Engine Idling Reduction Program for Snow Resorts

Final Report

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Disclaimer

The findings of this program are a result of the research conducted and do not reflect the specific opinions of the program participants or the funders of this study.

Executive Summary

With over 60 alpine and nordic snow resort members, the Ontario Snow Resorts Association (OSRA) is the voice for the Ontario snow resort industry. This report showcases the results of the OSRA-led Engine Idling Reduction Program (EIRP) from November 2009 to March 2011. The EIRP for snow resorts is the first program of its kind in North America to quantify fuel consumption and emissions from personal vehicles, motor coaches, school buses and snow resort fleet and subsequently through eco-driver training and other behaviour change initiatives, help snow resorts:

1. Reduce greenhouse gas emissions that contribute to climate change;
2. Improve air quality in immediate and surrounding areas;
3. Reduce noise pollution and improve guest experiences; and,
4. Increase operational efficiency across the resort.

The EIRP promotes mutually beneficial solutions to unnecessary idling at snow resorts through its four program components:

1. Learning Circle: With a membership of 35 snow resorts across Ontario as well as 8 in Québec and 10 in Western Canada, the Learning Circle served as a support group for implementing the EIRP and its members contributed to the creation of monitoring, measurement and communication tools as well as advised on eco-driver training.
2. Behaviour Change Campaign: A behaviour change campaign toolkit was made available to participating snow resorts. The toolkit included: an idling reduction action plan template, decals, posters, idle-free ice scrapers, idle-free reminders on parking passes, information cards for bus drivers and a program video.
3. Monitoring and Measurement Tools: Easy-to-use tools were developed to monitor unnecessary idling and enhance the operational efficiency of drop-off and pick-up areas at snow resorts.
4. Eco-driver Education and Training: Education and training was delivered to visiting motor coach drivers and operators of snow resort fleet (i.e. shuttle buses, trucks, vans, etc.). Both education initiatives stressed the importance of factors affecting fuel-efficiency, effects of vehicles emissions on health, vehicle maintenance and inspection, and smart driving techniques.

EIRP outcomes and results include:

- The 18 Ontario snow resorts that actively participated in the EIRP attract approximately 2 million skier visits to their resorts annually during the winter season. These guests arrive in personal vehicles and buses and collectively generate approximately 205,000 kilograms of carbon dioxide emissions per winter season from unnecessary engine idling. By implementing the EIRP at these snow resorts over the 2010 winter season, the EIRP collectively reduced these emissions by 59,000 kilograms or 29%.

- SmartDriver for Motor Coach was piloted at 1 snow resort and was well received by the 9 motor coach drivers that were trained. The Ontario Motor Coach Association promoted the initiative at its fall annual general meeting in 2010 where 75 attendees were in attendance.

- Vehicle monitoring technology was used to assess driver behaviour, fuel use and greenhouse gas emissions among twenty-two light and medium duty vehicles at three Ontario snow resorts. The results of the monitoring studies were integrated into eco-driver curriculum and behavioural changes were tracked post-training. In 2010, sixty-five snow resort fleet drivers received training in an intensive 2 hour eco-driver course. An additional 2 eco-driver education sessions were delivered at OSRA events, reaching 40 participants from 25 Ontario snow resorts. An eco-driver training video for operators of snow resort fleet was created and was first viewed at the 2011 annual spring OSRA conference by over 100 participants.

Program expansion and recognition:

- The EIRP for snow resorts has started to take hold in other parts of Canada. In 2011, the Association des stations de ski du Québec (ASSQ) oversaw the delivery of the EIRP across some twenty ski areas in the province of Québec through support given by the Québec Ministry of Sustainable Development, Environment and Parks. In western Canada, the Canada West Ski Areas Association (CWSAA) through its recently re-formed Environment Committee, disseminated information about the EIRP and several of its members were trained by OSRA on how to deliver the EIRP. A smaller cluster of ski areas in Atlantic Canada were informed of the EIRP through the Atlantic Ski Areas Association.

- The OSRA-led EIRP was nominated in the Sustainable Tourism category for the 2011 Ontario Tourism Industry Awards of Excellence. The Ontario Tourism Awards celebrate excellence and innovation in the tourism industry.

- The EIRP has received recognition for its innovative approach through the Canadian Transportation Research Forum (CTRF). The CTRF is a non-profit association of more than 300 transportation professionals across Canada with a mission to promote the development of research in transportation. Three research papers on the EIRP were presented at the 2010 and 2011 annual CTRF conference, i.e. “Analyzing the Engine Idling Reduction Opportunities at Three Ontario Ski Resorts”; “The Effects of Weather on Vehicle Idling”; and, “Vehicle Monitoring Technology: Opportunities to Improve the Environmental and Economic Sustainability of Ski Resort Fleet”.

- At the World Tourism Forum Lucerne, the results of the EIRP were presented by EIRP graduate student intern, Michelle Rutty. Michelle’s paper was awarded third place in the Young Talent’s Award.

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1.0 Introduction

Climate change, smog and air pollution pose real threats to the well-being of all Canadians. The passion many Canadians have for winter recreation is one avenue that can be utilized to raise awareness and more importantly, foster the behaviour changes needed to have an appreciable impact on climate change and air quality.

There are between 18 to 20 million skier visits made to snow resorts in Canada every year. The guests typically arrive in personal vehicles, school buses and motor coaches. Vans and highway trucks also arrive at snow resorts with deliveries of goods and services while snow resort employees maintain a fleet in the form of passenger shuttles, vans, trucks, snowmobiles and personal vehicles. Combined, these vehicles generate a significant amount of emissions when used and when idling.

In response to the growing interest among members of the Ontario Snow Resort Association (OSRA) to reduce engine idling practices at snow resorts, the OSRA Environmental Best Practices Taskforce developed an education strategy and action plan in March 2008 and a pilot program was trialed in 2009. Both initiatives served as initial steps towards implementing a universal engine idling reduction program for snow resorts.

1.1 Program Purpose, Principles and Objectives

The purpose of the EIRP is to build awareness and understanding among Canadians regarding the impacts of the unnecessary engine idling, in order, ultimately, to engage Canadians and their communities in taking action to reduce unnecessary engine idling.

In situations of prolonged engine idling, drivers often cite reasons for their behaviour that relate to comfort and/or convenience. The barriers to the desired behaviour (i.e. turning the engine off) include:

- In cold weather, drivers idle their engine to keep themselves warm;
- To heat up or cool down the cabin for passengers;
- Not stopping long enough to warrant turning off the engine;
- Stopped in an illegal place;
- The driver's belief that it is easier on the vehicle's engine to let it idle;
- The driver's belief that for stops of a few minutes use more gas to restart the vehicle than it does to keep it idling;
- The driver's belief that it is good to warm a vehicle engine before driving; and,
- Concerns about restarting the engine.

The EIRP offers resources and support to help snow resorts implement idling reduction plans that overcome these barriers and provide recognition to snow resorts that achieve their targets. The EIRP provides an opportunity for snow resorts to help:

- Reduce greenhouse gas emissions that contribute to climate change;
- Improve air quality in immediate and surrounding areas;
- Reduce noise pollution and improve guest experiences; and,

- Increase operational efficiency across the resort.

The EIRP is guided by the following principles:

- Accessible to interested snow resorts
- Turn-key
- Customizable to individual snow resorts
- Enhance operational efficiency
- Improve the guest experience
- Measure results
- Stimulate long term behaviour change
- Replicable across Canada

The objectives of the EIRP are to:

- Ensure snow resort staff, the skiing and snowboarding public, and other drivers are provided with clear and consistent messages on the benefits of reducing unnecessary idling;
- Engage and support an active core of industry and community leaders to deliver behaviour change initiatives to snow resort staff, the skiing and snowboarding public and other drivers. Equip this group with tools and resources to monitor and measure reductions in idling behaviour among drivers at snow resorts;
- Engage and motivate all stakeholders to contribute towards achieving significant, measurable reductions in idling behaviour among drivers at snow resorts;
- Provide opportunities for recognition, continual improvement and ongoing collaboration among partners; and,
- Share results and lessons learned.

The EIRP also strives to:

- Build alliances with local community groups and local governments;
- Share information and best practices with other organizations both within and outside the recreation and tourism sector so that efforts can be replicated;
- Create work experiences for high school, college and university students; and,
- Use idling as a starting point for implementing other fleet management initiatives.

1.2 Phased Approach and Core Activities

A phased approach enables the EIRP to evolve over time and benefit from lessons learned in rolling out the program beyond the pilot participants. Phasing also reflects the reality that building awareness and changing behaviour is a long-term investment. Throughout the phases, evaluation and monitoring underpins all activities in order to continually build on success, learn from past experience, and adapt to evolving attitudes, awareness and activity around engine idling reduction.

