in a five-star hotel, where change is almost exclusively about people. People are complicated equipment.

A case in point is how management went about assessing the need for an EMS and, for that matter, other energy-efficiency programs such as lighting retrofits. Instead of looking at pure return on investment as the sole criterion for efficiency projects, managers had to take into account their limited capital budgets. This means that an EMS with a 25% return on investment (good by any investment standard) or a lighting retrofit with a 65% return may compete with (and lose out to) new carpet, sheets, or flatware, which arguably have an instant payback by bringing in more guests and commanding a higher room price. This is particularly true given that mechanical or lighting efficiency is not even remotely on a hotel manager's radar screen. Lighting efficiency is meaningless to managers, because their mindset is that you make money by selling product, not by saving energy. They care about the temperature of the wine cellar, not the boilers. Finally, there is a catch-22: The strongest argument for most efficiency projects is their return on investment. For businesspeople, this should be enough. But here is the catch: The manager at the Nell wants to see his bills go down if he is going to invest in efficiency. Unfortunately, that may be impossible to guarantee, at least with lighting retrofits, because lighting loads are only a small fraction of electricity use, so a small increase in the need for refrigeration or snowmelt might cancel the savings. Also, because bills are bundled, nothing short of costly spot metering would make the case for savings. Whereas manufacturing plants may be obsessed with energy/unit product, this metric is alien to the service sector. "Kilowatt-hours per customer" is generally meaningless to hotel management.

Despite the obstacles, the EMS resulted in saving about $4,000 in energy costs and 26,800 kilowatt-hours (kWh) and 560 million British thermal units (MBtu; 1 MBtu = 1,054 MJ) per month, even when measured during the winter of 2001–2002, which had more heating demand days (i.e., colder temperatures) than the baseline year. These translated into reductions of greenhouse gas emissions of 1,504,800 pounds (lbs) (682,566 kg) of CO_2 equivalents annually.[7] A host of unforeseen benefits came with the installation of the system. While installing the EMS, the vendor got deeply involved in mechanical operations of the hotel and noticed that the exhaust fans in the garage had been installed using outdated ventilation codes based on emissions from '57 Chevys and '68 Mustangs. Cleaner cars mean garages do not require as much ventilation. The vendor connected a carbon monoxide sensor to the fans, which clicked on when CO concentrations rose, but stayed off most of the time. The benefits were cascading: Heating costs for the garage went down (the garage must be heated: guests do not want cold cars and hotel operators do not want frozen fire sprinkler systems); fans ran less, saving electricity; and the sewage smell disappeared. Why? The use of outdated ventilation codes and attempts to clear the sewage smell caused the fans to run at maximum speed all the time, pulling sewer gas from underground drains.

First Cost Barriers

"Common-sense" efficiency or green design proposals often encounter resistance in the resort industry for other reasons, and they are the same reasons efficiency can fail in the manufacturing world. In new construction, first costs present enormous obstacles when buildings are to be leased or sold, whether you are building a factory or a condominium. At Aspen Highlands, one of four ski mountains operated by ASC, the base area was developed by a third party, which then sold an office building to ASC. At the end of the design process, several windows were eliminated to save $800 apiece through a process commonly called "value engineering," which is late-stage cost cutting by elimination.[8] In the new offices, ASC staff were too hot, felt confined, and complained to management. In 2002, maintenance staff installed new windows at $1,300 apiece. What is economically rational for the developer (keeping building costs to a minimum) is counterproductive for the user (keeping operating and maintenance costs down). This is a classic example of conflicting incentives and a zero-sum outcome. Without a business relationship that is appropriately structured, or careful monitoring by the future occupant, either the developer saves money or the building occupant, but not both.

