Beyond the Turbine:
Initiatives for a Sustainable Jiminy Peak

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ENVI 302
Fall 2008

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PART I
Introduction and Background

Introduction

"Jiminy Peak strongly believes in preserving the Earth for future generations. We are showing our commitment by being the first Mountain Resort in North America to install a wind turbine in order to generate clean, natural energy. Together we can shape a sustainable community for the future***."***[1]

Jiminy Peak has become a recognized pioneer among green ski resorts. Their installation of Zephyr, a 1.5-megawatt wind turbine, combined with their implementation of a wide variety of energy conservation efforts and new green initiatives have decreased Jiminy's dependence on the grid by 49.4%. Our task was to push Jiminy's commitment to sustainability even further by researching and evaluating new and innovative environmental initiatives to further reduce energy and resource consumption at the resort. We hope that our study will help Jim Van Dyke, Jiminy Peak's Vice President of Environmental Sustainability, and Jiminy's Green Team propel the resort forward into a more sustainable future.

Background

Why Save Energy?

The big picture

Reducing energy demands is essential to reducing greenhouse gas emissions. Renewable energy, energy conservation, and energy efficiency are all ways to reduce carbon dioxide emissions. Reducing heat-trapping emissions is the most important step to curbing the rate and extent of climate change.

[1] http://www.jiminypeak.com/page.php?PageID=1255&PageName=Green+Jiminy,

According to the Intergovernmental Panel on Climate Change (IPCC), world temperatures could rise by between 2.0 and 11.5 degrees F during the 21st century.[2] This warming and associated sea level rise will continue for centuries due to current greenhouse gas concentrations. This warming will alter global climate patterns in significant and unpredictable ways. However, magnitude of future impacts varies based on human activity now. Though global warming is a global problem, the Northeast has a central role to play. Ranked against the nations of the world, the Northeast is the seventh largest emitter of carbon dioxide.[3]

Why saving energy matters to the ski industry

The Northeast Climate Impacts Assessment (NECIA) by the Union of Concerned Scientists has projected changes in average annual temperatures locally. Under a higher emissions path, temperatures are projected to increase 6.5-12.5 degrees F by the end of the century. An increase of 3.5-6.5 degrees F is projected on the lower path.

Either magnitude of temperature change ultimately means less snow for the northeast. Across the Northeast, the number of days with snow on the ground will be reduced by 50 percent in the higher emissions scenario, and by 25 percent under the lower scenario. More winter precipitation will fall as rain. Both projections will likely have serious implications for winter recreation and tourism in the region.[4]

Institutional Profile

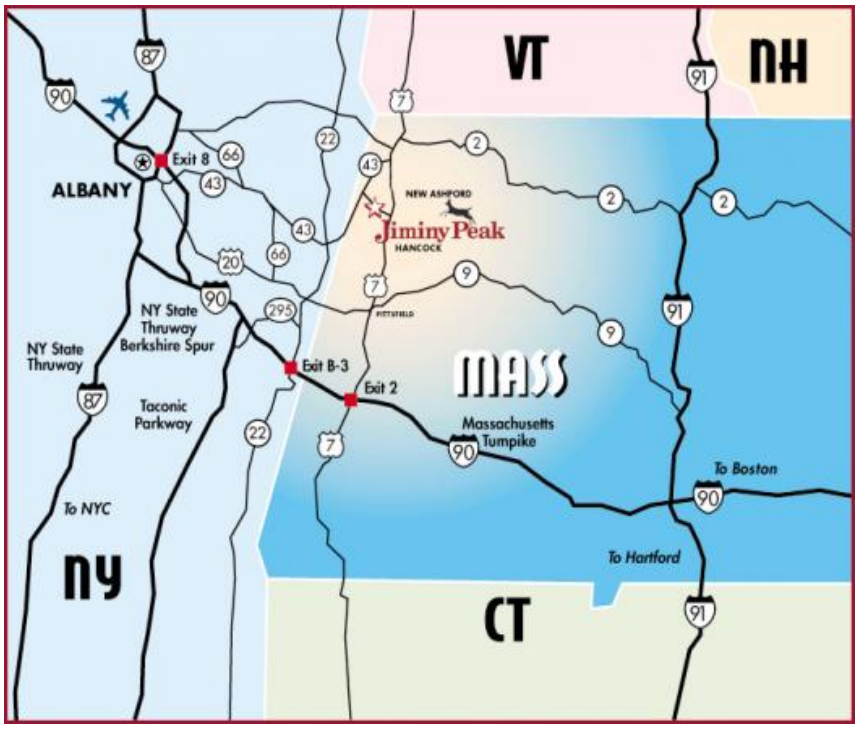
[2] from the Intergovernmental Panel on Climate Change (IPCC), 2007 report
[3] from the Northeast Climate Impacts Assessment (NECIA) by the Union of Concerned Scientists
[4] from the Northeast Climate Impacts Assessment (NECIA) by the Union of Concerned Scientists, 2007

Opened in 1948, Jiminy Peak Mountain Resort draws skiers, snowboarders, nature lovers, and conference-goers to the Berkshire Mountains year-round. Jiminy Peak is the largest ski and snowboard resort in Southern New England. In the winter, guests can enjoy 170 acres of the mountain, including 44 trails, 9 ski lifts, and 3 terrain parks. In the summer, Jiminy transforms into the Mountain Adventure Park, where guests can ride the ski lifts, hike the trails, and try out the alpine super slide, mountain coaster, euro-bungy trampoline, and much more. Conferences and weddings are also popular at the resort, with rooms accommodating up to 440 people.[5]

Jiminy Peak is located in Hancock, MA, close to the artistic and cultural hubs of Williamstown and North Adams, MA (figure 1). The majority of Jiminy's guests come from the Northeast: the top three origins of guests are New York City, Long Island, and New Jersey. Most guests arrive in their own vehicles, but Jiminy also offers a shuttle service from the New York area. Jiminy's employees live in 90 nearby cities in New York, Massachusetts, Connecticut, and Vermont.[6]

[5] Jiminy Peak Mountain Resort, http://www.jiminypeak.com, Accessed 26-Nov-2008. (Whole paragraph).
[6] Jiminy Peak Mountain Resort, http://www.jiminypeak.com, Accessed 26-Nov-2008. (Whole paragraph).

Figure 1. Location of Jiminy Peak Mountain Resort[7]



Current Green Initiatives at Jiminy

The Wind Turbine

In the summer of 2007, Jiminy Peak installed a $4-million dollar wind turbine to power their ski lifts, snowmakers, and some resort buildings. The 1.5 megawatt wind turbine, named Zephyr, generates 4.6 million kilowatt-hours of energy per year. Jiminy uses about half of the electricity generated by the turbine to supply around one-third of its electricity needs, returning the other half to the grid. Jiminy cannot use all of the electricity generated by the turbine because the turbine's supply schedule does not coincide completely with the resort's demand schedule—in the winter when it is windier,

[7] Jiminy Peak, "Directions," http://www.jiminypeak.com/page.php?PageID=1362&PageName=Directions, Accessed 26-Nov-2008.

the turbine generates more electricity but the resort's energy requirements are so great that the turbine can only provide half of the needed energy. In the summer the resort uses much less energy, so the turbine generates a surplus of energy that is returned to the grid. Additionally, the infrastructure required to connect buildings to Zephyr is very costly to install which hinders Jiminy's ability to use 100% of the energy generated by the turbine.

To help pay for the turbine project, Jiminy received federal tax rebates, Renewable Energy Credits, and a renewable energy grant from the Massachusetts Technology Collaborative of $582,000. The turbine should prove to be a great investment, as the estimated payback period is only 7-8 years for Jiminy's contribution and Jiminy will be able to produce clean, renewable energy for decades while inspiring other resorts around the country to follow in their footsteps. [8]

More Green Initiatives at Jiminy

The Base Area/Village Center of Jiminy peak includes a welcome center, children's center, equipment room, administration center, two lodges, a tavern, the 100-room Country Inn and restaurant, and Country Store. Other energy-using operations at the resort include the snowmaking machines, snow groomers that smooth out the snow, ski lifts, lighting, their own wastewater treatment plant, and water pumps. To power the resort, Jiminy uses a combination of electricity from their wind turbine, electricity from the National Grid, diesel fuel oil, propane, and gasoline.

In addition to the wind turbine, Jiminy has invested in a variety of other environmental initiatives that save energy and money. CFLs are used in the Country Inn

[8] http://www.jiminypeak.com/page.php?PageID=1367&PageName=Wind+Turbine+FAQ (whole paragraph)

and Village Center public spaces and hallways, exit signs are retrofitted with LED lights, and ski trails use high-efficiency 400-watt bulbs. The excess heat generated from the high-efficiency snowmakers is used to heat three buildings in the Village Center. Programmable thermostats are installed in many individual rooms in the Country Inn and elsewhere to facilitate the control of heating and cooling. A reservoir at the summit of the mountain stores water in the summer that can flow downhill to the snowmaking machines during the winter, reducing the need to use energy to pump water uphill. About 400 gallons of waste oil from snowmakers, grooming machines, and vehicles are used annually to heat the Mountain Operations building. In the Country Inn, guests' towels and sheets are only washed once every three days, saving about 25,000 gallons of water per year. The washing machines are attached to an Ozone Water Treatment System, which reduces water temperatures from 90 to 60 degrees, reduces drying time, and reduces the amount of chemical detergents needed. The installation of 12 waterless urinals saves 486,000 gallons of water per year. Finally, JJ's Lodge restaurant uses high efficiency motors for heating and cooling, energy-efficient exhaust hoods, and a water cooled tower to reduce air conditioning needs.[9]

[9] http://www.jiminypeak.com/page.php?PageID=1369&PageName=Sustainable+Environmental+Initiatives (whole paragraph), Accessed Nov 2008.

PART II
Problem Identification and Scope

Energy Use at Jiminy

To begin to narrow the scope of our project, we looked at the total energy usage of the resort. There are many different energy-using sectors of the resort, including restaurants, lodging, administration, mountain operations such as snowmaking, snow grooming, and lift maintenance, transportation, and more. Four different types of energy provide power to Jiminy—electricity, propane, oil, and gasoline (Table 1). In addition, the electricity can be broken down by supplier—either the wind turbine or the National Grid. Electricity comprises the largest percentage of Jiminy's energy cost at 65%, while fuel oil/diesel consumes 20%, propane 12%, and gasoline 3% of Jiminy's total energy budget (Table 1).

Table 1. Energy usage of Jiminy Peak resort in 2008 according to type of energy[10]

ELECTRIC (National Grid and TransCanada)	Kilowatt-hrs	Cost
Total electric	**10260328**	**$868,097.75**
Percent of total:		**65%**
FUEL OIL/DIESEL	Gallons	Cost
TOTALS:	**79080.1**	**$258,795.36**
Percent of total:		**20%**
PROPANE	Gallons	Cost
TOTALS:	**79623.3**	**$160,613.71**
Percent of total:		**12%**
GASOLINE	Gallons	Cost
TOTALS:	**11735.6**	**$38,086.95**
Percent of total:		**3%**
TOTAL (ALL types of energy):		$1,325,593.77

[10] From Data Entry Sheet—Energy Accounts 2008.xls

Justification for Focus on the Country Inn & Snowmaking

We chose to focus our efforts on the Country Inn and snowmaking operations because they consume such a high percentage of Jiminy's total energy budget. Out of the $1.3 million spent each year on energy not provided by the turbine—including electricity, propane, oil, and gasoline—the Country Inn comprises 15% of this spending and diesel for the snowcats that groom the slopes comprises 9% of this spending (Tables 2 and 3). Other single buildings or operations consume substantially smaller percentages of energy. Together, the Country Inn and Snowcats represent 24% of Jiminy's energy needs not supplied by the wind turbine.