The first phase (2009-2010), focused on rolling out the EIRP among snow resorts in Ontario; piloting the EIRP in Québec; and, building a base for support and understanding around unnecessary engine idling among snow resorts across Canada. Activities during this phase aimed to enhance and

support the success achieved in the pilot phase. In addition, this phase positioned OSRA as a mentor to snow resort industry associations across Canada. Some of the activities initiated during the first phase and were carried forward into the second phase. The core activities of this phase included:

- Expand and support the behaviour change campaign among participating snow resorts across Ontario.
- Pilot the EIRP at 5 to 8 snow resorts in Québec.
- Develop and trial tools and approaches for monitoring, measuring and reporting reductions in idling behaviour among drivers at snow resorts. Encourage wide-spread use in the second phase.
- Grow the EIRP web portal as a clearinghouse of information, best practices and research on encouraging fuel-efficient driving behaviours. Compile and share lessons learned from participating snow resorts as well as EIRP partners and stakeholders. Continue expansion in the second phase.
- Increase and strengthen the network of members involved in the EIRP online community.

The second phase (2010-2011), involved the full EIRP roll-out through the realization of a strong network of multi-stakeholder involvement and shared leadership among regional snow resort associations across Canada. The core activities included:

- Develop and pilot fuel-efficient driver training to snow resort staff in Ontario.
- Build a network of shared leadership among regional snow resort associations across Canada and other partners that support and facilitate the adoption of the EIRP across Canada.
- Develop program delivery expertise on the EIRP among an active core of industry and community leaders across Canada.
- Secure additional funding leveraged through cash and in-kind contributions from provincial governments, communities, industry, academic and non-governmental organizations for the purposes of providing support and resources towards the delivery of the EIRP across Canada.

1.3 Work Plan

The work plan took place over the 2009-2010 and 2010-2011 fiscal periods. Table 1 outlines the tasks and timelines involved in delivering the four components of the EIRP.

Table 1: EIRP Work Plan

EIRP Work Plan		
Program Component and Main Tasks	**Outcomes**	**Timelines**
Learning Circle: - Expand the membership of participating snow resorts. - Design workshop curriculum and step-by-step guidebook on "How to Develop an Idling Reduction Action Plan for your Snow Resort". - Maintain EIRP web portal for online learning, participant reporting and information exchange. - Build EIRP delivery expertise among an active core of industry and community leaders across Canada.	Phase 1: - Workshop and step-by-step guidebook on "How to Develop an Idling Reduction Action Plan for your Snow Resort" piloted at OSRA fall education week and fall ASSQ seminar. - Idling reduction action plans for participating snow resorts finalized. Phase 2: - Guidance and feedback from the learning circle incorporated into the creation of monitoring, measurement and communication tools as well as delivery of fuel-efficient driver training. - Workshop curriculum and step-by-step guidebook on "How to Develop an Idling Reduction Action Plan for your Snow Resort" updated to reflect lessons learned from the EIRP component activities undertaken in phase 1. - A series of online and face-to-face 'Train the Trainer" EIRP workshops delivered in partnership with snow resort associations across Canada.	Phase 1: Fall 2009 (3 months) Phase 2: Spring 2010 to Winter 2011 (12 months)
Behaviour Change Campaign: - Identify and coordinate resource requirements to implement idling reduction action plans. - Assemble guidance documents, materials, behaviour change prompts and incentives into a toolkit and distribute for use by participating snow resorts. - Provide implementation and monitoring support where needed at participating snow resorts. - Identify and solicit support from community stakeholders (i.e. municipal governments and NGOs) - Recruit, train and oversee data	Phase 1: - Idle-free signage installed at participating snow resorts. - Snow resort staff informed of EIRP. - Behaviour change prompts and incentives selected and in place at participating snow resorts. - Baseline data and post-launch data collected. - Data analysis performed. Phase 2: - 'Ski Idle Free' toolkit updated to reflect lessons learned from the EIRP component activities undertaken in phase 1 and made available in English and French for use by snow resorts across Canada. - Commitment to support and facilitate the adoption of the EIRP secured from at least one additional regional snow resort association in Canada. - Promotional video on the EIRP available for download	Phase 1: Fall 2009 to Winter 2010 (7 months) Phase 2: Spring 2010 to Winter 2011 (12 months)

EIRP Work Plan		
Program Component and Main Tasks	**Outcomes**	**Timelines**
collection team to monitor the impact of the behaviour change campaign - Formulate an action plan to implement the EIRP across Canada with support from an active core of industry and community leaders across Canada. - Design a 'Ski Idle Free' registry that recognizes those snow resorts that have adopted an idling reduction action plan - Acquire testimonials from program participants and stakeholders and solicit the creation of a promotional video	on EIRP web portal. - 'Ski Idle Free' registry launched and promoted across Canada.	
Monitoring and Measurement Tools: - Review existing idling measurement tools with CO_2 emission calculators - Identify data parameters and construct engine idling scenarios based on skier visits and other snow resort attributes - Develop, test and refine a web-based idling measurement and reporting tool with customizable scenario builder and CO_2 emissions calculator	Phase 1: - EIRP monitoring and measurement protocol piloted at participating snow resorts. Phase 2: - EIRP monitoring and measurement protocol updated to reflect lessons learned from phase 1. - Idling measurement and reporting tool launched and promoted across Canada.	Phase 1: Fall 2009 - Winter 2010 (7 months) Phase 2: Spring 2010 to Fall 2010 (7 months)
EcoDriver Education and Training: - Coordinate opportunities for snow resorts to host SmartDriver workshops for visiting motor coach and school bus drivers - Conduct pre-training driver attitude survey(s) - Design driver training syllabus - Deliver syllabus and train drivers at participating snow resorts - Conduct post-training assessment and evaluation survey(s) - Investigate options for developing an online driver refresher training course	Phase 1: - Syllabus designed and trainer(s) secured - Training session dates and locations secured - Training session registration promoted Phase 2: - 5-8 fuel-efficient driver training sessions delivered to drivers of snow resort fleet - 'In-vehicle training' component piloted in at least one of the fuel-efficient driver training sessions - Host SmartDriver 2-3 workshops for motor coach and school bus drivers - Evaluation of training sessions completed - Option recommended for online driver refresher training	Phase 1: Winter 2010 (3 months) Phase 2: Spring 2010 to Winter 2011 (12 months)

1.4 Program Partners

The following program partners have contributed to the successful delivery of the EIRP over 2009-2011:

- Ontario Snow Resorts Association
- Association des stations de ski du Québec
- Canada West Ski Areas Association
- Atlantic Ski Areas Association
- My Sustainable Canada
- Green Communities Canada

Included below is a brief description of each program partner and their role in fulfilling the EIRP deliverables.

Ontario Snow Resorts Association (OSRA): OSRA is the Ontario snow resort industry's voice as its membership comprises of over 55 Ontario alpine and nordic snow resorts as well as over 65 associate members whom mainly comprise of vendors that supply goods and services to snow resorts. As a membership-based, non-profit organization, OSRA is funded through membership fees, conferences and training activities. OSRA serves its members as a key information provider on best practices for snow resort owners and operators in Ontario. OSRA has actively been promoting environmental best practices to its membership since 2003 through the creation of the OSRA Environmental Best Practices Taskforce. OSRA oversaw the administration and promotion of the EIRP.

Association des stations de ski du Québec (ASSQ): The ASSQ is a non-profit organization that represents more than 75 Québec ski areas. Its mission is to promote downhill skiing and improve product quality and ski area performance. In addition to promoting snow sports, the ASSQ finances various ski school programs. The ASSQ oversaw the delivery of the pilot phase of the EIRP in Québec.

Canada West Ski Areas Association (CWSAA): The CWSAA is the non-profit representative body for the ski areas and heli and snowcat operations of British Columbia and Yukon, Alberta, Saskatchewan, and Manitoba. The CWSAA's mission is to develop, coordinate and vigorously promote superior programs that educate and enhance the well-being of the ski industry and its individual members. With a recently re-formed Environment Committee, the CWSAA disseminated information about the EIRP and several of its members were trained on how to deliver the EIRP.

Atlantic Ski Areas Association (ASAA): The ASAA is a non-profit organization that represents 10 ski areas in Atlantic Canada. As a partner of OSRA, the ASAA disseminated information about the EIRP to its members.
My Sustainable Canada (MSC): MSC is a national not-for-profit organization whose mission is to help Canadians have a positive impact on the environment and society by empowering them with the tools and means to become sustainable consumers of products and services. The OSRA Environmental Best Practices Task Force is chaired by MSC. MSC managed phase 1 and 2 of the EIRP, including preparing materials, communicating with all partners and producing this final report.

Green Communities Canada (GCA): The GCA is a national association of community-based non-profit organizations that deliver innovative practical environmental solutions to Canadian households and communities. GSA operates EcoDriver, a community-based social marketing program that is currently active in twelve Ontario communities. EcoDriver engages drivers in the promotion of three core behaviour changes: driving fuel efficiently, buying fuel efficiently and driving less. The GCA adapted and delivered the driver education and training curriculum for vehicle operators and managers of snow resort fleet (e.g. shuttle buses, trucks, vans, etc).

1.5 Funding Partners

The funding provided by Natural Resources Canada was leveraged for the purposes of securing additional support and resources towards the delivery of EIRP across Canada. Included below is a brief description of the funding partners that have been engaged to support the EIRP.