At the Snowmass Club, under construction in 2002, a highly experienced lighting design firm, hired for their efficiency expertise, specified a lighting plan for an underground garage that bounced superefficient fluorescent light off whitewashed walls. System efficiencies were projected to save 3,625 kWh and 7,250 lbs of CO_2 annually over a conventional system, with additional maintenance benefits due to bulbs lasting 24,000 instead of 3,000 hrs. Annual payback on the investment would be $1,040 in reduced maintenance and energy costs. Better yet, the more efficient system would have provided better visibility (Nelson 2002). Still, managers defaulted to relatively inefficient metal halide lamps at the last minute to save $4,000, because they would not be paying operating costs for the building and ASC did not perceive energy efficiency as a marketing advantage.

The rejection came in part because of a recent experience with the design and installation of energy-efficient lighting for indoor tennis courts. Working with the same designer, ASC had specified superefficient T5 fluorescent lighting instead of conventional lamps. To avoid interfering with play, designers raised the height of the long rows of lamps. Given the constraints of the structure's pitched roof, however, subcontractors eliminated one set of lamps on each end of each fixture during installation. The new lighting, which faced upward, got covered in dust from the clay court surface. Lighting levels were dimmer than expected, reducing the performance of the facility. The staff thought they could correct the problem by washing the lights (which raised maintenance costs). They washed the lights, but lighting intensity remained low. It took a visit from the lighting designer to determine that the ballasts had been wired incorrectly at the factory, cutting light output by more than half. Once replaced, the system functioned closer to specifications. (It turned out that the reduction in the number of lamps caused by the pitched roof, and the fact that they got covered in dust, were red herrings. The changes had only minute effects on lighting levels, but distracted managers from the real issue.) In the end, despite the fact that the ballast problem was an anomaly, and not inherent to efficient lighting, management concluded that it did not pay to be an early adopter of new technology and was reluctant to be a guinea pig again.

First cost obstacles are also occurring in ASC's development of a base village at Snowmass, where condominiums and commercial space will be built and sold. Why design a superefficient condo that costs more when the sale price is predetermined by the market? Advocates of green development argue that green building still makes sense economically (Romm and Browning 1994; Wilson et al. 1998), based on benefits such as increased worker productivity, but real-world experience all too often falls short. In fact, for the build-to-sell residential and commercial spaces at the Snowmass base village, every single accepted argument for green development fell flat. The only one that remained, and ultimately worked, was ethical: Green development was the right thing to do.

Nutrient Cycles: Out of the Fryolator and into the Snowcat

Implementing the idea of feedback into a guest-service operation is not much of a reach. But applying other ideas from IE is more abstruse. How, for example, might you create a nutrient cycle on a ski slope to make food from waste? Our first stab at this started in a grease trap and ended in a snowcat, a vehicle used to groom ski slopes.

On ASC's four mountains, we burn 260,000 gal of diesel annually, powering snowcats that turn Aspen's powder into its famously manicured trails. Diesel also runs the buses that transport skiers and workers up this long mountain valley; and diesel runs backup motors on electric lifts that take skiers up the mountain. The problems of diesel are well known. It creates high particulate emissions and contributes to local air pollution that often exceeds U.S. Environmental Protection Agency (U.S. EPA) standards. Diesel exhaust contains carcinogenic polycyclic aromatic hydrocarbons, arsenic, benzene, and formaldehyde (SRPTAC 1998). Although critical to operations, diesel also compromises our product: a beautiful outdoor experience.

We have not been able to identify a manufacturer of nondiesel snowcats, so ASC decided to explore cleaner fuels, in particular blends of soy-based diesel, a renewable product known as biodiesel. Pure biodiesel is the only alternative fuel to have passed the rigorous health effects testing requirements of the Clean Air Act (U.S. EPA 1998; NBB 2000). The results, submitted to the U.S. EPA in 2000, show biodiesel reduces toxic emissions and is biodegradable and free of sulfur. Biodiesel cuts emissions of particulate matter, unburned hydrocarbons, carbon monoxide, and sulfates by varying degrees (U.S. EPA 2002). For every unit of fossil energy needed to make biodiesel, 2.51 units of energy are gained (Morris et al. 1994).