Table 2. Energy usage of Snowcats compared to total fuel oil use and overall energy use at Jiminy Peak resort in 2008[11]

FUEL OIL/DIESEL	Gallons	Cost
TOTALS:	79080.1	$258,795.36
Percent of total:		20%
SNOWCATS	**32993.9**	**$114,474.46**
Percent of Fuel Oil/Diesel:	**42%**	**44%**
Percent of total:		**9%**
TOTAL (ALL types of energy):		$1,325,593.77

Table 3. Energy usage of the Country Inn compared to electric, diesel, propane, and total energy uses at Jiminy Peak resort in 2008[12]

ELECTRIC (National Grid and TransCanada)	Kilowatt-hrs	Cost
Total electric	**10260328**	**$868,097.75**
Percent of total:		**65%**
COUNTRY INN	**811,867**	**$43,411**
Percent of National Grid electric:	**15%**	**15%**
Percent of total:		**3%**
FUEL OIL/DIESEL	Gallons	Cost
TOTALS:	**79080.1**	**$258,795.36**
Percent of total:		**20%**

[11] From Data Entry Sheet—Energy Accounts 2008.xls
[12] From Data Entry Sheet—Energy Accounts 2008.xls and EnemDemon Readings.xls for Country Inn 2008

COUNTRY INN	**36690.2**	**$117,653.65**
Percent of total:		**9%**
PROPANE	Gallons	Cost
TOTALS:	**79623.3**	**$160,613.71**
Percent of total:		**12%**
COUNTRY INN	**18158.5**	**$36,096.79**
Percent of total:		**3%**
TOTAL (ALL types of energy):		$1,325,593.77
COUNTRY INN total		$197,161.81
COUNTRY INN Percent of total:		**15%**

While we focused on researching initiatives that could be implemented in the Country Inn, most of the technologies can also be implemented in other resort buildings and operations. We suggest installing new energy-saving technologies in the Country Inn first, since the Inn uses such a large percentage of the resort's total energy, and if the initiatives are successful then they could be easily applied to other resort buildings.

After we decided to focus on the Country Inn, we reviewed the number of guests staying at the Inn each month of the year. This allowed us to evaluate whether our initiatives should have been more applicable during the summer or the winter months, depending on when guests were present in the Inn. We found that guests stay year-round, with peaks in both the summer and winter months (Figure 1). Therefore, we chose to research technologies that would be operable and beneficial at the Inn year-round.

We also noticed that the electricity usage in the Country Inn does not correlate with the number of guests staying at the Inn per month (Figure 1). The maximum electricity usage by the Inn occurs from March to June, when low numbers of guests are present. We wonder if the air conditioning system is consuming large amounts of energy in these months and should be more closely monitored in the future to determine this discrepancy in energy usage. We would encourage further investigation of this enigma.

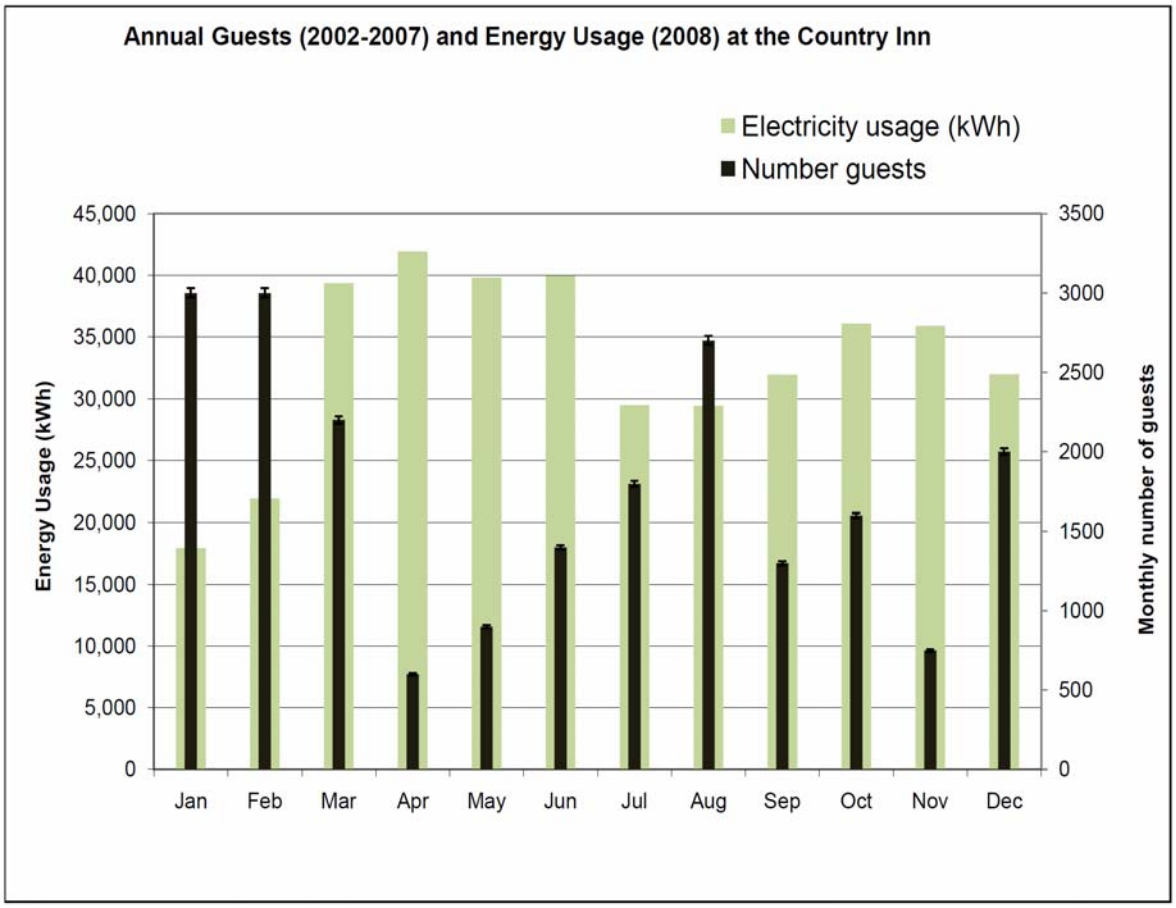


Figure 1. Numbers of guests staying at the Country Inn per month, from 2002-2007, and the total electricity usage in the Country Inn in 2008.

List of Initiatives Investigated

We have organized our initiatives according to those that could be implemented in the Country Inn, followed by changes in operations (snowcat and snowmaking considerations). We have also included other suggestions for sustainability that we think the Green Team should consider but which do not have a direct, quantifiable impact on the energy usage of the resort. For each initiative, we include a description, case studies from hotels in the Northeast or greater US, any relevant policies and resources, and possibilities for implementation of the technology in the Country Inn.

Country Inn Initiatives

- Insulation Improvements
- Low-flow plumbing
- Vending machine misers
- Motion detectors
- Dimmer CFLs
- In-suite recycling
- Energy Star appliances
- Energy Management Systems
    - Keycard
    - Infrared
- Solar Thermal Systems
- Solar Electric Systems (Photovoltaic)
- Solar Pool Heating
- Drainwater heat recovery

Snowcats and Snowmaking

- Biodiesel for Snowcats
- Greywater for snowmaking

PART III
Research Plan

Research Methods

Jim Van Dyke, the Vice President of Sustainability at Jiminy, did not assign a specific task in terms of greening Jiminy; instead, he was open to any suggestions and emphasized his enthusiasm for innovative ideas. Therefore, after narrowing the scope of our project and finding out where most of the energy was being consumed, we decided to focus our efforts on the Country Inn and snowmaking. We divide our research plan into three main categories. First, we took a tour of the Country Inn with Dave Crammer who is the Director of Lodging at Jiminy to gain a better understanding of the physical space and energy use. Our tour included a visit to the boiler room, John Harvard's restaurant and kitchen, guest rooms, laundry room, game room and the gymnasium. On our visit, we got a chance to see the type of appliances and systems being used in the guestrooms which proved valuable later on when we did feasibility evaluations.

Since insulation is the first step to saving energy and reaping benefits from innovative energy technology, we decided to do an energy audit. Bill Lafley from the Center for Ecological Technology was our energy auditor and Gene Weatherall who is the grounds manager for Jiminy accompanied us during the energy audit. Most notably, the audit shed light on the most critical insulation problems at Jiminy which were the deteriorating insulation in the attic and the insulation surrounding the recessed lights.

Next, we conducted interviews with hotels that were advertised as green or had implemented a specific green initiative that we were pursuing. For green initiatives such as key-card systems, recycling, and dimmer CFLs we disregarded the location. But for

initiatives that required a certain climate, such as solar heating systems, we looked at hotels in the Northeast or hotels that shared a similar climate to Jiminy.

In order to better understand the types of green initiatives we wanted to recommend to our client, we got in touch with experts in the field, via email, telephone, or meetings. We met with Barbara and Craig Robertson. Mr. Robertson is the president of Heliocentrix in Williamstown and an expert on insulation and solar water heating systems. He was also able to offer us advice on drainwater heat recovery systems and their feasibility. We also had email correspondence with Lee Harrison, the Vice President of Berkshire biodiesel. We were also in touch with Auden Schendler, the Executive Director of Sustainability at Aspen who gave us valuable advice on what factors to consider when greening a resort.

Finally, we brought together the information from the Country Inn tour, the energy audit, and the various interviews with experts and hotels to come up with a list of green initiatives. We then analyzed the success of each initiative in a matrix according to a set of evaluation factors. We assigned a weight to each factor according to its importance in making an initiative successful. Our weight scale ranged from 0 to 5, with 5 scoring the highest and 0 scoring the lowest in all scenarios.

Evaluation Factors and the weight assigned to each

A. Energy Savings

Energy savings is the capacity of the initiative to reduce energy use. It does not necessarily apply only to a reduction in the electricity bill. For example, if the technology saves water, how many gallons can it save per month or per year, and how does this

translate into energy savings? We assigned a weight of 5 to this factor since this was our primary goal in greening Jiminy.

B. Sustainability

Sustainability is a complex term. The definition of sustainability embraced by the United States Environmental Protection Agency (EPA) is "meeting the needs of the present without compromising the ability of future generations to meet their own needs." [13] This definition is weighed towards the social aspect of sustainability. However, we also embraced the ecological aspect of sustainability-in terms of resource use- when we evaluated our initiatives. We defined sustainability as the best environmental impact overall. We assigned a weight of 5 for sustainability since it was among the major goals of our project.