YMCA Eco-Internship Program **($45,150 cash contribution)**

The YMCA's Youth Eco Internship program is a national program, funded by the Government of Canada's Economic Action Plan, offering paid internship placements for youth ages 15-30 years. The EIRP was successful in securing three internships for 2009-2010 (i.e. 9 month placement and two 4 month placements), and two internships for 2010-2011 (i.e. two 4 month placements). The Interns helped deliver the EIRP across Ontario snow resorts and their duties included:

- Data collection and outreach activities at participating ski resorts across the Barrie, Collingwood and Hockley Valley areas;
- On-site outreach activities that encourage changes in driver behaviour from personal vehicles, motor coaches and school buses;
- Assist in the coordination of eco-driver training among drivers of ski resort fleet;
- Using on-board data logging devices, collected and analyzed post eco-driver training data on driver behaviour among light and medium duty vehicles at one Ontario snow resort during the 2010-2011 winter season;
- Assist in the writing of academic journal articles on the results of the Engine Idling Reduction Program and the Vehicle Monitoring Technology project; and,
- Write and edit communications, web materials, and newsletter content.

MITACS ACCELERATE – Graduate Research Internship Program **($7,500 cash contribution)**

MITACS ACCELERATE is a national internship program managed by MITACS Inc. which connects companies and other organizations with the vast research expertise in Canada's universities. MITACS brings over ten years of experience in successfully engaging the public, private and academic communities in joint research collaboration.

The EIRP was successful in securing a graduate student internship for 2009-2010 for an eight month, part-time placement for the research project, "Monitoring and Characterizing Driver Behaviour Among Ski Resort Fleet". Using on-board data logging devices, the Intern collected and analyzed baseline data on driver behaviour among 26 light and medium duty vehicles at three Ontario snow resorts during the 2009-2010 winter season.

Québec Ministry of Sustainable Development, Environment and Parks **($49,000 cash contribution)**

In 2011, the Québec Ministry of Sustainable Development, Environment and Parks provided the ASSQ with a $49,000 grant for the implementation of Phase 2 of its EIRP. The grant will help enable the ASSQ to extend the existing program to some twenty ski areas throughout Quebec and to produce educational tools.

2.0 Engine Idling Reduction Program Components

2.1 Learning Circle

The Learning Circle involved a series of discussions, demonstrations, and presentations through which the members of the Learning Circle share their knowledge and experience, learn new information and apply and test new skills. Its purpose is to serve as a support group for implementing the various EIRP components. The Learning Circle attracted ski industry members and program partners from across Canada and contributed to the creation of monitoring, measurement and communication tools as well as advised on eco-driver training. Members of the Learning Circle convened through face-to-face workshops, online discussion forums and teleconference calls.

Over the two phases of the EIRP, membership of participating snow resorts grew to over 50 snow resorts across Canada, including 35 in Ontario, 8 in Québec and 10 in Western Canada. EIRP delivery expertise is now firmly rooted amongst the three major ski resort associations in Canada (i.e. OSRA, ASSQ, and CWSAA). Listed below are key events/meetings that were convened through the Learning Circle and lead to the expanded membership in the EIRP.

- The Ontario Snow Resorts Association
  - January, 2010: "Develop an Idling Reduction Action Plan for your Snow Resort", face-to-face meetings held with snow resort operators at 12 resorts.
  - April, 2010: Delivered a presentation highlighting the EIRP and the snow resort fleet monitoring study to approximately 150 participants at the OSRA Annual General Meeting at Hockley Valley Resort.
  - September, 2010: Delivered a presentation highlighting the EIRP and the snow resort fleet monitoring study to approximately 40 participants at the OSRA Fall Education Week.

- Association des stations de ski du Québec
  - November, 2009: Delivered a web-based training session with members of the ASSQ on the "Develop an Idling Reduction Action Plan for your Snow Resort", guidebook.
  - November, 2009: Delivered a train the trainer session with the lead EIRP delivery agent for the ASSQ.
  - December, 2009: Documentation, signage and data collection templates were translated for use in Québec pilot project.
  - March, 2010: Debrief on results and lessons learned.

- Canada West Ski Areas Association
  - April, 2010: Conducted a web-based conference call with Adam Sherriff, chair of the Canada West Ski Areas Association Environment Committee. Discussed EIRP activities, outcomes and next steps. Adam Sherriff identified the monitoring of fuel consumption amongst snow resort fleet and snowcats to be of high interest for members of the Canada West Ski Areas Association.

- May, 2010: Delivered a 60 minute learning session on the results of the EIRP with members of the Canada West Ski Areas Association's Environment Committee. Discussed EIRP activities, outcomes and next steps. Identified potential partnership opportunities with the CWSAA including project ideas and funding sources.

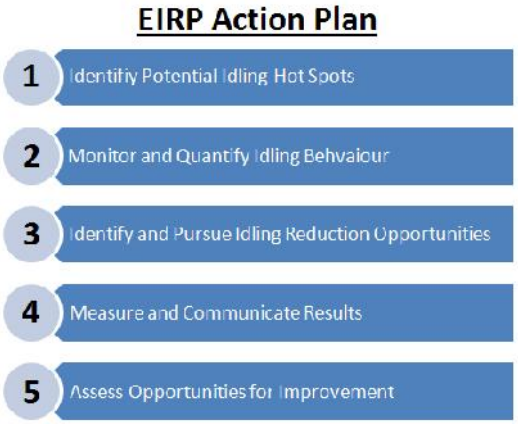
- Blue Mountain Resort Horseshoe Resort and Glen Eden Ski and Snowboard Centre Executive Teams
  - March, 2010: Delivered a 45 minute learning session on the results of the EIRP with members of the Horseshoe Resort senior management team.
  - May, 2010: Delivered a 2 hour pilot eco-driver training session to 10 members of the Blue Mountain Management Team. Solicited feedback for inclusion in future eco-driver training sessions.
  - June, 2010: Delivered seven learning sessions (30 to 60 minutes each) on the results of the EIRP with members of the Blue Mountain Resort senior management team.
  - July, 2010: Coordinated face-to-face meetings at Blue Mountain Resort to discuss the content and develop a training schedule for the eco-driver training sessions.
  - September 2010: Delivered a 45 minute learning session on the results of the EIRP with members of the Glen Eden Ski and Snowboard Centre senior management team.
  - February 2011: Seven face-to-face Blue Mountain Resort departmental meetings held updating the departments with the summarized data on eco-driving practices of resort staff over the first part of the 2011 winter season.
  - February 2011: Presentation delivered to the Executive Team at Blue Mountain Resort reporting on the progress of their drivers after the eco-driver training.

2.1.1 Learning Materials and Web Portal

Listed below are key EIRP learning materials that were created over 2009-2011:

- Engine Idling Reduction Action Plan: provides step-by-step guidance on how to develop an idling reduction action plan for 'your' snow resort. As illustrated in Figure 1, the engine idling reduction action plan is based on a five s process and the step-by-step guidebook on the "How to Develop an Engine Idling Reduction Action Plan for your Snow resort" can be found in Appendix A.
- Education video on "How to implement an engine idling reduction program": a five minute video that showcases how a snow resort can reduce unnecessary engine idling at its resort. The education video was widely promoted amongst OSRA members and easily accessible through the learning portal.

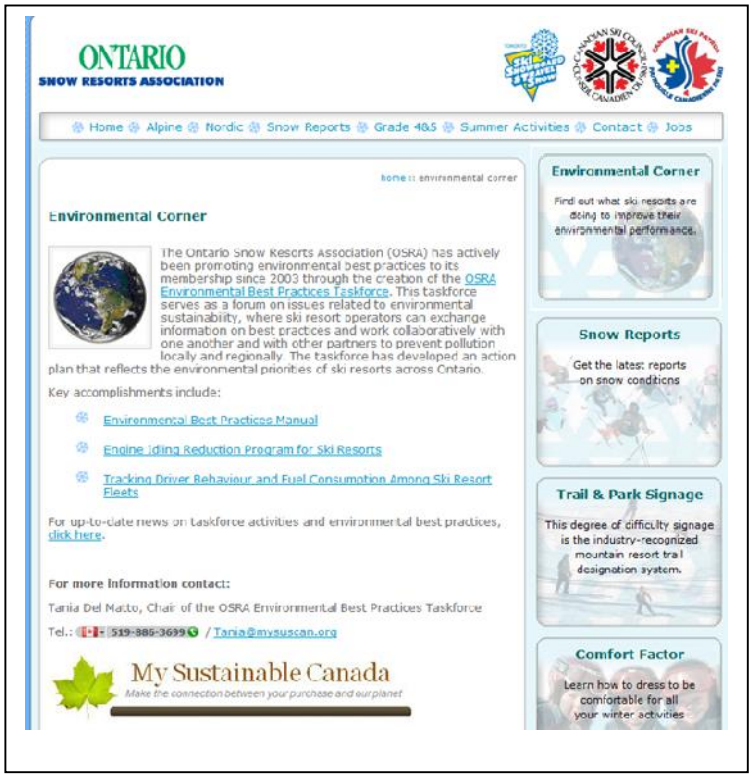
Figure 1: EIRP Five Step Action Plan



- Training video on “Eco-driving techniques at your snow resort”: a five minute video that showcases how drivers of snow resort vehicles can drive smarter, reduce emissions and save money. The training video was widely promoted amongst OSRA members and easily accessible through the learning portal.