In the winter of 2002, ASC experimented with an 80% diesel/20% biodiesel blend. Mechanics noticed that the fuel, which makes snowcat exhaust smell like french fries, radically reduced black tailpipe smoke and that the snowcats ran smoother, a result of biodiesel's higher lubricity, a quality that also extends the life of mechanical components. Based on our testing, ASC will be switching its entire fleet of snowcats to biodiesel over two years starting in the winter of 2002. The cost is about 20 cents more per gallon, a small cost to pay for benefits that include hydrocarbon emissions reductions of 20% and CO and particulate reductions of 10%. The one drawback is that biodiesel typically increases NO_x emissions by 2% (U.S. EPA 2002).

So how does this relate to nutrient cycling or making food out of waste? It turns out that biodiesel can be readily made from used restaurant grease. With more than 15 restaurants of our own, and hundreds locally, there is enough fryolator oil to run our entire fleet of snowcats and maybe some buses. Although ASC is not currently making biodiesel from waste grease, the possibility holds promise. And having moved to biodiesel blends, we are on the road to a quintessential application of IE in a ski resort.

Closing the Oil Loop

ASC uses 8,000 gal of motor oil annually, a fraction of a percent of the 1.3 billion gal of waste oil generated in the United States each year. Although most used oil gets recycled, few companies have actually closed the loop. To address this problem, ASC switched from virgin motor oil to a recycled product. Rerefined motor oil, used oil that has been cleaned and reconditioned, is equivalent to virgin oil in performance and meets all standards set by the American Petroleum Institute at no additional cost. An additional benefit for ASC is it is not subject to the price volatility of virgin oil, something mountain managers appreciate when preparing budgets.[9]

Tapping Existing Energy Flows

The largest component of a ski resort's ecological footprint is its electricity use (ASC 2002). The use of renewable energy to reduce that footprint is one solution, but for such an energy-intensive operation, that alternative can be very expensive. One solution may be staring ski-area operators in the face. Many ski resorts have extensive snowmaking systems that route water from storage ponds high on the mountain through pipes to snowmaking stations lower down. These systems are, in effect, microhydroelectric plants requiring only the addition of a turbine. In the spring of 2003, ASC will build the ski industry's first hydroelectric plant tied to a snowmaking system. The project will cost $62,000 and return $10,000 annually in renewable electricity, generating roughly 250,000 kWh. The quantity is relatively small in relation to the 22.5 million kWh ASC uses annually, but we have at least five other high-quality sites. And the water is running through the pipes whether we tap the energy or not. With more than 200 ski resorts in the United States, the potential, and payback, is huge.[10]

Ecosystem Diversity: Battling Monoculture at Ski Resorts

A critical component of efforts to model business operations on natural systems is system diversity. This is of particular importance to the Aspen community, and the economic and age diversity of the population is as critical to the guest-service industry as it is to a healthy ecosystem. Although issues such as equity and population diversity may not readily come to mind in IE circles, they are a core part of today's sustainability discussions (Elkington 1998; Hawken et al. 1999). As Karl-Henrich Robèrt and his colleagues at The Natural Step have said, "In the sustainable society, basic human needs must be met with the most resource efficient methods possible, and their satisfaction must take precedence over luxury consumption" (Robèrt et al. 1997).

In contrast to the beauty and relative health of the surrounding environment, the city of Aspen is rapidly becoming a monocultural community dominated by wealthy second homeowners who drive up the cost of real estate and drive out low-income workers. This has a direct impact on the guest-service industry because of our dependence on skilled and unskilled labor. Expensive homes, often empty in the winter, take the place of cheaper, higher density units that might house teachers, firefighters, street cleaners, hotel workers, and lift operators. As a result, the community loses its vibrancy and diversity and ASC loses employees.