C. Initial Cost

Initial Cost referred to the cost of implementing an initiative, that is, the purchasing cost and the installation cost. We assigned a weight of 4 as this was not among the top priorities but still an important factor considering Jiminy operates on a business model.

D. Payback Period

Payback period is the time taken to fully recover the cost of implementing an initiative. We assigned a weight of 4 as this was not among the top priorities but still an important factor considering Jiminy operates on a business model.

[13]Environmental Protection Agency, http://www.epa.gov/Sustainability/ (12/06/08)

E. Public Relations Potential

Public relations on a basic level is the capacity of an initiative to promote a positive image of a business in terms of environmental sustainability. However, for our purposes it also refers to the ability of a hotel or ski resort to educate the guests and staff on sustainability and energy efficiency. We assigned a weight of 4 for various reasons. First, public relations potential was not as important as energy savings or initial cost in gauging feasibility.

Because Jiminy is a business, it is more inclined to spend where it can gain; that is invest in initiatives that will increase marketing potential. We believe, though, that a business like a ski resort has a unique opportunity to educate guests about environmental issues through leading by example. More so than NGOs or the government, businesses can affect their consumers' outlook and choices in a meaningful way because their first purpose is fulfilling their particular business niche. However, if they also demonstrate a commitment to being good stewards of the environment, it goes a long way toward convincing the public that environmental stewardship is not a fringe interest, but in the best interest of all. While NGOs can be seen by the public as having a direct vested interest in advocating for environmental issues, a business is not necessarily seen this way. If a business takes it upon itself to show commitment to sustainability, it furthers the vital goal of making the public see an environmental ethic as integrated with economic interests and our everyday lives.

F. Guest Reactions

Guest reactions are how the guests receive the green initiatives, if they are affected by it at all. Do they complain about it, or do they compliment the initiative? We assigned a weight of 3 to guest reactions for various reasons. First, even though Jiminy has a responsibility to cater to its guests to attract business and maintain its livelihood, we believed that guest reactions could be nebulous in evaluating.

Sustainability and energy savings are clear-cut, as is initial cost, and all are very important. In terms of guest reaction, some guests may see a certain initiative as especially desirable, whereas others might see it as less desirable. Perhaps initial guest reactions, if negative, could be improved by marketing or education efforts. Even if guests are displeased with an initiative or completely enamored with it, this reaction doesn't immediately impact either of our bottom lines- environmental impact and economic impact. Therefore, we assigned an in-between weight of 3 to this factor.

G. Ease of Implementation

Ease of implementation refers to the how much effort would be required on Jiminy's part to implement an initiative. We assigned a weight of 2 since we believed that it counted little towards how successful an initiative could be in terms of greening. When comparing whether an initiative offered a large energy savings versus whether it was challenging to implement, we thought it was more important to save energy at a lower cost. Implementation difficulties were seen as surmountable obstacles- important in that they could be a hassle and prolong time taken to implement an initiative. In the end, implementation ease was not as vital as the other factors weighted.

PART IV
Research Findings

I. Country Inn

Insulation Improvements

Insulation is a crucial issue at Jiminy Peak during the winter and summer months, as large variations in temperature necessitate substantial heating and cooling efforts. If the building is not well insulated and leaks air, then much more money than necessary will be spent on any renewable energy efforts. While we offer our suggestions here, we would highly recommend scheduling an energy audit with an insulation professional.

Common places for air leaks and insulation holes include the space between fireplaces and attics, attic walls and floors, and doors and windows. Air leaks and insulations holes can mean huge energy losses—leaving 2% of an area uncovered by insulation can decrease insulation efficiency by 42%.[14] When we toured the Country Inn with Bill Lafley and Gene Weatherall, Mr.Lafley offered some preliminary suggestions on insulation and weatherproofing. First, the double front doors could be replaced entirely since large gaps exist between the door frames and the walls, floor, and ceiling, and previous attempts at installing weatherstrips to seal the gaps have proven unsuccessful due to mischievous children tugging them down. Other doors should be checked for gaps where air can leak through and weatherstripped.

Second, the insulation in the attic should be improved by replacing the existing R-19 fiberglass batt insulation or spraying an alternative insulation over it. The insulation is peeling up in many places and contains numerous clearly visible holes. There are some simple, easy-to-install insulation methods on the market. Alternatives to fiberglass insulation include non-fiberglass batts, sprayed foam insulation, and sprayed fiber

[14] Harley, Bruce, "Home Remedies for Energy Nosebleeds," www.finehomebuilding.com, Oct/Nov 2007.

insulation. Overall, these insulation alternatives cost slightly more than regular fiberglass batt insulation but will begin saving energy and money immediately, ensuring short payback periods.

Non-fiberglass batts include cotton, wool, and rock wool batts, but we would not recommend this type of insulation as completely replacing the existing insulation would require more time and labor than covering the existing insulation. Sprayed foam insulation is another alternative that must be installed by a professional. Sprayed foam expands to fill cavities, acting as both an insulator and an air sealer. One issue is finding environmentally-friendly foams that don't contain Chlorofluorocarbons or formaldehyde. In addition, Bill Lafley cautioned that sprayed foam insulation may be too heavy for the ceiling in the Country Inn to support. [15]

Sprayed fiber insulation includes recycled materials such as cellulose or mineral wool materials that are mixed with water and possibly adhesive, sprayed into cavities and allowed to dry. Mineral wool doubles as a fire-retardant. Sprayed fiber insulations can be 50% more expensive than regular fiberglass batt installations, but can offer more insulation which significantly cuts heating and cooling costs. In a case study for Oakwood Homes in Denver, CO, sprayed fiber insulation was installed quickly and easily, took 48 hours of drying time, and decreased air leakage over fiberglass batt insulation. [16] Bill Lafley recommended spraying a layer of cellulose fiber insulation over the existing insulation.

[15] http://www.toolbase.org/Technology-Inventory/walls/sprayed-fiber-insulation (whole paragraph)
[16] http://www.toolbase.org/Technology-Inventory/walls/sprayed-fiber-insulation (whole paragraph)

The approximate costs and insulation effectiveness (R-values) of these insulation materials are as follows, but will vary depending on local material costs, labor rates, and thickness of insulation.

Fiberglass Batt Insulation: $0.70 per s.f. (R-19)
Cellulose Wall-Spray: $1.20 per s.f. (R-19)
Cotton Batt Insulation: $1.20 per s.f. (R-19)
Spray Foam (1" flash coat with R-19 batt): $1.60 per s.f.
Sheep's Wool: $2.40 per s.f. (R-19)
Spray Foam Insulation: $1.25 to $2.25 per s.f. (R-19)
Blown Insulation (attic): $0.50 per square foot (R-38)
Cementitious Foam through a Membrane: $1.45 to
Insulation Blown or Foamed through a Membrane: $1.40 per s.f. (R-19)
$2.45 per s.f. for an R-19 wall (a 2x6 wall filled with cementitious foam is R-21.5 and would cost about 10% more) [17]

Between 20 and 40% of heated or air conditioned air never reaches the intended rooms.[18] The water heater in the Country Inn's attic may exacerbate this problem even further: The heater is currently housed in a room intended to be well-insulated though gaping holes through the insulation prevail. We would suggest removing any battered insulation and replacing it with new fiberglass batt insulation. This cheap method will keep the heater from losing its heat to the colder surrounding attic spaces. Large insulation holes also exist where recessed lighting and speakers have been installed in ceilings. For example, in John Harvard's restaurant, Bill's Infrared temperature monitor recorded a temperature of 48º F in front of the lights and speakers, compared to an ambient temperature of 75º F! Care should be taken to fill these holes with new insulation and install track or exterior lighting and exterior speakers.

[17] ToolBase TechSpecs "Alternative Insulation Materials". http://www.toolbase.org/Technology-Inventory/walls/sprayed-fiber-insulation.
[18] Harley, Bruce, "Home Remedies for Energy Nosebleeds," www.finehomebuilding.com, Oct/Nov 2007.

Third, consideration should be given to installing interior storm windows that reduce air leakage. The Country Inn currently has old double-frame windows in most of its rooms, and simple weatherstripping is not possible on these windows. In John Harvard's restaurant, the Infrared temperature monitor recorded a temperature of 63º F in front of the windows compared to an ambient temperature of 75º F. Interior storm windows would add another layer of insulation without sacrificing the exterior aesthetics of the buildings. They do not weather like exterior storm windows and can be removed during the summer to allow for fresh air and breezes.[19] The payback period for storm windows is around 5-10 years, about one-quarter to one-half shorter than replacing all of the windows.[20]

Finally, thought should be given to lowering the ambient temperature of the public spaces in the hotel. We were informed that the ambient temperature is usually held at 72-74 degrees F. Lowering the temperature by even a couple of degrees could yield large energy savings.

Low Flow Plumbing

Low flow plumbing is attractive because it can save water with relatively few adjustments to the existing system. In terms of low-flow fixtures, Jiminy has already installed low-flow faucet aerators in guest bathrooms.

The first initiative we took into consideration is the dual-flush toilet. Dual-flush toilets save more water than the current toilets in Jiminy that use about 1.6 gallons of

[19] Servicemagic, "Storm Windows Will Save Your Home," http://www.servicemagic.com/article.show.Storm-Windows-Will-Save-Your-Home.13487.html, Accessed 12-9-08.
[20] Facilitiesnet, "Weighing the Costs and Benefits of Window Replacement," http://www.facilitiesnet.com/bom/article.asp?id=2636 , Accessed 12-9-08.

water per flush. This device, which is standard issue in many European hotels, has two buttons to operate the toilet. There is one for a 0.8-gallon flush (for liquid waste) and one for 1.6 gallons (for solids). The toilets, which average just under one gallon per flush as opposed to 7 gallons for some older toilets are standard in much of the world. However, they raise the issue of whether reminding customers to be more aware of their resource consumption and act accordingly is an inconvenience.[21] The biggest obstacle in implementing this initiative is the high cost of dual-flush toilets. Prices vary according to the model; the prices usually range from $250-$400.

Next we looked at low-flow shower heads. Jiminy has attempted to install low-flow shower heads; however, guest complaints have kept the initiative from becoming successful. Currently, there are shower heads available that arrive at a middle ground: these aerating shower heads mix air into the water stream so that the pressure is maintained with less water. While the old shower heads use as much as 5.3 gallons per minute, the Neco shower head that we recommend "pumps out 1.9 gallons per minute and uses a 'patented vacuum flow technology' that renders a higher pressure than other

[21] Bernstein, F."Checking In- Will Americans Accept Greener Hotel Rooms?," The New York Times, 3 August 2008. Available at http://www.nytimes.com/2008/08/03/realestate/commercial/03sqft.html)

low-flow showers, giving a spray sensation roughly equivalent to most 2.5 gallons per minute showerheads."[22] These shower heads cost $99. However, there are low-flow shower heads available for as little as $8-$50[23], but these may not work as well as the Neco shower heads. Low-flow shower heads do not only save water, but they also save energy, which means potential savings on heating and electricity bills for Jiminy. On average, each low-flow shower head is expected to pay for itself in the first year.[24] Almost every hotel that we interviewed, including Jurys Boston Hotel and Double Tree Hotel Burlington, use low flow shower heads. However, they have not installed dual-flush toilets because of the high initial cost.