The EIRP web portal supported the Learning Circle in a complementary way by: serving as a clearinghouse of information and research on reducing engine idling practices at resorts; compiling and sharing lessons learned from regional activities; and, linked to other stakeholder websites where possible. Figure 2 below is a screen capture of what the web portal looks like (http://www.skiontario.ca/envbestprac.asp).

Figure 2: Web Portal



2.1.2 Communicating to the OSRA Membership

Eight articles featuring aspects of the EIRP were published in the OSRA member newsletter over the course of the behaviour change campaign. The OSRA member newsletter is mailed to 215 members. Readership is at least twice that number as the newsletter gets forwarded among snow resort management and employees, reaching a circulation of over 500 readers.

2.1.3 Database of Stakeholders

A stakeholder outreach database was created containing 235 contacts. The database features 55 contacts from Ontario snow resorts; 131 Canadian snow resorts outside Ontario; 11 tourism related

associations; 26 community-based idling reduction groups and 12 motor coach companies as well as the Ontario Motor Coach Association.

The database (see Figure 3) was used over the second phase of the EIRP as a tool for reaching out to those stakeholders that have an interest in learning about EIRP results.

Figure 3: Database of Stakeholders

	Province	Organization	Organization Description	Website	Key Contact	Contact Phone	Contact E-mail
2	BC	Kicking Horse	snow resort	http://www.kickinghorseresort.com	Adam Sheriff	250-344-6018 (ext 224)	asherriff@kickinghorseresort.com
3	BC	Mt Baldy	snow resort	http://www.skibaldy.com	Andrew Simmonds	(250) 498 4089	andrews@skibaldy.com
4	NH	Marble Mtn	snow resort	http://www.skimarble.com/	Chris Beckett (GM)	603-637-2601, or 603-637-2601	chris@skimarble.com
5	QC	Mont Tremblant	snow resort	http://www.tremblant.ca/	Christine Tremblay	819 681 2000	ctremblay@intrawest.com
6	BC	Kimberely	snow resort	http://www.skikimberely.com	Crosbie Collier		ccollier200@aol.com
7	BC	Murray Ridge	snow resort	http://murrayridge.com/	Daniel Goff (GM)	250 993 8515	murrayridge@gmail.com
8	BC	Whistler/Blackcomb	snow resort	http://www.whistlerblackcomb.com	David Hennessey (fleet maintenance manager)		DHennessey@whistlerblackcomb.com
9	BC	Mt Washington	snow resort	http://www.mountwashington.ca/	Don Sharpe	250 334 5789	donsharpe@mountwashington.ca
10	BC	Panorama	snow resort	http://www.panoramaresort.com/	George Duncan (ops manager)		george.duncan@panoramaresort.com
11	QC	Centre de ski Belle Neige	snow resort	http://www.bellenoige.com/	Gilles Roger Vigeant	(819) 322 3311	gvigeant@bellenoige.com
12	NL	Sheny Mtn	snow resort	http://www.skisheny.com/	Heather Campbell Dewar	709 834 5477	info@skisheny.com
13	QC	Edelweiss (MSSI)	snow resort	http://www.mssi.ca/	Jean-Sebastien Sala (GM)	819.450.2328 #7117	jssala@mssi.ca
14	BC	Powder King	snow resort	http://www.powderking.com/	Jim Salisbury (owner/GM)	250 499 5902	jim@powderking.com
15	AB	Worsely Clear Hill Ski Area	snow resort	http://www.telusplanet.net/public/	Lily Peters (manager)		info@clearworsley.com
16	QC	Mont Orford	snow resort	http://www.orford.com/hiver_fr/ski	Marc Beaudoin	819 843 6548	mbeaudoin@orford.com
17	BC	Crystal Mtn	snow resort	http://www.crystalresort.com/	Mike Morin (GM)	250 760 4212	mike@crystalresort.com
18	BC	Silver Star	snow resort	http://www.skisilverstar.com/	Milli Cann	(250) 558-6070	mcann@skisilverstar.com
19	QC	Mont Sutton	snow resort	http://www.montsutton.com/en/	Nadya Baron	(450) 538-2535, poste 206	nbaron@montsutton.com
20	QC	Mont Ste Marie	snow resort	http://montstemarie.com/	Danielle Isabelle Godin	819 467 5900	
21	AB	Lake Louise	snow resort	http://www.skilouise.com/	Ron Allen		Ron.Allen@skilouise.com

Ski Industry | Tourism Industry | Anti-Idling Groups

2.1.4 Other Communication Activities

The EIRP sought to extend its network to interested stakeholders that operate in the broader tourism industry as well as practitioners/researchers that focus on transportation related issues. Listed below are events/networks in which the EIRP was featured:

- The Canadian Transportation Research Forum (CTRF) – a non-profit association of more than 300 transportation professionals with a mission to promote the development of research in transportation and related fields and provide a forum for networking and discussion. Every year, papers are presented at the annual conference representing research and experience from a wide range of industry, government and academic perspectives. CTRF publishes these papers in a Proceedings book for its members and other interested parties.
    - May, 2010: Delivered a 30 minute presentation highlighting the EIRP and the snow resort fleet monitoring study to approximately 45 participants at the CTRF Annual Conference in Toronto. The conference paper, "Analyzing Engine Idling Reduction Opportunities at Three Ontario Ski Resorts" was published within the conference proceedings and hard copies of the paper were distributed to 300 members of the CTRF.
    - May, 2011: Presented two papers featuring EIRP results, "The Effects of Weather on Vehicle Idling" and "Vehicle Monitoring Technology: Opportunities to Improve the Environmental and Economic Sustainability of Ski Resort Fleet" to a collective audience of approximately 75 CTRF participants and hard copies of the papers were distributed to 300 members of the CTRF.

- The Ontario Tourism Summit – an annual event for the Ontario tourism sector that brings together approximately 500 tourism organizations from across Ontario.
    - November, 2010: Participated in the Summit and distributed over 100 EIRP factsheets to participants. Approximately 25 contacts made at the Summit were added to the EIRP stakeholder database.

- The Ontario Motor Coach Association (OMCA) – is one of the largest travel and tourism-related associations in Canada and the voice of private sector bus operators, inter-city bus lines, charter and coach tour companies in Ontario. The OMCA has over 1100 members and represents more than 75 bus operators, over 100 tour operators and some 800 affiliated sellers to the group tour industry.
    - At the fall 2010 annual general meeting, a two page EIRP factsheet on idling reduction opportunities between snow resorts, bus companies and drivers and skiers and snowboarder was distributed to 75 attendees (see Appendix B).

- World Tourism Forum Lucerne – is a non-profit organization in the form of an association and serves as a global platform for leaders and young talents who are dedicated to designing new strategies and creating a shared vision for the future of tourism. World Tourism Forum Lucerne 2011 attracted more than 160 top managers, ministers and tourism experts from all continents.
    - April, 2011: The results of the EIRP were presented by Michelle Rutty, the EIRP graduate student intern. Michelle's paper was awarded third place in the Young Talent's Award.

2.2 Behaviour Change Campaign

The behaviour change campaign encourages changes in driver behaviour to reduce fuel consumption and emissions from personal vehicles, motor coaches, school buses and freight. As part of the campaign, participating snow resorts were provided with behaviour change campaign materials. Summarized in Table 2 below is a brief description of those materials and their estimated reach amongst visiting drivers of personal vehicles and buses as well as skiers and snowboarders.

Table 2: Estimated Reach of Behaviour Change Campaign Materials

Behaviour Change Campaign Material	Description	Quantity	Estimated Number of Individuals Reached
Idle Free Signage	These portable signs provided an effective visual reminder to resort visitors to turn off their engines at drop-off and pick-up areas.	250 signs installed at 36 Ontario snow resorts	Assume 36 snow resorts have 2,000,000 skier visits that arrive in 665,000 personal vehicles. Estimate 25% of drivers notice the signs, reaching **166,250 drivers annually.**
A-Frame Idle Free Zone Signs	Adhesive vinyl signs served to provide a	30 A-frame signs distributed across 12	Assume 12 snow resorts have 1,000,000 skier visits

	visual reminder to visitors to turn off their engines while waiting.	Ontario snow resorts	that arrive in 300,000 personal vehicles. Estimate 25% of drivers notice the signs, reaching **75,000 drivers annually.**
Go Idle Free Posters	These posters were displayed inside resort cafeterias.	150 posters displayed across 20 Ontario snow resorts	Assume each poster is noticed by 1,000 skiers and snowboarders, **reaching 150,000.**
Go Idle Free Helmet Stickers	These stickers were aimed to bring awareness of the go idle free message to a younger audience.	1,500 stickers given out to young skiers and snowboarders	Assume 5 additional people see the sticker, reaching **9,000 skiers and snowboarders.**
Go Idle Free Ice Scrapers	Served a practical purpose and provided a daily reminder to go idle free. They were handed out as rewards to visitors that turned off their engines marked idle free zones.	500 ice scrapers given out to snow resort guests	Assume 3 additional people see/use the icescraper, **reaching 2,000 skiers and snowboarders.**
Idle Free Information Cards for Bus Drivers		400 were given out at Blue Mountain Resort	**400 bus drivers**
Windshield Parking Passes	Given out to overnight guests at Blue Mountain Resort	50,000	**50,000 overnight guests**
Total estimated number of individuals reached by EIRP behaviour change campaign materials during 2009-2011:			**452,650 individuals**

2.3 Monitoring and Measurement Tools

Monitoring and measurement tools provide snow resort management and staff with the means to not only track the number of visiting drivers and their idling behaviours, but also identify opportunities that enhance the guest experience and increase operational efficiency where vehicles flow in and out of drop-off/pick-up areas.