David Tilman, a conservation biologist, has shown that increased biodiversity tends to improve the health and stability of natural systems, making them more resilient when disrupted (Tilman and Downing 1994). The same is potentially true for ski towns. As socioeconomic and cultural homogeneity increase, the economy may be at risk, cultural development may slow, and stagnation may set in. Moreover, the consequence of a wealthy, aging population[11] is that ski towns have fewer customers, because as people age, fewer engage in on-mountain sports. To survive, destination resorts need a constant source of new guests. For example, ASC has made substantial efforts to bring in ESPN's winter X Games, which would attract a younger generation of visitors.

Monoculture may also affect the environment. Hotels and resorts that cannot develop new guest sources may eliminate environmental staff (as another Colorado ski area did in 2002) and avoid new environmental initiatives in response to declining revenues. Stagnating towns may find that their tax base declines, making less money available for public works, parks, open-space preservation, stream enhancements, and environmental protection.

In response, ASC subsidizes mass transit by over $1 million annually, because many employees commute from far away, where housing prices are cheaper. ASC also owns employee housing (currently about 300 units) that enables people to live where they work. This provides an additional business benefit beyond the employee/employer relationship. Similar to Henry Ford, who voluntarily increased the minimum wage in the early 1900s so that more people would be financially able to buy cars, ASC supports community affordable housing because it creates both employees and guests.

In attempting to address the issue of monoculturism, advocates may run into contradictions within the triple bottom line. For example, two years ago there was a proposal in Aspen to convert a small local park into affordable housing. Conventional environmentalists vociferously opposed the project, fearing a decline in quality of life and placing priority on protection of open space (Hooper 2000). The park stayed, but at the potential cost of creating a community that does not actually use it. Wealthy second homeowners may enjoy the fact that it is there, but they are rarely in town, and when they are, the park is not a destination.

Local Sourcing through Ranching

Although the park in Aspen might have been better off as employee housing, open space in general is vitally important for the health of communities and surrounding ecosystems. But how do you ensure it stays open? In rural areas, conservation easements[12] provide landowners with a return on capital while preserving land. For ski resorts, easements can be a good business decision, too. Near Aspen, open space appeals to guests that enjoy the rural nature of the Roaring Fork Valley and contributes to the health of the local environment, a quality we sell to our guests. But easements can be extremely costly. One way to reap the benefits of land preservation locally without the high cost of purchased easements may be to tap a first-order principle of IE: local sourcing of inputs in the form of food from local ranches (Clift 2001).

Aspen is at the far end of the valley, an old agricultural community that owes a debt to ranching, which to this day preserves land and provides beautiful vistas free of charge. The existence of working ranches makes the area unique among Colorado valleys with growing populations. Since the early 1990s, however, ranchers have been fighting an uphill battle against depressed beef prices, increasing expenses, encroaching development, and rising land prices. At roughly 70 cents per pound, the wholesale market for beef does not allow producers to break even. In Vail, Colorado, land that used to host ranches and lettuce farms is now a long strip of condominiums. Many ranchers in the Roaring Fork Valley have already chosen to sell or develop their land and leave.

One potential solution being put into practice by ASC is to buy beef directly from ranchers. By eliminating the middleman and selling the beef as a premium product, ranchers earn a higher price per pound, making their business more economically viable, keeping them on the land, and indirectly preserving open space. Restaurants receive a unique product that outsells regular beef.[13] Guests like to support local businesses and appreciate that the beef is grass fed and chemical and hormone free. Buying beef locally eliminates long-distance trucking, reducing pollution and improving quality of life for those living along the transportation corridor. And maintaining a sense of place by preserving agricultural heritage also contributes to the triple bottom line.

People as Product

One way to use the lens of IE to view the guest-service industry is to ask what our product is and what its life-cycle impacts are. For ASC, our "product" is twofold: the services we provide (the impacts of which have been amply discussed in this article) and the "throughput" for our industrial process, our guests. Guests come from outside the area, are processed at ASC, and return home. What, if anything, has the Aspen experience done to these people?

If we "discharge" guests without addressing the potential for improving their environmental consciousness, they could be considered a waste product of our business, going on to ever-greater levels of consumption and pollution. But if each guest returns home open to taking the bus to work, recycling, or driving a hybrid car, then we have discharged a nutrient, a positive force, into the world.