Vending Machine Misers and Motion Detectors

Vending machine misers and motion detectors use passive infrared sensors that switch a technology "on" when they detect motion. According to Bill Lafley during the energy audit, motion detectors for lighting should be installed in closets, storage rooms, and bathrooms throughout the Country Inn. Due to the fire chief's specifications, no motion detectors for lighting should be installed in the basement hallways. Standard wall

[22] Treehugger, The Neco Showerhead. http://www.treehugger.com/files/2006/07/the_neco_shower.php (11/28/08)
[23] EarthEasy, Low Flow Aerators, http://www.eartheasy.com/live_lowflow_aerators.htm (11/28/08)
[24] Hometips. Showerheads that Save Water: Low Flow Shower Headshttp://www.hometips.com/cs-protected/guides/showerhd.html (11/28/08)

switches can be easily retrofitted with the new motion detector lighting, and many lights that contain a manual on/off switch that override the infrared detector ensure that guests and staff are never left in the dark.[25] A typical switch is the AS-100 Automatic Control Switch from WattStopper, which sells for about $70 each, or $7,000 for 100.[26] In the DoubleTree hotel in Sacramento, CA, the WattStopper team installed 448 infrared lighting sensors in guest room bathrooms. These sensors also had a high-efficiency LED light for nightlighting. The team calculated an annual energy savings of about $8000, with a 2.5-year payback period. The hotel reported no guest complaints, and guests reacted positively to the nightlight that helped them make their way to the bathroom during the night.[27]

Simple plug-in infrared detectors could also be attached to the video games powercords in the Inn's game room, since the games are kept on throughout the day but guests probably don't play the games during most hours.

Vending machines cost about $300 per year to run; by installing a vending machine miser, energy costs can be reduced by $125 per machine. Misers can be easily installed using simple tools by attaching it to the vending machine and plugging it into the wall. Drinks are kept cold by the Miser which also monitors the temperature of the machine. Austin Energy sells a typical VendingMiser and offers a free trial Miser.[28]

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[25] Watt Stopper, "AS-100 automatic control switch," http://www.wattstopper.com/products/details.html?id=29, Accessed 12-9-08.
[26] The AS-100 White automatic control switch, http://www.goodmart.com/products/1034899.htm, Accessed 12-9-08.
[27] Watt Stopper, "WN Nightlights: Fuel Energy Savings and Guest Satisfaction at DoubleTree Hotel," http://www.wattstopper.com/getdoc/426/DoubleTreeCaseStudy.pdf. Accessed 12-9-08.
[28] Austinenergy.com, "Save energy with a free vending miser," http://www.austinenergy.com/Energy%20Efficiency/Programs/Energy%20Miser/vendingMiser.htm

Dimmer CFLs

Compact fluorescent light bulbs use 1/3 the electricity and last up to 10 times as long as incandescents. A single 18 watt CFL installed to replace a 75 watt incandescent bulb will save approximately 570 kWh of energy over its lifetime. At 8 cents per kWh for energy, that is a savings of $45.[29]

While Jiminy Peak has retrofitted the incandescent light bulbs in all of its hallway and in-room fixtures with CFLs, the Clark and Fischer conference rooms use incandescent lighting on dimmer switches. About 51 overhead incandescent lightbulbs, and 13 wall sconce incandescents were counted between the two rooms.

Because Jiminy retrofitted with CFLs some years ago, perhaps dimmer CFLs were not an option at the time. Older CFL lightbulbs had a ballast structure that made them incompatible with dimmer switches. CFL technology evolves quickly, and these lightbulbs are now on the market. However, contemporary CFL lightbulbs compatible with dimmer switches are readily available. Installation of such lightbulbs would be an easy way for Jiminy to save energy.

[29] EarthEasy, *Energy Efficient Lighting: Compact Fluorescent Lightbulbs.* http://www.eartheasy.com/live_energyeff_lighting.htm. accessed Nov 2008.

In-suite Recycling

While Jiminy already has a recycling central facility, in-suite recycling is a way to increase the effectiveness of the existing recycling program. Recycling, and therefore reducing landfill waste (methane emissions) and the energy involved in producing items from raw materials as opposed to recycling existing items (carbon dioxide and particulate matter emissions), reduces overall carbon footprint. With almost all the interviews conducted with both hotels and ski resorts, recycling in-room was mentioned. Each case cited positive feedback as a result of their in-room recycling bins. Mammoth Mountain in California and Aspen both have in-room recycling. According to Sha Miklas at the Arapahoe Basin ski area, the resort has in-room recycling, and has become so excited by waste reduction initiatives that the employees have begun a small-scale composting operation in the staff kitchen. In addition, recycling bins were viewed as sending a positive message to both customers and staff about environmental commitment and stewardship.

Energy Star Appliances

The Energy Star program was promulgated in 1992 under the auspices of the Environmental Protection Agency in order to save energy and reduce carbon emissions into the atmosphere. The Energy Star label is given when an appliance/a product or a building meets energy efficiency guidelines set by the EPA and Department of Energy. Among the appliances that Jiminy can target are Room Air Conditioners, Refrigerators, Dishwashers, Televisions sets, and DVD players. Besides saving energy and cost of utility bills, using energy star appliances convey a positive message of environmental sustainability to the guests.

Table 4: Energy Star appliances and energy savings

Appliance	Energy Savings
Dishwasher	use at least 41 percent less energy than the federal minimum standard for energy consumption
Room AC	Use 10% less energy than conventional models.
Refrigerator	use at least 20% less energy than required by current federal standards and 40% less energy than the conventional models sold in 2001
TV	use about 30% less energy than standard units
DVD	use as little as one quarter of the energy used by standard models

Source: Energy Star at http://www.energystar.gov/index.cfm?c=appliances.pr_appliances

Energy Management Systems

Currently, digital programmable thermostats are installed in about 50% of the rooms in the Country Inn. These thermostats provide guests with direct and fast-working control of the temperature within their suite. However, huge amounts of energy in heating and cooling are wasted when guests leave their suite and fail to turn down their thermostat. In addition, the Country Inn staff must enter each room after a guest leaves and turn the heat to a fallback temperature of 60 degrees F, which might not be done promptly each time a guest leaves.

To sharply reduce these energy losses, hotels around the world are using Energy Management Systems, either the Keycard system or the Infrared system. Although these systems are most prominently used in Europe and Asia, the systems are gaining in popularity in the US.

The keycard Energy Management Systems work by allowing guests to insert their room key into a control box on the wall in order to activate the lighting and other electrical outlets in their room. Removing their card as guests are leaving turns off the

electricity. Some systems can even control the heating and air conditioning (HVAC) in the room. The Infrared systems offer the same control of electricity and HVAC in guest rooms automatically.[30] Instead of inserting a keycard into a control box, the PIR systems sense movement and sometimes temperature in the room to detect when guests are present in the room and adjust energy flow to the room accordingly. Guests can also manually set the temperature of the room using programmable digital thermostats if they wish.

Many companies now sell keycard systems to US hotels. One company called Entergize has fitted large hotels such as Westin Hotels and Resorts, La Quinta Inns and Suites, and Holiday Inn with keycard systems, and offers a free quote.[31] Energy Eye also sells similar systems.[32] According to Entergize and Energy Eye, the system saves 25-40% of energy consumed per room, cutting energy bills by the same amount. The system is relatively easy to install, immediately begins saving energy and reducing costs, has a payback period of two years or less, and has an excellent green marketing potential. Guests react well to the technology, as the control box provides a safe place to keep their keycard while in their room, avoiding lost cards. However, one hotel reports that about 5% of guests will thwart the system by leaving a spare key in the control box while they are gone.[33] Entergize also offers an infrared system called Passive Infrared Systems (PIR).

Hotels Using Keycard Systems

[30] Entergize, http://www.entergize.net/, accessed Nov 2008.
[31] Entergize, http://www.entergize.net/, accessed Nov 2008.

[32] Energy Eye: Control Your Resources, ***http://www.energy-eye.com/indextest.htm***, accessed Nov 2008.
[33] Hasek, Glenn, "Keycard-Based Energy Management Systems Gain Acceptance in US," Aug. 2 2007, http://www.greenlodgingnews.com/Content.aspx?id=1270. Accessed Nov. 8 2008.

Many hotels have reported successful use of keycard systems in the United States. The high-class Orchard Garden Hotel in San Francisco opened in 2006 with 86 rooms and LEED certification. We spoke to Trisha Clayton in Public Relations, who reported that although the keycard system had an expensive initial cost—about $37,000 for purchase and installation—it had a short payback period of two years, and had provided 20% energy savings over these two years.[34] The hotel purchased the system from a company in the UK called Diyses Ltd.[5] The Orchard Garden Hotel keycard system controls not only the lighting and electricity in the rooms but also the heating and air conditioning. Trisha explained that the hotel has capitalized on the public relations potential of the Energy Management System by providing handouts at the front desk about the system, posting informational sheets, and using the system towards its LEED certification. Guests have responded very positively to the technology and no longer have to worry about losing their cards. The staff does not have to worry about turning the heat up or down, and have also responded positively. Overall, the Orchard Garden Hotel reported great success with the Energy Management System that started saving them huge amounts of energy and money within two years.

[34] http://www.theorchardhotel.com and Personal Comm. with Trisha Clayton 12/1/08 (See Appendix)

Diyses Ltd, Bowmore, Fintry, Turriff, Aberdeenshire, AB53 5PS
Tel. 01888 551778, Fax 01888 551784
http://www.diyses.co.uk/energysavingequipment/card.htm
Feel free to contact Melanie Lapointe if you would like more detailed information on this:
Melanie Lapointe, LEED AP
Swinerton Builders
260 Townsend Street
San Francisco, CA 94107
(510) 385-7879 mobile

The Westin Convention Center in Pittsburgh, a certified Gold LEED building, also installed the system in its 616 rooms.[35] It spent $125,000 to install the system but this money was completely paid back in 10 months, and provides 25% energy savings.[36] The Convention Center educates guest about the keycard system in the reception area, which they credit for the success of the technology.

Hotels Using Infrared Systems

Jenn Holderied from The Golden Arrow Lakeside resort in Lake Placid, New York also reported positively on the Energy Management System. They have installed the system in fifteen of their new rooms to test out the technology, but plan on retrofitting the rest of its rooms soon. They used the Gem Energy Management System from Lodging Technology and reported a four-year payback period, although the payback period will be shorter when they install the system in more rooms. It allows guests to have control over the system when they are in the room, but as soon as they leave the sensor reverts to a fallback temperature and shuts off electricity. Ms. Holderied disclosed problems when they installed the sensors beneath the windows and the sensors would detect motion from the breeze and turn on even if guests were not present. In-house market research through guest surveys revealed that guests would be willing to switch to the Energy Management technology, and so far guests have reacted positively.[37]

[35] http://www.starwoodhotels.com/westin/property/overview/index.html?propertyID=1370
[36] Hasek, Glenn, "Keycard-Based Energy Management Systems Gain Acceptance in US," Aug. 2 2007, http://www.greenlodgingnews.com/Content.aspx?id=1270. Accessed Nov. 8 2008.
[37] Holderied, Jenn, Golden Arrow Lakeside Hotel, personal comm. 12/4/08 (See Appendix).