2.3.1 Quantifying Idling Behaviour through Observation Techniques

Two full-time data collection Interns monitored the impact of the behaviour change campaign at idle-free zones across participating Ontario snow resorts over the 2009-2010 ski season. The monitoring activities at participating snow resorts involved data collectors observing a reasonable

sample of vehicles from each vehicle category (see Table 3 below) and recording: (1) the potential idling time per idle-free zone and (2) the total number of vehicles that did or did not idle during pre-launch and post-launch phases of the behaviour change campaign. The resulting data (1) and (2) was used to estimate the quantity of greenhouse gas emissions based on the following equations:

Average Potential Idling Time × Total Observed Vehicles Idling = Total Estimated Idling Time

Total Estimated Idling Time × GHG Emissions per Minute Idling = Total Estimated GHG Emissions (kg CO2)

Due to the varying sizes of engines and fuel types, a different rate of greenhouse gas emissions per minute idling was used for each vehicle type as outlined in Table 3 below.

Table 3: Greenhouse Gas Emissions per Minute of Idling by Vehicle Type

Greenhouse Gas Emissions per Minute of Idling by Vehicle Type			
Vehicle Category	**Fuel Consumed per Minute Idling**	**GHG Emission factor**	**GHG Emissions per Minute Idling**
Personal vehicles	0.0300L gas/minute	2.289 kg CO_2/L gas	0.0687 kg CO_2/minute
School Buses	0.0533L diesel/minute	2.663 kg CO_2/L diesel	0.1420 kg CO_2/minute
Motor Coaches and Freight	0.0667L diesel/minute	2.8 kg CO_2/L diesel	0.1868 kg CO_2/minute

*Environment Canada, National Inventory Report 1990-2007, Table A12-11, April 2009

When collecting the data, weather conditions and temperature were recorded to allow a comparison between pre-launch and post-launch data. Where significant differences in climate exist, these differences were factored into the data analysis when comparing the number of vehicles that did or did not idle during pre-launch and post-launch.

2.3.2 Vehicle Monitoring Technology

Vehicle Monitoring Technology (VMT) was used in the EIRP to assess driver behaviour, fuel use and greenhouse gas emissions among snow resort fleet. As part of a three step process outlined in Figure 4 below, this initiative pioneered the use of vehicle monitoring technology in snow resort fleet. The collected data was used to inform the eco-driver training curriculum and to identify opportunities to improve fuel efficiency and thereby reduce the emissions associated with the operating fleets of snow resort vehicles.

Figure 4: Timeline for Assessing Driver Behaviour

Eco-driver training can reduce fuel consumption between 5% and 25% over the short-term (less than one year) and between 4% and 8% over the long-term (more than one year) (Natural Resources Canada, 2008; Beusen et al., 2009). When this training is partnered with VMT, there is greater driver awareness about the economic and environmental impacts of driving behaviour. VMT provides continual feedback to drivers and reinforces lessons learned from eco-driver training on a continual basis to maximize positive driver behaviour change.

The VMT selected for use in the EIRP was the CarChip®. As shown in Figure 5, the CarChip is an on-board data logger that plugs into a vehicle's existing on-board diagnostic input and records all trips for the vehicle.

Figure 5: CarChip

2.3.4 Program Calculator and Scenario Builder

(a) EIRP Calculator and Scenario Builder – For Guests Arriving in Personal Vehicles, School Buses and Motor Coaches

This tool assists a resort in quantifying and reporting on the amount of greenhouse gas emissions associated with unnecessary idling from guests that arrive at snow resorts in personal vehicles, school buses and motor coaches. Using observational data from 18 snow resort sites in Ontario, the tool was created using Microsoft Excel.

As shown in Figure 6, four pieces of information are initially required by the user of the tool: number of skier visits per season and the percentage of those skier visits arriving in personal vehicles, school buses and motor coaches. Based on the information entered, the calculator arrives at a baseline estimate of how many kilograms of carbon dioxide emissions are generated per winter season from vehicles and buses that unnecessarily idle their engines. This baseline estimate is arrived at through a series of assumptions (listed in Table 4) generated from the observational data acquired at 18 snow resort sites in Ontario.

Figure 6: Screen Capture of the EIRP Calculator and Scenario Builder - for Guests Arriving in Personal Vehicles, School Buses and Motor Coaches

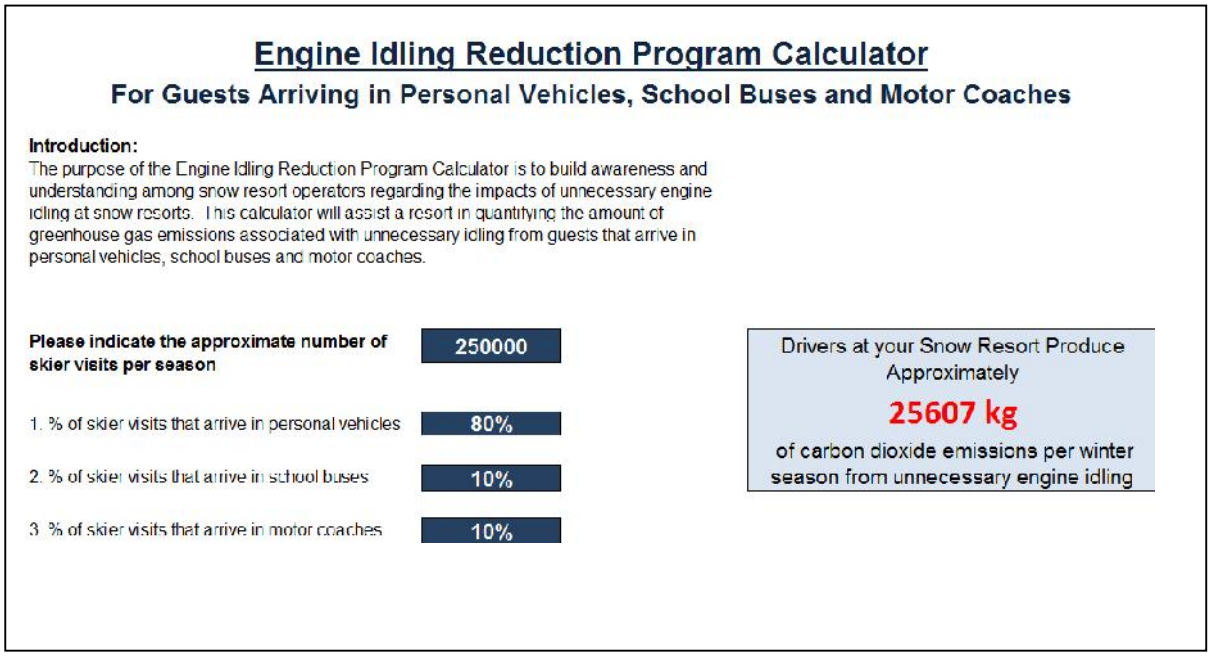
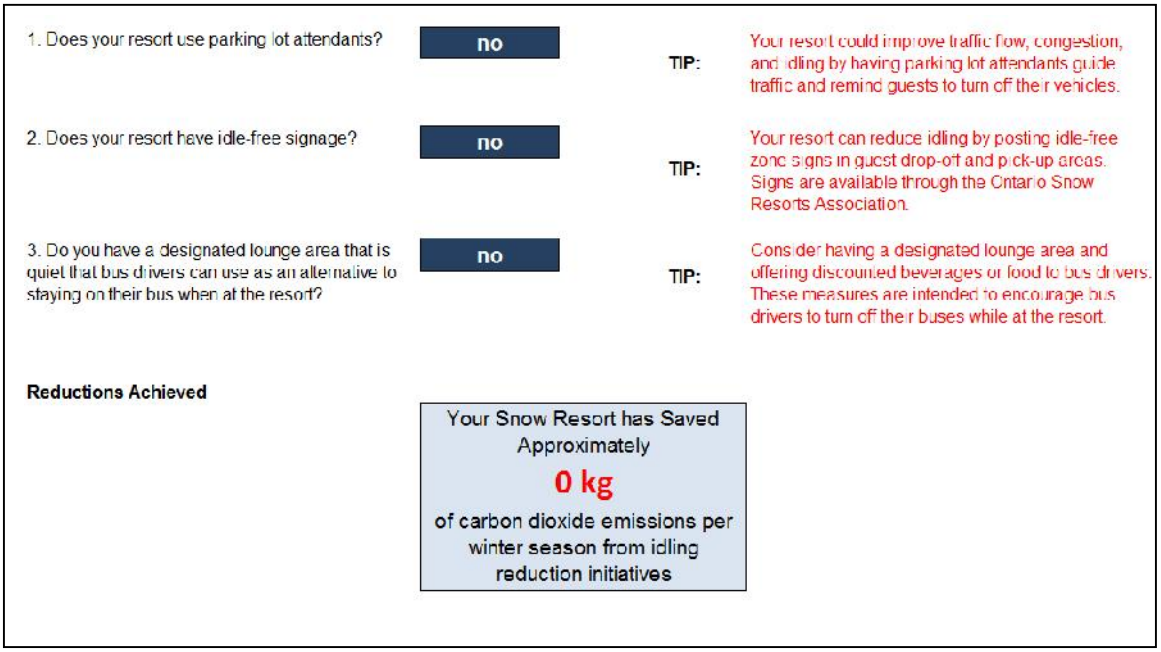