We educate our guests in a number of ways: free on-mountain nature tours, a Web site with extensive environmental information (referenced on all our trail maps), local television appearances discussing environmental action, and green living tips on local radio. We include two pages of environmental information in our annual brochure, and we hand out "green cards" to guests that suggest five ways to protect the environment in Aspen, five things ASC is doing, and five actions guests can take at home. After their experience here, we hope our guests will sow the seeds of sustainability far and wide: We host 1.3 million visitors each winter from all over the planet.

The guest-services business may be in a unique in position to educate customers about environmental actions they can take in their own lives. In the book *Cradle to Cradle*, McDonough and Braungart (2002) distinguished between "biological nutrients" composed of biodegradable industrial waste products and "technical nutrients" that are industrial compounds that do not biodegrade, but can be reused in industrial processes, the way motor oil can be refined and reused forever. Educating our guests about environmental responsibility creates a new category: "social nutrients" that are agents of change in society. At Aspen, our guests include the powerful, wealthy, and influential, who have direct opportunities to sway large businesses and governmental agencies, as well as people who can effect smaller changes in their communities and their lives.

A New Perspective

If you were to randomly select a skier from an Aspen slope and ask him or her what ski resorts and skiers should be doing to protect the environment, the answer would be "recycle." In ASC's experience, the absence of recycling containers in any area guarantees guest and employee complaints. Many ski-area managers have the same perspective: "environmentalism = recycling." Taken a step further, conventional environmental thinking in the guest-service industry leads to "don't wash my towels" signs and unsophisticated environmental education efforts. Although these measures are important, they miss the bulk of the industry's ecological footprint. And they are, often intentionally, a denial of the real issues. IE tools help environmental managers by providing a big-picture lens with which to view the world. For example, an IE perspective shows that 61% of ASC's total carbon footprint of 37,033 tons CO_2 equivalents came from electricity, whereas less than 1% came from solid waste disposal. Meanwhile, the skiing industry is among the top three emitters of CO_2 per participant in the tourism/leisure industry (U.S. EPA 2000). Therefore, climate change, not recycling, should be the premier environmental concern for the industry. But it is not, mostly because the perspective is too narrow. IE provides a way of getting at broad questions: How does the resort industry fit into our increasingly global environment in a harmonious way? What are the material preconditions that will allow us to survive as a business indefinitely? And how do we create the change needed to do that?

That IE perspective is slowly taking hold in the ski industry, in part due to a pollution prevention guidebook published in 2002 and funded by the U.S. EPA.[14] A case in point: In February 2003, the National Ski Areas Association unveiled the industry's first climate policy, called "Keep Winter Cool." The campaign is the most broad-reaching statement the industry has ever made about its relationship to the planet.

Still, even this apparent progress points to the two main obstacles practitioners of IE encounter in the guest-service sector: cultural barriers and the real-world difficulties associated with implementation. Culturally, the ski industry has long been afraid to acknowledge climate change, for fear that guests would not buy condos for their retirement or teach a new generation to ski. Additionally, industry leaders remain reluctant to take any action that is perceived to increase operational costs in this low-margin, highly energy-intensive business. The Keep Winter Cool campaign is primarily customer outreach. It does not require resorts to reduce their carbon footprint or take strong political positions. Even though enormous strides have been made, long-standing ski industry perceptions continue to prevent more significant action.

Meanwhile, on the ground, implementation of energy efficiency projects, as described in this article, can be made nearly impossible by a litany of unforeseen cultural obstacles. We recently powered a lift with wind by agreeing to pay a premium to our local utility for renewable energy. But maintenance staff, when asked about the wind-powered lift, told guests and employees, "That thing ain't wind powered—we don't see anything different. That's greenwash." An environmental success became a public relations nightmare. In this case, a strong cultural obstacle was deeply ingrained suspicion of corporations that take environmentally responsible actions.