Solar Energy

Solar energy can be used to heat water or generate electricity. Overtime, the efficiency of solar energy technology has increased. As newer models and more quantity enter the market, the cost of solar energy systems is decreasing, although it still remains very expensive. Using solar has several benefits: it saves energy, decreases utility bills and reduces the amount of greenhouse gases entering the atmosphere that contributes to climate change. During our initial meeting with Jim Van Dyke, he mentioned that Jiminy was looking to install a solar energy system in the next two years. Here, we provide an analysis of the different types of solar energy generating systems and their feasibility at Jiminy.

The biggest obstacle in installing a solar heating system is the high initial cost. However, solar energy systems save a considerable amount on gas or electricity bills in addition to providing a sustainable energy source. The payback period for solar energy systems that replace electricity use is shorter than those replacing natural gas. It is difficult to cite the exact costs or the payback period for these systems because prices vary according to the model and model selection has to be specific to the site or location. Therefore, a price can only be given by a professional after evaluating where Jiminy wants the system to be installed.

Even though solar energy systems are expensive, Massachusetts offers numerous tax exemptions for any "solar or wind powered climatic control unit and any solar or wind powered water heating unit,"[38] which is elaborated on in a later section.

[38] The General Laws of Massachusetts, http://www.mass.gov/legis/laws/mgl/63-38h.htm (12/03/08)

Solar Thermal

The factors to consider when installing a solar thermal system are geographic location, system design, collector orientation, and collector size. The main parts of the solar water heating system include a hot water storage tank, a solar collector that absorbs solar energy, a back-up energy source, and (for forced circulation systems which is what is used mostly in the U.S.) a pump and controls. The energy collectors for solar energy systems come in two main forms: flat plate collectors or evacuated tubes.

1. Flat Plate Collector

A flat-plate collector is an insulated metal box with a glass or plastic cover and a dark-colored absorber plate.[39] These collectors heat liquid or air at temperatures less than 180°F. Our research showed that flat plate collectors have fewer option of installation since the unit has to be placed directly at 12 degrees off south for maximum efficiency. Flat plate collectors are more effective in warmer, sunnier and southern climates where freezing is less likely.[40] A disadvantage with using flat plate collectors is if a portion of the collector fails, the entire collector system has to be replaced.

Solar Flat Plate Collector

2. Evacuated Tubes

[39] US Department of Energy http://www1.eere.energy.gov/solar/sh_basics_collectors.html
[40] http://solarhotwater.siliconsolar.com/pdfs/flat-plates-vs-evac-tubes.pdf (12/03/08)

Evacuated tube collectors consist of parallel rows of transparent glass tubes, each tube containing a glass outer tube and metal absorber that absorbs solar energy and inhibits radiative heat loss.[41] Because air is removed from the space between the two glass tubes to form a vacuum, conductive and convective heat losses do not occur in this system, which gives it an edge over flat plate collectors in cooler climates.

Solar Evacuated Tubes

If one tube in an evacuated tube unit fails, it does not lead to a failure of the whole system; the failed tube can be individually replaced. Although evacuated tubes are more expensive than flat plate collectors, they have a much lower rate of thermal loss which leads them to produce much higher temperatures. Evacuated tubes are also much more energy efficient (between 55-82%) than flat plate collectors (about 40%).[42]

Table 5: Conversion Factor, Thermal Loss and Temperature for Collector Units

Type of Collector	**Conversion Factor**	**Thermal Loss Factor in W/m² °C**	**Temperature Range in °C**
Flat-plate collector	0,66 to 0,83	2,9 to 5,3	20 to 80
Evacuated-tube collector	0,62 to 0,84	0,7 to 2,0	50 to 120

Source: The Solar Server, Forum for Solar Energy[43]

[41] US Department of Energy http://www1.eere.energy.gov/solar/sh_basics_collectors.html#flatplate (12/03/08)
[42] Efficiency rates given by Craig Robertson during an interview.
[43] The Solar Server. http://www.solarserver.de/wissen/sonnenkollektoren-e.html (12/04/08)

Because of Jiminy's cold climate and a large energy load during winter months, we recommend evacuated tubes instead of flat plate collectors. Craig Robertson also advocates for the use of evacuated tubes and claims that installing a solar hot water system on the roof of the Country Inn is a "no-brainer" since it has a heavy hot water load (hot water used in the guest rooms and John Harvard's Kitchen) and its location can guarantee the collection of solar energy.

Below is a table that contrasts the two types of collectors.

Table 6: Comparing Flat Plate Collectors and Evacuated Tubes

Flat Plate Collectors	**Evacuated Tubes**
Fewer options for installation; may have to sacrifice aesthetics for performance	More freedom & aesthetics in system design and installation
Less expensive than evacuated tubes	More expensive than solar plates (2-3 times the cost of the plate)
Less efficient than evacuated tubes (about 40%)[44]	More efficient than flat plate collectors (about 55% - 82%)
Must be installed as one solid unit	Can be installed in pieces
If one plate fails, the entire system has to be replaced	If one tube fails, only that tube needs to be replaced
More effective in warmer, sunnier, southern climates	Perfect for northern climates with cooler temperatures, shorter days & lower sun angles

Business Using Solar In Massachusetts

A major business that already uses solar energy is the Barrington Brewery in western Massachusetts. We talked to one of the owners Andrew Mankan and he informed us that they installed a $55,000 solar thermal system on their roof in order to meet the

[44] Efficiency rates given by Craig Robertson during an interview.

1,000 gallons of hot water per day demand they have at the brewery. They use flat plate collectors and the solar thermal system feeds the existing hot water system. Because of the solar they now use less than ½ of the natural gas they originally used. The panels are accompanied by a 1500 gallon hot water tank in the basement. The payback period for the project is 10-12 years. According to Mr. Mankan, there are not many tax incentives for businesses to adopt solar technology- incentives are targeted for residential installations.

Barrington Brewery reports no difficulties with the system so far. It is the largest hot water system in Massachusetts, and took about a year to plan. They had to deal with several logistical obstacles- they had to figure out if the roof could hold the weight of the panels, and also figure out how the mechanics of the plumbing would work. For this, they had to bring in a specialized engineer. They are so pleased with the system's performance they just bought 15 extra panels to maximize its potential. They used a local supplier for the technology.[45]

Solar Electric (Photovoltaic Cells (PV))

As for solar electric systems (using photovoltaic cells), the initial costs are higher than solar thermal systems. PV cells usually consist of rectangular devices ranging in size from 2' by 4' to as large as 4' by 8'. While rigid PV cells have glass cover, flexible cells have film cover to protect them from storms or degradation caused by UV rays.[46] To maximize efficiency, PV cells require unobstructed sunlight. Where they can be installed is quite flexible: roof tops, or as free standing units that can also rotate to receive the most

[45] Interview with Andrew Mankan, owner of Barrington Brewery
[46]Toolbase Services. http://www.toolbase.org/Technology-Inventory/Electrical-Electronics/pv-systems (11/15/08)

sunlight. They operate silently (which is a great plus for a hotel) and requires very little maintenance; the only part that needs to be maintained is the battery storage. Depending on the state tax exemptions and rebates, PV generated electricity can be as competitive as utility supplied electricity.

However, compared to solar thermal systems, PV systems score lower in terms of efficiency: the efficiency of PV ranges from 18% to 25% while the efficiency of solar thermal systems using evacuated tubes range from 55%-82%. The efficiency ratio of solar thermal to PV systems in 4:1.[47] Therefore, we would recommend installing a solar thermal unit instead of a PV unit.

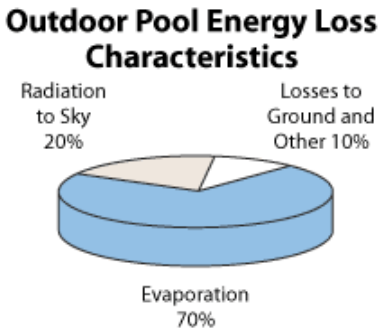
Solar Pool Heating

Before installing a solar pool heating system, we would like to stress the importance of covering the pool to avoid unnecessary heat loss.

Jiminy's Outdoor Pool at Country Inn

Factors that contribute to the loss of heat from an outdoor pool are low humidity, high temperature of the pool and high wind speed- all of which are conditions that can exist at Jiminy during winter when the pool is heated.

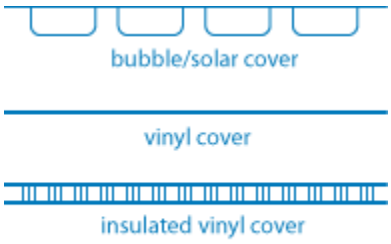
[47] Efficiency rates given by Craig Robertson during an interview.



Source: DEP website

Using a pool cover reduces the size of the solar heating system needed to heat the pool. Since Jiminy's pool is kidney-shaped, it is impossible to mount an automatic pool cover. The mechanism that Jiminy uses currently-a pool cover reel- is the best available option. There are different types of covers that can be used for covering the pool recommended by the DEP. They are: UV-stabilized polyethylene; polypropylene; or vinyl. In addition, pool covers can also be transparent or opaque. For an outdoor pool that absorbs 75-85% of solar energy that hits the surface, a transparent bubble cover will only reduce pool solar energy absorption by 5-15%, which saves energy.[48] For a more durable cover, vinyl is recommended as it is made of heavier material. Insulated vinyl that has a thin layer of flexible insulation is also available. There are also other benefits to using a pool cover; it helps to conserve water by reducing the amount of make-up water needed by 30%–50%; reduces the pool's chemical consumption by 35%-60%; and reduces cleaning time by keeping dirt and debris out of the pool.[49]

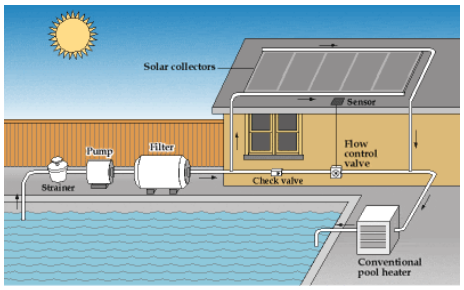
[48] US Department of Energy http://apps1.eere.energy.gov/consumer/your_home/water_heating/index.cfm/mytopic=13140 (10/29/08)
[49] US Department of Energy http://apps1.eere.energy.gov/consumer/your_home/water_heating/index.cfm/mytopic=13140 (10/29/08)



Types of pool covers Source: DEP website

An innovative way to use solar energy is to heat pools by directly connecting the solar water heating system to the pool. The U.S. Department of Energy provides a formula for calculating the solar pool heating system's energy output per dollar spent or invested. It is as follows:

(Btu(British thermal unit)/day X # of collector panels/piping modules) ÷ total installed cost of system = Btu/$ per dollar spent



Solar Pool Heating Model

A solar pool-heating system costs between $2,000 and $10,000 in terms of purchasing and installation costs, depending on size. Costs run between $7 - $12 per square foot depending on system design and collection type.[50] A pool of about 300 to 400 square foot surface area can be fitted with a solar pool heating system with an initial

[50] US Department of Energy. http://www1.eere.energy.gov/solar/sh_basics_pool.html (11/12/08)

investment of about $3,000 to $5000.[51] If it is properly sized and well maintained, the system can last for 15 to 20 years and pay for itself in energy savings in 2 to 3 years.[52] Although solar heating system will not generate the full amount required to heat the outdoor pool in the winter at Jiminy, it will significantly reduce the amount of non-renewable sources used and will decrease the cost of energy bills.