Table 4: Assumptions for EIRP Calculator and Scenario Builder for Guests Arriving in Personal Vehicles, School Buses and Motor Coaches

3 people per personal vehicle **25%** of guests arriving in personal vehicles use the drop-off and pick-up zone and of those guests that use the drop-off and pick-up zones, **55%** of personal vehicles idle on average **9** minutes (4.5 minutes at both pick-up and drop-off) **75%** of guests arriving in personal vehicles use the parking lots and don't idle once parked however idle for 4.5 minutes at the end of the day when preparing to leave the resort **0.0687** kilograms of carbon dioxide are generated per minute a vehicle idles **30** people per bus or motor coach **60%** of school buses and motor coaches idle **0.14** kilograms of carbon dioxide are generated per minute a school bus or motor coach idles School buses and motor coaches idle for **70** minutes (45 minutes at drop-off and 25 minutes at pick-up)

Once the baseline estimate is arrived at, the user is then lead through a series of scenarios where a resort can reduce emissions from unnecessary engine idling. The following questions are asked with yes/no responses: Does your resort use parking lot attendants? Does your resort have idle-free signage? Do you have a designated lounge area that is quiet that bus drivers can use as an alternative to staying on their bus when at the resort? In Figure 7 below, the screen capture illustrates what content is displayed when the user answers no to all three questions. The content displayed is a series of tips on how the resort can use parking lot attendants, idle-free signage and designated lounge areas for bus drivers as ways to improve operational efficiencies, thereby reducing emissions from unnecessary engine idling.

Figure 7: Screen Capture of Scenarios When Answered "No"



In Figure 8 below, the screen capture illustrates what content is displayed when the user answers "yes" to all three questions. The calculator arrives at these estimates based on a set of assumptions (see Table 5) generated from the observational data acquired at 18 snow resort sites in Ontario.

Figure 8: Screen Capture of Scenarios When Answered "Yes"

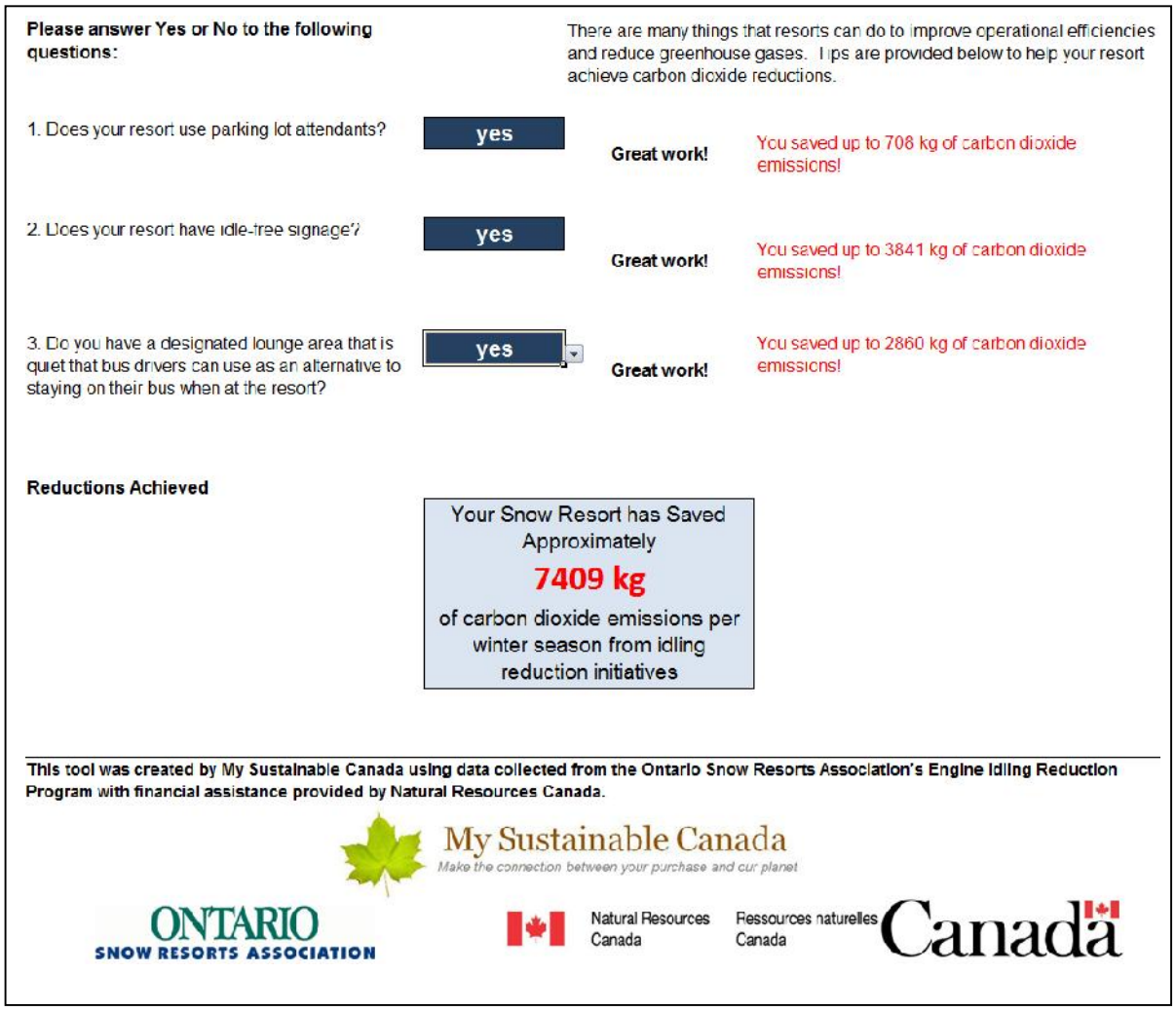


Table 5: Assumptions for EIRP Behaviour Change Initiatives

Parking lot attendants in drop-off zones reduce incidences of idling in personal vehicles by **15%**.
Idle-free signage reduces incidences of idling by **15%**.
Having a designated lounge area for bus drivers and discounted beverages or food as incentives for school bus and motor coach drivers to turn off their vehicles, reduces incidences of idling by **25%**.

(b) Engine Idling Reduction Program Calculator – For Snow Resort Fleet

The purpose of this EIRP tool is to build awareness and understanding among snow resort operators regarding the impacts of unnecessary engine idling at snow resorts. This tool assists a resort in quantifying and reporting the amount of greenhouse gas emissions associated with driving snow resort fleet vehicles.

Using data collected from the vehicle monitoring technology research projects at three snow resorts, a customizable scenario builder and carbon dioxide emissions calculator was created using Microsoft Excel. This section of the report demonstrates how the tool works on a step-by-step basis using screen captures of the customizable scenario builder and carbon dioxide emissions calculator.

As shown in Figure 9, nine pieces of information are initially required by the user of the tool. Eight of the questions are related to the number and type of vehicles the snow resort has within its fleet as well as the number of kilometres driven in a season. The ninth question asks for the current price of fuel per litre. Based on the information entered, the calculator arrives at a baseline estimate of how many kilograms of carbon dioxide emissions are generated per season from fleet vehicle use as well as arriving at an estimate cost for fuel spent in a season. This baseline estimate is arrived at through a series of assumptions listed in Table 6 and from data collected from the vehicle monitoring technology research projects that were carried out at three snow resorts.