The key cultural problem in the service industry is not changing human habits per se, but changing habits in the context of an overarching emphasis on the customer, the source of all profit. Changes that might easily occur in other settings can be more difficult to implement because of perceived declines in service; for example, it may be easier to install fluorescent light bulbs in a factory than in an expensive hotel suite. (At the Little Nell, managers were concerned that fluorescent lights would affect the hotel's five-star rating.)

Cultural obstacles aside, it is extremely difficult to reduce a ski resort's carbon footprint without extensive up-front investment in either efficiency or renewable energy. (Sadly, there is no such thing as a sustainability trust fund that corporations can tap for green projects.) The only way to make these sorts of changes is through an emphasis on the triple bottom line of social, environmental, and economic accountability. What does not work (as this article unfortunately indicates) is an overreliance on the dogma that sustainability is good for the planet and the bottom line, because, to paraphrase Shakespeare, there are more obstacles in heaven and earth, Horatio, than are dreamt of in your sustainability philosophy. Benefits are either impossible, or impossibly expensive, to quantify, or simply do not exist. A good example is the productivity improvements claimed by green development advocates. Little "productivity improvement" can be made in a condo. And attempting to explain, let alone demonstrate, benefits like increased retail sales resulting from daylighting (i.e., the use of daylight in lieu of conventional light fixtures) to a ski shop owner is difficult, especially when he is asked to pay more for that feature from the beginning. Ultimately, in the pursuit of sustainability, education and theory count less than toughness and realism. Thankfully, at least for Aspen, those two traits are common among skiers.

Notes

1. One of the few available studies of environmental impacts associated with tourism estimated that the tourism industry used 0.3% of total U.S. energy consumption (72.1 GWh) and 4% of total commercial water consumption (Davies and Cahill 2000).
2. The Green Hotels Association ⟨www.greenhotels.com⟩ was founded in 1993 (Griffin 2002).
3. For a case study of environmental activities at Patagonia, see Chouinard and Brown (1997).
4. For a detailed analysis of the impact and cause of the Vail fires, see Glick (2001).
5. ASC's 2001–2002 report is available at ⟨www.aspensnowmass.com/environment⟩.
6. Unless otherwise noted, all tons are short tons (1 short ton ≈ 0.91 metric tons ≈ 0.91 Mg).
7. Based on annualized numbers from the report by Brand (2002) and using conversion factors from ASC's 2001–2002 sustainability report.
8. Amory Lovins has commented that value engineering does not add value and is not engineering (Hawken et al. 1999).

9. See the California Integrated Waste Management Board Web site ⟨www.ciwmb.ca.gov/used oil/Facts.htm⟩ for information on the impacts of used oil.
10. Local energy supplier Holy Cross Energy calculates that for every kilowatt-hour of electricity produced using coal, 1.99 lb of CO_2 is released into the atmosphere. Assuming ASC has, at minimum, the capacity for five micro-hydroturbines like the one described, the potential savings in CO_2 emission is 2.5 million lb.
11. Between 1990 and 2000, the number of county residents over the age of 85 soared nearly 140%, residents between the ages of 50 and 59 rose 135%, and every other age group over 45 saw large increases, while the number of county residents 44 and younger dropped (Hooper 2002).
12. A conservation easement is a legal action designed to preserve a piece of property as open space, usually forever. Easements are often purchased by land conservation groups.
13. When first introduced, the local-beef burger at the microbrewery in Steamboat Springs, Colorado, cost $1 more and outsold the regular burger by 2:1.
14. *Greening Your Ski Area: A Pollution Prevention Handbook* grew out of an effort by the Colorado Department of Public Health and Environment to initiate discussions with ski-area representatives about proactive strategies for improving regulatory compliance, reducing wastes, and conserving natural resources. These discussions ultimately led to the development of a project involving Colorado ski areas, funded by the U.S. EPA, and contracted to Tetra Tech EM Inc. (Tetra Tech) for project implementation. It is available online at ⟨http://peakstoprairies.org/p2bande/skigreen/⟩.

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