State Incentives for Solar

More specifically, there are two incentives provided by the state of Massachusetts for solar water heating. The first is the Corporate Income Tax Deduction (M.G.L. c.63, sec. 38H.). Under this tax deduction:

> A business which purchases a qualifying solar or wind-powered "climatic control unit" or "water heating unit" is allowed to deduct from its net income, for state tax purposes, any costs incurred from installing the unit, provided the installation is located in Massachusetts and is used exclusively in the trade or business of the corporation.[53]

The second incentive is the renewable energy tax exemption (M.G.L. ch. 59, sec. 5, cl. 45). Under this initiative:

> Massachusetts law provides that solar-energy systems and wind-energy systems used as a primary or auxiliary power system for the purpose of heating or otherwise supplying the energy needs of taxable property are exempt from local property tax for a 20-year period. This incentive applies only to the *value added* to a property by an eligible system, according to the Massachusetts Department of Energy Resources

[51] FlaSolar. http://www.flasolar.com/pool_main.htm (11/12/08)
[52] FlaSolar http://www.flasolar.com/pool_main.htm (11/12/08)
[53] The General Laws of Massachusetts, http://www.mass.gov/legis/laws/mgl/63-38h.htm (12/03/08)

(DOER). It does not constitute an exemption for the full amount of the property tax bill.[54]

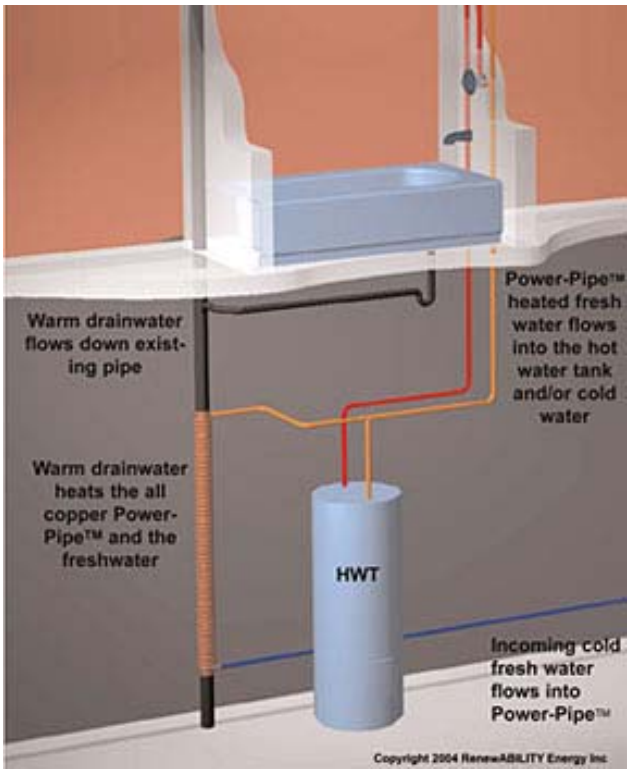
Massachusetts Technology Collaborative (MTC) promulgated a Commonwealth Solar Rebate program in January 2008 that will carry through December 2011.[55] Solar PV is the only eligible energy type for this rebate and the maximum that a commercial applicant can get is $1.6 million per calendar year. For non-residential systems to be eligible they have to produce 500 kW DC.[56] There are other specific requirements for eligibility. Some of the important ones to note are: all equipment must be new; minimum warranty has to be 5 years for the product with a 20 years performance for modules and 10 years for inverters. There are also some interesting requirements. One is that the electrical work must be performed by a Massachusetts licensed electrician. The program has a total of $68 million for rebates.[57]

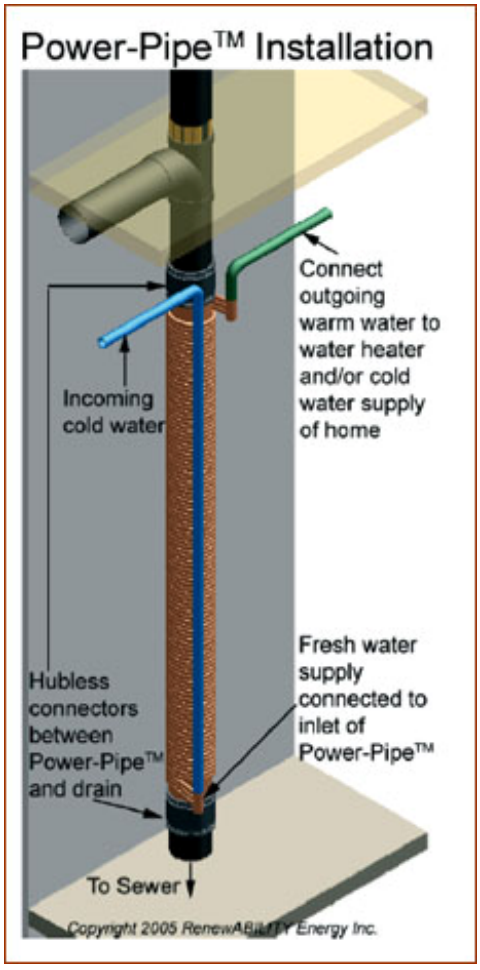
Drainwater Heat Recovery

Hot water that goes down the drain carries with it energy, energy that typically represents 80-90% of the energy used to heat water in a home. [58] Drainwater heat recovery recaptures energy from hot water that would otherwise be wasted and utilizes it.

[54] Ibid.
[55]http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=MA71F&state=MA&CurrentPageID=1&RE=1&EE=1
[56] ibid
[57] Ibid.
[58] U.S. Department of Energy. Energy Efficiency and Renewable Energy: *Drainwater Heat Recovery.* Available at http://apps1.eere.energy.gov/consumer/your_home/water_heating/index.cfm/mytopic=13040

Drain water heat recovery systems capture this heat energy, and redirect it to warming cold water entering other fixtures or entering the water heater.[59]





Payback period ranges from 2.5 to 7 years, variable based on frequency of system use.[60] For a business with a large hot water load, like a hotel, payback period can be as short as 1 to 5 years. Heat recovery is a cost-effective way for restaurants, hotels, and other businesses with high hot water demands to save money on energy costs.

ReTherm Energy Systems advertises its heat recovery technology as a sensible and cost-effective way for business to reduce energy costs. The ReTherm company

[59] http://www.toolbase.org/Technology-Inventory/Plumbing/drainwater-heat-recovery
[60] Available at http://apps1.eere.energy.gov/consumer/your_home/water_heating/index.cfm/mytopic=13040 Retrieved 11/10/08

custom configures multi-unit systems to accommodate large volumes of drainage water from business or commercial sources interested in installing the system. ReTherm advertises a payback period on initial investment as short as two years for a water-intensive business venture like a hotel.[61]

There are several ways drainwater heat recovery could work for Jiminy Peak. When Craig Robertson, a local renewable energy expert, was consulted he had a suggestion. A powerpipe or multiple units would be installed in the boiler room next to the hot water heater. An extra tank of preheated 'warm' water could sit next to the hot water tank. The powerpipe(s) could be coiled around the wastewater pipe(s) in order to conduct the heat from them. Cold water pipes would be run through the powerpipes, and run preheated fresh water to the warm water tank. The warm water tank could move water to the hot water tank, and the energy required to raise the temperature of water in the hot water tank to the temperature at which it is released to hotel patrons would be lessened significantly.

Case studies for drainwater heat recovery

RenewABILITY, a Canadian company, has patented what it calls the power pipe, a copper pipe that can be fitted around the hot water pipe and conduct heat to cold water pipes routed through it. RenewABILITY has worked with businesses in order to customize the drainwater heat recovery system on a commercial level.[62] The system's application varies based on the logistics of plumbing, but business RenewABILITY has

[61] http://www.retherm.com/
[62] http://www.renewability.com/Power_Pipe_biz/index.htm

worked with include the Cedar Corners Hotel in British Colombia, Canadian Department of National Defense, and Toronto University. [63]

Overall, drainwater heat recovery is not a costly retrofit.[64] Installation is relatively simple even in commercial settings, and immediately creates large energy savings over a short payback period.

Contacts for drainwater heat recovery:

ReTherm Energy Systems
Commercial and small business solutions consultation line
1.877.436.6529 (toll free)

RenewABILITY, Inc.
60 Baffin Place, Unit 2□Waterloo, ON□N2V 1Z7
Tel: 519-885-0283□Toll free: 1-877-606-5559□Fax: 519-885-4475
Office Hours: 9:00am - 4:30pm EST

Biodiesel for Snowcats

Jiminy Peak uses diesel fuel to power its snow groomers. While there is some controversy about Biodiesel is a clean burning alternative fuel that can be produced from renewable sources such as soybeans, corn, animal fat or vegetable oil. Though biodiesel contains no petroleum, it is blended with petroleum diesel to create what is known as a biodiesel blend. This blend can be used in compression-ignition, or diesel, engines with little to no retrofitting of the engine structure.

[63] http://64.233.183.132/search?q=cache:kwFJGVKPaZoJ:www.gfxtechnology.com/CanadianGFX-Installations.pdf+cedar+corners+hotel+canada&hl=en&ct=clnk&cd=6&gl=us&client=safari
[64] http://www.retherm.com/ProductsAndPricing.htm

Table 7: Biodiesel vs. Petroleum Diesel

Advantages	Disadvantages
Domestically produced from non-petroleum, renewable resources	Use of blends above B5 not yet warrantied by auto makers
Can be used in most diesel engines, especially newer ones	Lower fuel economy and power (10% lower for B100, 2% for B20)
Less air pollutants (other than nitrogen oxides) and greenhouse gases	Currently more expensive
Biodegradable	More nitrogen oxide emissions
Non-toxic	B100 generally not suitable for use in low temperatures
Safer to handle	Concerns about B100's impact on engine durability

Table taken from http://www.fueleconomy.gov/feg/biodiesel.shtml

Biodiesel blends are characterized on the basis of what is known as "B" factor. The "B" factor refers to the amount of biodiesel comprising a fuel mix. For example, a fuel that contains 80% petroleum and 20% biodiesel is classified as B20. A pure biodiesel, uncombined with any petroleum, would have a label of B100. Commercially available biodiesel, viable for use in contemporary diesel engines, is sold blended with a non-renewable petroleum component.[65]

[65] http://www.afdc.energy.gov/afdc/fuels/biodiesel.html

Table 8: Biodiesel vs. Petroleum Diesel Emissions

AVERAGE BIODIESEL EMISSIONS COMPARED TO CONVENTIONAL DIESEL, ACCORDING TO EPA		
Emission Type	**B100**	**B20**
Regulated		
Total Unburned Hydrocarbons	-67%	-20%
Carbon Monoxide	-48%	-12%
Particulate Matter	-47%	-12%
Nox	+10%	+2%
Non-Regulated		
Sulfates	-100%	-20%*
PAH (Polycyclic Aromatic Hydrocarbons)**	-80%	-13%
nPAH (nitrated PAH's)**	-90%	-50%***
Ozone potential of speciated HC	-50%	-10%

* Estimated from B100 result
** Average reduction across all compounds measured
*** 2-nitroflourine results were within test method variability

We acknowledge that biodiesel classification as a renewable fuel is controversial, and equity issues surround obtaining it from potential food sources. However, because only diesel-powered snowcats exist, we believe biodiesel is the best option possible. The carbon footprint of B20 biodiesel is about 18.87 lbs CO_2 per gallon, whereas the carbon footprint of diesel gasoline is about 19.59 lbs CO_2 per gallon. For every unit of fossil energy needed to make biodiesel, 2.51 units of energy are gained.