Figure 9: Screen Capture of the EIRP Calculator and Scenario Builder - For Snow Resort Fleet

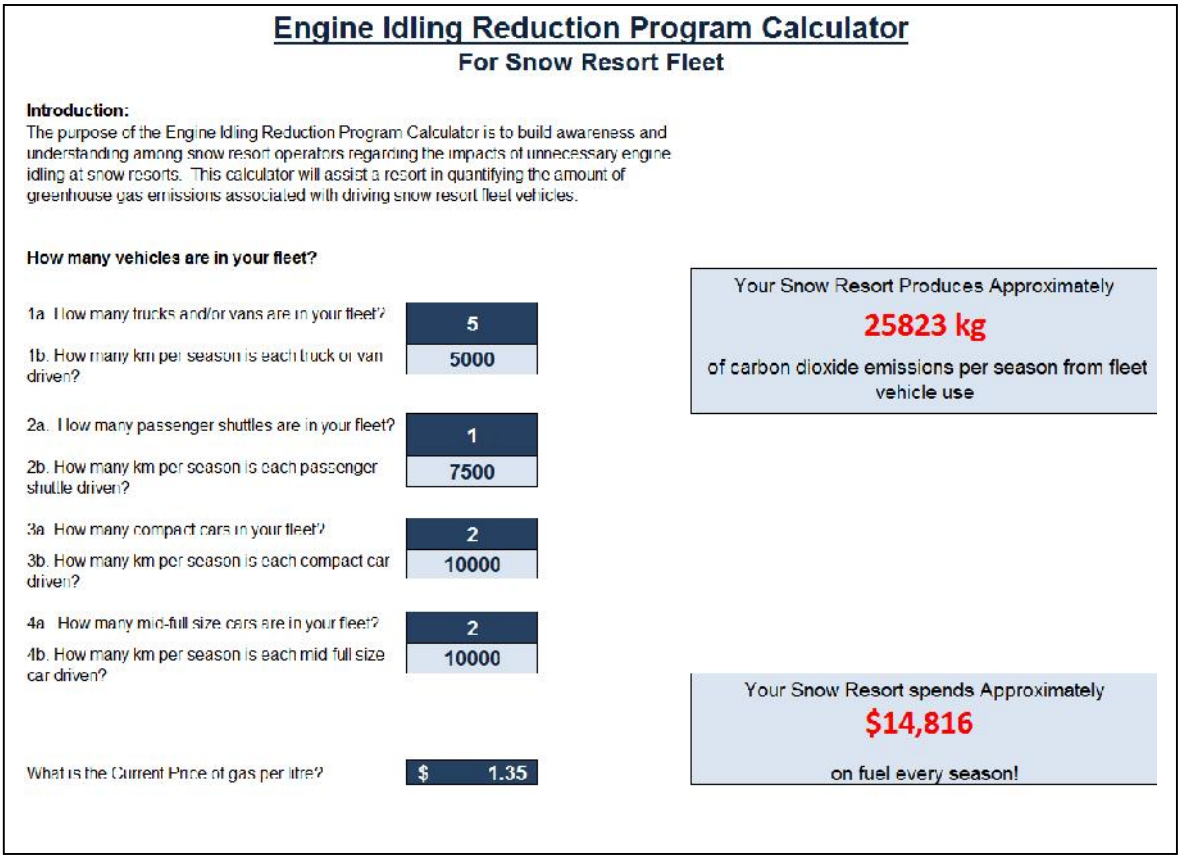
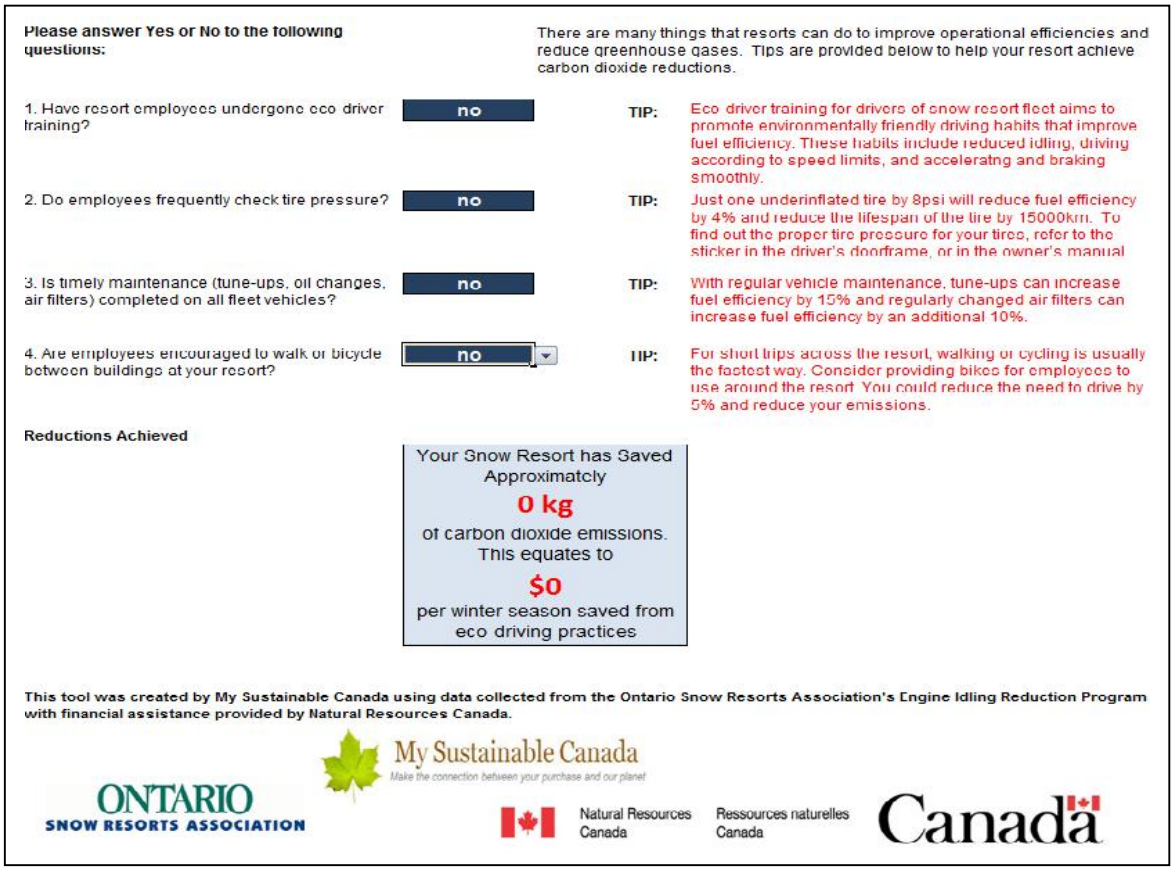


Table 6: Assumptions for EIRP Calculator for Snow Resort Fleet

Trucks/Vans use 18 litres of fuel per 100km
Passenger Shuttles use 25 litres of fuel per 100km
Mid to full-size cars use 15 litres of fuel per 100 km
Compact cars use 8 litres of fuel per 100 km

Once the baseline estimate is arrived at, the user is then lead through a series of follow-up questions targeted at ways in which a resort can reduce emissions through eco-driving practices. The following questions are asked with yes/no responses: Have resort employees undergone eco-driver training? Do employees frequently check tire pressure? Is timely maintenance (tune-ups, oil changes, air filters) completed on all fleet vehicles? Are employees encouraged to walk or bicycle between buildings at your resort? In Figure 10 below, the screen capture illustrates what content is displayed when the user answers "no" to all four questions. The content displayed is a series of tips related to eco-driver techniques as well as routine maintenance and encouraging more active forms of transportation where possible.

Figure 10: Screen Capture of Scenarios When Answered "No"



In Figure 11 below, the screen capture illustrates what content is displayed when the user answers "yes" to all four follow-up questions. The content displayed are estimates of the emission reductions achieved. The calculator arrives at these estimates based on a set of assumptions listed below in Table 7 and from data collected from the vehicle monitoring technology research projects that were carried out at three snow resorts.

Figure 11: Screen Capture of Scenarios When Answered "Yes"