Case studies for biodiesel snowcats

The Wachusett Mountain ski resort in Princeton, Massachusetts uses biodiesel in its snowcats and in its backup generators.[66]This biodiesel is sourced from recycled cooking oil.[67] Cranmore Mountain Ski Resort in North Conway, New Hampshire uses B20 biodiesel in its truck fleet. Cranmore has positive feedbank regarding this conversion,

[66] http://www.wachusett.com/TheMountain/WachusettIsGreen/Conservation/tabid/86/Default.aspx
[67]Available http://www.thebostonchannel.com/news/15013775/detail.html Retrieved on 11/9/08

as the trucks have not experienced any cold temperature-related problems, such as "gelling' with the biodiesel. Mount Sunapee Resort in New Hampshire has changed its snow removal and snow-grooming vehicles to run on B20 biodiesel. In addition, the resort uses B5 biodiesel in its heating systems.[68]

Aspen ski resort uses B20 biodiesel fuel in its snowcats. The Aspen website touts the biodiesel, from Blue Sun Biodiesel manufacturers, as representing a great reduction in black tailpipe exhaust as well as promoting greater lubricity in the operation of the snowcats. Aspen Vehicle Manager Don Mushet is quoted as saying, "B20 has worked very well for us and we have been problem-free throughout the long, cold Colorado winters."[69]

Aspen states that after an unsuccessful search for a snowcat manufacturer that did not use diesel, the resort decided to convert their snowcats to biofuels. The Aspen website has positive feedback about this move:

> 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 switched its entire fleet of snowcats to biodiesel. Benefits include hydrocarbon emissions reductions of 20% and CO and particulate reductions of 10%. The one drawback is that biodiesel typically increases NOx emissions by 2%."[70]

Mount Sunapee in Newbury, NH uses B20 biodiesel fuel in its snow removal and snow grooming machines. They use a local supplier, Evan's Fuels in New Hampshire, to

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[68] http://www.jacksonholestartrib.com/articles/2007/12/25/news/regional/2a83559eb1a3fb98872573bb006a1324.txt

[69] http://www.biodiesel.org/cold/customers/aspen.shtm

[70] http://www.aspensnowmass.com/environment/world/default.cfm

supply the biodiesel. They report that depending on the diesel and biodiesel markets, biodiesel can cost anywhere from 5 to 20 cents more per gallon than conventional diesel fuel. Mount Sunapee uses B10 biodiesel in its compressors, B5 heating oil, and B20 biodiesel in its snowcats. The machines have not had any problems with gelling in cold weather, and expect greater lubricity of biodiesel to create savings in longer engine life for their machines.[71]

A concern Jiminy expressed regarding biodiesel use in its snow grooming equipment was the voiding of the machine warranties. While using biodiesel made from restaurant waste greases might void warranties, ASTM certified biodiesel generally does not. It is safe to use in diesel engines with no retrofitting involved. If biodiesel use is a problem in Jiminy's Cassbohrer Piston Bully brand snowcats, changing brands is a possibility. Because Jiminy cycles one of its four snowcats out every year to buy a new one, changing to another brand would be a short-term change. Mount Sunapee uses the Prinoth brand of snowcat, and reports no warranty voidance as a result of biodiesel use.[72]

Contacts for Biodiesel:

Evan's Fuels
Enfield, NH
http://www.evansbiofuel.com

Steven J. Levy
Sprague Energy
4 New King Street

[71] Mount Sunapee information is from an interview conducted with Jim Freeman at the resort on Dec. 4th, 2008
[72] Ibid.

White Plains, NY 01604
914-328-6770

Dennis K. Burke
Burke Oil, Inc.
P.O. Box 6069
284 Eastern Ave.
Chelsea, MA 02150

The town of Keene, NH powers all of its municipal vehicles using biodiesel.
Stephen Russell
Fleet Services Superintendent, City of Keene, NH
603-757-0656

Greywater for Snowmaking

Snowmaking produces snow artificially by forcing pressurized air and water through a machine, a snow cannon, that nebulizes water particles and freezes. Snowmaking is an energy- and water-intensive process. At Jiminy Peak, the energy for snowmaking comes from the renewable wind power produced by the on-site turbine.

The water-intensive nature of the process is not currently mitigated by any Jiminy Peak initiatives. Water for snowmaking comes from surrounding aquifers, is drawn up the mountain for snowmaking, and drains back into the water table. However, the process of drawing a large amount of water from the aquifer at once can be damaging and energy-intensive. Conserving water and energy, along with preventing disturbances to the water

table (even in areas that are not drought-prone) is environmentally responsible on the part of a ski resort.[73]

Case studies for greywater snowmaking

An area of growing interest in the ski community is the use of reclaimed water for snowmaking. As global warming changes prevailing climate patterns across the world, warmer climates in ski areas will demand an increase in production of artificial snow. Use of reclaimed water for snowmaking has been considered at ski areas in Australia and within the United States.

Mt. Buller Ski Resort in Australia is in the process of developing a greywater snowmaking system. Mt. Buller sources greywater for snowmaking from areas of the resort including showers and roadmelt. The greywater undergoes several phases of treatment after being collected- it is initially filtered to reduce nutrient load, treated with ultraviolet light, treated with ozone, and 'ultrafiltered' to remove bacteria and viruses. The resulting clear water is deemed safe for snowmaking and is described by the resort as 'crystal clear.' [74]

The Seven Springs Mountain Resort, southeast of Pittsburg, Pennsylvania, has been using reclaimed water to create snow since 1985. Seven Springs is renowned for its prolific snowmaking, which incorporates an estimated 600,000 gallons of reclaimed

[73] Available http://query.nytimes.com/gst/fullpage.html?res=9900EEDA1631F93BA35751C0A9679C8B63&sec=&spon=&pagewanted=all
[74] Available http://www.abc.net.au/science/news/stories/s578722.htm

water per day into operations. Seven Springs uses greywater from wastewater treatment lagoons and stormwater runoff.[75]

Obstacles

Using greywater for snowmaking is not currently legal in Massachusetts. According to Mark Schleeweis of the Massachusetts Department of Environmental Protection, greywater legislation is still in the works for non-residential purposes. Massachusetts legislation for commercial greywater use, 314 CMR 20, has not yet been passed pending further research. Especially in the case of a large amount of human contact with the greywater, there are concerns about human health effects.[76]

In addition, it was difficult to find examples of ski resorts that used greywater for snowmaking. Presumably, this has to do not only with the legal issues surrounding greywater, but because it doesn't have very much PR value. It would seem that customers aren't drawn into a ski resort by being told the resort uses recycled water to make snow they want pristine.

In order to obtain the same positive environmental impact generated by greywater snowmaking, we propose HKD gun improvements to save both water and energy in the snowmaking process. According to Jiminy's website, their snowmaking technology is from 1997. We assume that there have been significant advances in snowmaking technology since that time, and believe it would be prudent to consider researching that area. We also recommend that Jiminy look into using stormwater collection or roof runoff as water for snowmaking.

[75] Available http://www.reclaimthepeaks.com/index.cfm?fuseaction=view_template&templateID=82
[76] Interview with Mark Schleeweis, MASS DEP, Dec. 2008

PART V

Recommendations

Matrix

Evaluation factor	A	B	C	D	E	F	G	TOTAL SCORE
Weight of evaluation factor (0-5 scale)	5	5	4	4	4	3	2	145
Technologies (0-5 scale):								
Insulation improvements	5	5	3	5	1	3	4	**103**
Low-flow plumbing	2	3	4	2	2	2	4	71
Biodiesel for snowcats	1	4	4	1	4	3	5	80
Dimmer CFLs	4	4	3	4	4	3	5	**103**
In-suite recycling	1	5	3	5	5	4	4	**102**
Vending machine misers/motion detectors	3	3	5	4	3	4	5	**100**
Energy Star Appliances	2	4	3	2	3	4	2	78
Energy Management System (Keycard)	4	5	2	4	4	5	3	**106**
Energy Management System (Infrared)	4	5	2	4	3	3	3	96
Solar water heating [evacuated tubes]	4	5	2	3	5	5	3	**106**
Solar water heating for pool	4	5	3	3	5	3	4	**106**
Photovoltaic system	3	5	1	1	5	5	2	87
Drainwater heat recovery	3	4	5	5	1	3	5	98
Greywater for snowmaking	2	4	1	1	3	2	1	58

Key:
A: Energy Savings
B: Sustainability
C: Initial Cost
D: Payback Period
E: Public Relations Potential
F: Guest Reactions
G: Ease of Implementation

Rationale for scoring, by evaluation factor

Each initiative (eg. insulation, photovoltaic system) was scored on a comparative scale of 1 to 5, based on our case studies and research, by evaluation factor (eg. energy savings, sustainability). 1 was the lowest possible (least desirable) score, and 5 was the highest possible (most desirable).

A. **Energy savings.** The more energy an initiative saved compared to the others, the better (closer to a 5) it scored in this category. Insulation improvements would be the best way of all the options studied to achieve energy savings, and were therefore assigned a score of 5. Biodiesel saves energy but, especially in the case of B20 blends, not an amount as significant as dimmer CFLs or energy management would..

B. **Sustainability.** The better an initiative's overall environmental impact, the better (closer to a 5) it scored in this category. Initiatives with the most desirable overall environmental impact and resource conservation potential were insulation improvements, in-suite recycling, energy management systems, and solar renewable energy.

C. **Initial Cost.** The lower an initiative's initial cost, the better (closer to a 5) it scored in this category. In other words, the more costly it was the closer to a 1 it scored; the less costly initiatives scored closer to a 5. Therefore, photovoltaic systems and greywater snowmaking, as the most costly, were assigned the lowest score of 1. Vending machine misers and motion detectors, and drainwater heat recovery have relatively small initial costs and therefore scored the highest possible score of 5. Other initiatives were in between a higher and lower initial cost and were categorized accordingly. For example, solar water heating for the pool, energy star appliances, and purchasing bins for in-suite recycling all have a middle of the road initial cost, and were given a 3. Low-flow plumbing, in terms of new showerheads and some new toilets along with the added cost of biodiesel fuel per gallon, both got a score of 3. They did not have an initial cost as large as that of photovoltaics or of energy management systems, but were not as low in initial cost as vending machine misers.

D. **Payback period.** The shorter an initiative's payback period, the better (closer to a 5) it scored in this category. In other words, the initiatives with longer payback periods scored closer to a 1, whereas those with shorter payback periods scored closer to a 5. Insulation improvements and drainwater heat recovery have relatively short payback periods according to our research and the aforementioned case studies, and therefore scored a 5. Keycard management systems have a relatively short payback period, as do dimmer CFLs and vending machine misers, and so got a 4. Biodiesel, because it does not save money directly through its use except potentially by increasing lubricity in engines and therefore extending the life of a snow groomer, scored a 1 in this category. Photovoltaic systems also have very long payback periods because of high initial costs and also scored a 1.

E. **Public relations potential.** The better an initiatives public relations potential, the higher (closer to a 5) it scored in this category. We assigned the maximum score of 5 to

all of the solar options, along with in-suite recycling. We believed those to be the most high-profile and visible initiatives of which guests could take notice. These would provide a focal point for educating guests and staff about environmental issues, and create positive interest. Low-flow plumbing and drainwater heat recovery both scored low in this category, as they are not particularly 'sexy' initiatives and are not readily visible for guests to take notice of and consider.

F. **Guest reactions.** The more positive guest reaction would be to an initiative, the higher (closer to a 5) it scored in this category. For this category, we ranked initiatives that would have a positive guest reaction as a 5, and negative guest reactions as a 1. If we believed guests would not notice an initiative or be ambivalent toward it, we gave it a 3. Therefore, energy management systems scored very high, as guests have had positive reactions to them in the cases we have studied. Solar water heating and photovoltaics are also attention-grabbing initatives that wow guests and create a positive impression. We thought low-flow plumbing and greywater for snowmaking were on the other end of the scale. Guests could complain about water pressure being too low, or about dual-flush toilets being difficult or confusing to operate. Greywater is not regarded as being a desirable component of ski snow, and therefore we did not believe it would promote a positive guest reaction. The low-profile initiatives, such as drainwater heat recovery and insulation improvements, were given a 3 as they would go unnoticed by guests for the most part and not create either a positive or negative reaction.

G. **Ease of implementation.** The easier an initiative would be to implement, the higher (closer to a 5) it scored in this category. The initiatives that scored highest in this category were dimmer CFLs, biodiesel, vending machine misers/motion detectors, and drainwater heat recovery. All of these are relatively simple installations. Dimmer bulbs easily screw in to replace incandescents, biodiesel is poured right into the machine in lieu of petroleum diesel, misers are simply plugged in, and drainwater heat recovery requires expert installation but not much else. The more difficult implementation was in the case of graywater for snowmaking, energy star appliances, and a photovoltaic system. Graywater for snowmaking might require a different method of filtration and routing of the water to the treatment plant and then to snowmakers. Energy star appliances would have to be decided on, and then installed room by room. This could prove difficult, especially in the case of dishwashers that are connected to the existing infrastructure of rooms. Rooms would have to be vacated for this to occur, and a team of movers would have to be hired. Photovoltaics are difficult to decide on, to decide where to install, at what angle to install, and are a laborious installation.

Scoring process
After scores of 1 to 5 were assigned to each initiative in each evaluation factor category, this score was multiplied by the evaluation factor weight to yield a score. The composites each initiative received when evaluation factor weight was multiplied by score in evaluation factor category were added together to yield a total score:

> Formula for composite for each initiative = (Score in evaluation factor category) x (Weight of evaluation factor)
>
> Total score initiative receives=Composite score for evaluation factor A+ Composite score for evaluation factor B....+Composite score for evaluation factor G

For instance, let's look at insulation improvements as an example.

> Formula for composite: [Score in evaluation factor A (energy savings) category: 5] x [Weight of evaluation factor A (energy savings): 5]=25

If we multiply these two scores together, we get 25. Then, we'd move on to evaluation factor B, then C, and so on all the way to G, and use the same process to score each time:

> Composite= [Score in evaluation factor G (ease of implementation) category: 4] x [Weight of evaluation factor G (ease of implementation): 2]=8

We would then multiply those two numbers together, and get 8.

After getting the composite scores in each evaluation factor for an initiative, we added up the scores to come up with a total for each technological initiatives. We compared the totals to come up with our recommendations.

> Using insulation improvements as an example again, we would add composite score A, 25, with composite score B, all the way to composite score G, 8. The total score, out of a possible 145 points, was assessed for each initiative. In the case of insulation improvements, this method yielded a total score of 103.
>
> Composite score A (25)+Composite score B....+Composite score G (8)=Total score (103)

The maximum possible score was a 145. This was calculated by multiplying together the fixed weight of each evaluation factor category on the 1 to 5 scale, by the maximum possible score of 5 an initiative could have scored in that category.

Our Recommendations

Our evaluation produced three clear winners: the keycard energy management system; solar water heating using evacuated tubes; and solar pool heating. Therefore, these are the initiatives that we recommend Jiminy look into first.

We also had close runner-ups: insulation improvements; installing dimmer CFLs; facilitating in-suite recycling; and attaching misers to vending machines and using motion detectors on some lights in the hallways.

In terms of biodiesel, it should be pointed out that the reason it did not score well overall is because it does not have a payback period, and it does not directly save energy (although it does reduce emissions). Therefore, while it did not score well within our framework, we would still recommend it as an initiative to increase sustainability and reduce carbon footprint.

Overall, because of legal and health concerns, the energy-intensive nature of filtering greywater to make it suitable for snowmaking, and the low PR-value it has, greywater snowmaking is not a desirable initiative at this time.

Further Suggestions and Resources for Sustainability

- *Green cleaning products*

Many of the hotels we interviewed used natural, non-toxic cleaning products. For example, the Orchards Garden Hotel in San Francisco uses Sierra Natural cleaning supplies that are natural, citrus-based and non-toxic. To test out the cleaning supplies, they had half of their staff use the old, chemical cleaners and half use the new, citrus-based cleaners for a short period of time. Then the groups switched, and evaluated each

of the systems. The staff loved the new citrus-based cleaners because they were not only more effective than the chemical versions but did not leave them with burning hands and throats at the end of the work day. A wide variety of natural cleaning products are readily available online, including Sierra Natural Cleaners (http://www.sierranaturalcleaners.com/) and Shaklee (http://www.shaklee.com/index.shtml).

- *Sustainable Suppliers*

Jenn Holderied from the Golden Arrow Lakeside resort suggested that the biggest challenge she faced in greening the hotel was finding suppliers who are actually operating sustainable companies. She suggested two contacts who know green suppliers for any technology or product:

Ray Burger: Suites and Freshstay Hospitality, and Ecorooms

Glenn Hasek: Green Lodging News

She also referred us to Hoymeyers Lodge in Lake Clear, NY as a model for a sustainable lodge. Jenn said she would love to be a contact for Jiminy Peak for help greening the Country Inn. She can be reached at:

Jenn Holderied
Director of Marketing/Owner
Golden Arrow Lakeside Resort
2559 Main Street
Lake Placid, NY 12946
www.golden-arrow.com
(518)523-3353

- *Alternative Technologies Database*

Tool Base Services (http://www.toolbase.org/index.aspx) provides an extensive listing of building innovations, including energy- and resource-saving technologies. Their database, called PATH (Partnership for Advancing Technology in Housing) evaluates technologies according to affordability, energy efficiency, quality and durability, environmental performance, and safety and disaster mitigation (http://www.toolbase.org/TechInventory/ViewAll.aspx). Information on cost comparisons, case studies, and tips for installation are also included.

- *Reducing unnecessary wrapping, use sustainable packaging*

Avoid using bottled water and individually packaged toiletries. In addition, we recommend using biodegradable packaging instead of styrofoam-based products.

- *Green toiletries*

Offering guests green toiletry products, from companies that source ingredients sustainably and use fewer chemicals in manufacturing and in their end products. Hotels in the green hospitality industry are turning increasingly to using green soaps and lotions. For example, see (http://www.pineapplehospitality.com)

- *Incentives*

Sleepy Hollow Inn ski and touring center gave out free day passes for customers who drove up in hybrids, electric, or renewable-energy vehicles.

Conclusion

The implications of global climate change are grave- in order to stem the tide of global warming it is necessary to do everything possible to reduce carbon dioxide emissions. The best way to do this is to reduce reliance on fossil-fuel based energy, and implement as many sustainable initiatives as possible. Jiminy Peak has already proven itself to be a pioneer business in this area, with its installation of the Zephyr wind turbine.

Jiminy also has the opportunity to be recognized for its leadership in the green power movement. The EPA has a Green Power Partnership that recognizes and rewards businesses that use green power, for part or all of their energy. This program gives businesses a chance to gain a great deal of public acknowledgment of their environmental stewardship, and gain recognition from the government for what they've achieved.[77] As businesses transition to green power, national energy policy promises to be impacted in a big way.

Jiminy has a great deal of power to enact further positive change, mitigate impact on global climate change, and influence energy policy broadly. Jiminy can do more to expand publicity regarding its green initiatives, thereby gaining recognition but also drawing much-needed attention to environmental issues it addresses. As a model, Aspen has undertaken a campaign called SaveSnow, which it gears to a young ski population, to increase awareness of the link between skiing and global climate change.

By making people aware something they love is at risk, change is inspired.[78] Jiminy is already a leader in the field of green business, but could do much more to set an example for other businesses, its employees, and for its customer base. Jiminy Peak has

[77] http://www.epa.gov/greenpower/
[78] http://www.savesnow.com

already moved far toward sustainability; we are at a critical environmental juncture and now is the time to take the necessary final steps.

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Tel. 01888 551778, Fax 01888 551784
http://www.diyses.co.uk/energysavingequipment/card.htm
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260 Townsend Street
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(510) 385-7879 mobile
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Appendices

Interview Format

Name of Hotel/Ski resort:
Name of the Interviewee:
Date:

We are students from Williams College, MA, conducting a study on green hotels/ski resorts. As a recognized leader in Green Hospitality/green skiing, we would like to ask you some questions on the green initiatives that you have implemented.

Interview:

1. What green initiatives has your hotel implemented so far?

2. Have these initiatives been successful? If so, how?

3. How much energy did it save?
    a. Electricity
    b. Water
    c. Heating

4. Did you face any obstacles in implementing …….. initiative? If so, what were they?
    a. Legal
    b. Customer-relations concerns
    c. Cost

5. How long was the payback period for
    a. Initiative 1
    b. Initiative 2
    c. Initiative 3
    d. Initiative 4

6. How long did it take to implement
    a. Initiative 1
    b. Initiative 2
    c. Initiative 3
    d. Initiative 4

7. How have the guests at your hotel/ski resort received
    a. Initiative 1
    b. Initiative 2
    c. Initiative 3
    d. Initiative 4

8. What are the staff/employees responses (positive, negative….) towards
    a. Initiative 1
    b. Initiative 2
    c. Initiative 3
    d. Initiative 4

9. Could you please rank the initiatives according to how successful they have been?

10. Please describe why you ranked them in that order?

11. Is there anything else we would like to add?