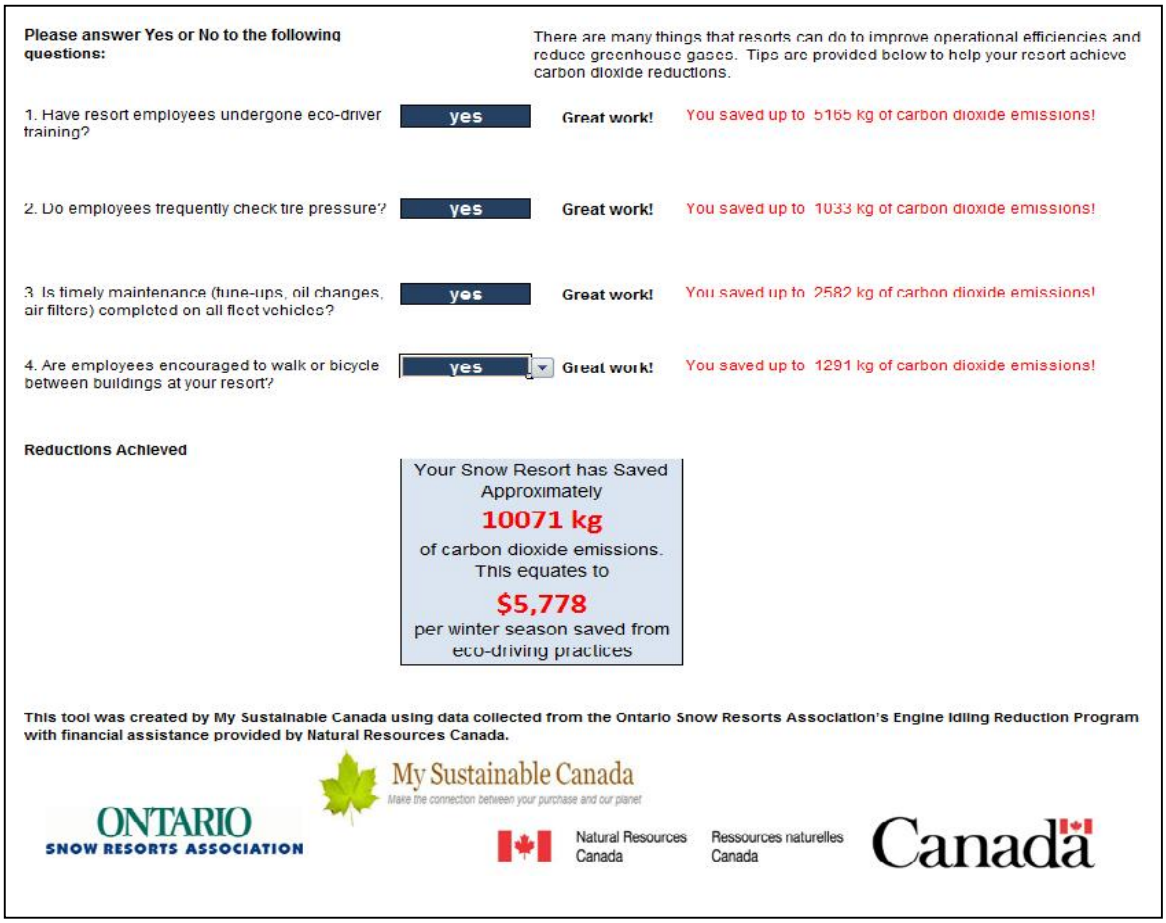


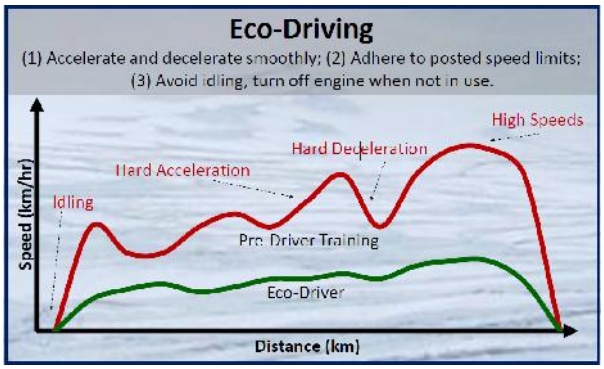
Table 7: Assumptions for EIRP Calculator for Eco-driver Practices

Eco-driver training: 20% reduction in fuel consumption. Properly inflated tires reduce fuel consumption by 4%. Timely maintenance reduces fuel consumption by 10%. Using bikes or walking on resort saves approximately 5% in fuel consumption.

2.4 Driver Education and Training

Reducing fuel consumption by educating drivers on how to change their driving behaviour has great potential to be a cost-efficient approach to reducing energy use, improving the quality of the local environment and lowering fuel costs. Ecological, economical and safe driving (eco-driving) is a relatively new concept which was first developed and integrated into driver training courses by the German Federation of Driving Instructor Associations in the mid-1990s (Dandrea 1996). As illustrated in Figure 12, there are three key facets that govern eco-driving:

Figure 12: Eco-Driving



(1) Smooth and gradual acceleration and deceleration. Driving based on sudden acceleration/deceleration uses approximately 33-40% more fuel (Ericsson 2001, NRCan 2009a, Saboohi & Farzaneh 2009, Thew 2007).

(2) Maintaining a steady speed by anticipating traffic flow while adhering to the posted speed limits. While each vehicle reaches its optimal fuel economy at different speeds, fuel efficiency decreases 10-23% at speeds above 90 kilometers per hour (NRCan 2009a, West et al. 1999).

(3) Avoid idling by turning off the engine when not in use. Idling is the most inefficient use of fuel at zero kilometers per liter of fuel. More than 10 seconds of idling consumes more fuel than would have been used if the engine was turned off and restarted (NRCan 2009b).

Although there are very limited studies that have evaluated eco-trained drivers, the results are promising. A literature review for the European Conference of Ministers of Transport by the International Energy Agency (2005) found an average estimated reduction of fuel consumption of 5% for OECD (Organization for Economic Cooperation and Development) regions. Since then, additional studies have recorded 2% decrease in fuel consumption 12 months after corporate bus drivers were trained (Wahlberg 2007). Zarkadoula et al. (2007) noted a decrease of 18% for two bus drivers and an average decrease of 10% for all bus drivers during a post-training monitoring period of two months. Beusen et al. (2009) stated average fuel consumption four months after the course fell 5%, with most drivers showing an immediate improvement in fuel consumption. This is also the only known study that details the influence of eco-driver training on idling, which realized an average decrease of 1.5%.

The EIRP provided training on eco-efficient driving practices to two core audiences: visiting motor coach drivers and vehicle operators of snow resort fleet (i.e. shuttle buses, trucks, vans, etc). A description of both types of training is summarized in the sections below.

2.4.1 SmartDriver Workshop for Bus Drivers

Charter motor coaches and school buses are a popular means of transportation for groups travelling to and from snow resorts in Ontario. They provide a valuable service by reducing the number of personal vehicles travelling to snow resorts, thereby reducing vehicle emissions as well as reducing stress on limited parking availability at resorts. However, the issue of unnecessary engine idling and resulting emissions has been of growing concern at Ontario snow resorts.

The SmartDriver for Motor Coach program offered by Natural Resource Canada's FleetSmart provides training to bus drivers such that they can incorporate behaviours that reduce fuel consumption significantly. The training addresses the importance of fuel-efficient driving, factors affecting fuel-efficiency, effects of vehicle emissions on health, vehicle maintenance and inspection, and smart driving techniques. Promotion of the SmartDriver for Motor Coach program began in November, 2009 to motor coach companies that transport guests to Ontario snow resorts.

Traditionally this form of training is conducted over an entire day (i.e. Four 2-hour training modules) and requires that drivers be taken off the road for that day to receive the training and in some cases this presents challenges for motor coach companies. The EIRP presented a unique opportunity for snow resorts to host workshops while motor coach drivers are on-site thus eliminating the need to take drivers off the road.

The following motor coach companies were contacted and sent invitation letters:

Great Canadian Holidays and Coaches (http://www.bigbluecoach.com/)
First Student Canada (http://www.firstbuscanada.com/index.php)
Coach Canada (http://www.coachcanada.com/coachcanada/language.asp)
Denny's Bus Lines (http://www.dennysbuslines.ca/)
Elliott Coach Lines (http://www.elliottcoach.com/)
Kunkel Bus Lines(http://www.kunkelbuslines.com/)
AYR Coachlines (http://www.ayrcoach.com/)
Pacific Western (http://www.pwt.ca/)

The EIRP was able to successfully coordinate SmartDriver training for 9 motor coach drivers from Pacific Western on the weekend of January 23rd/24th, 2010 (see Figure 13). In order to accommodate the short time period that drivers have on-site at the resort, the training modules needed to be condensed to 1 hour each from 2 hours each. Module 1 (Setting the stage) and Module 2 (Four key factors affecting fuel efficiency) were delivered on day one over a 2 hour period. Module 3 (Vehicle care and inspections) and Module 4 (Smart driving techniques) were

Figure 13: SmartDriver Workshop for Bus Drivers

delivered on day two for a 2 hour period. Drivers received certificates for completing the training.

Future opportunities exist to host SmartDriver training for Motor Coaches at Mount St. Louis Moonstone and Horseshoe Resort.

2.4.2 EcoDriver Training for Snow Resorts

Developed by Green Communities Canada, *EcoDriver* aims to promote environmentally friendly driving habits that reduce fuel consumption and carbon dioxide emissions. These habits include improvements to vehicle maintenance and operation, selection of a fuel-efficient vehicle, consideration of alternatives to driving and avoidance of unnecessary driving.

In December 2009, discussions began with Green Communities Canada on the development and planning of the eco-driver training course for snow resorts. On the development side, the eco-driver training curriculum needed to be tailored to the specific needs of three distinct audiences:

1. Fleet drivers: focus on driving techniques, trip planning, 'right sizing';
2. Managers: focus on driving techniques, maintenance, purchasing/vehicle replacement; and,
3. Executives: similar to managers, plus the business case for eco-driving.

The process involved with customizing the curriculum by developing scenarios and examples specific to the operating environment of snow resorts and included the following topics:

- Trip planning
- Right sizing (i.e. use the size of vehicle that fulfills the travel/hauling requirements and shifting to the use of smaller vehicles)
- Purchasing/vehicle replacement
- Vehicle maintenance
- Smarter driving style: accelerate gently, follow speed limits, anticipate traffic flow, coast to decelerate
- Reducing unnecessary idling
- Reducing warm-up times
- On-resort bicycles for staff during warmer months
- Carpooling
- Building partnerships with bus companies to reduce unnecessary idling
- Encouraging guests to travel by bus thereby reducing demand to expand resort parking lots

Seven training sessions took place over April-May, 2010 and September-December, 2010. The first two eco-driver training sessions for snow resorts took place in front of a broader audience of management and staff at both the Ontario Snow Resorts Association's Annual General Meeting at Hockley Valley Resort and the 2010 Fall Education Week at Blue Mountain Resort.

Figure 14: In-class component of eco-driver training

Five eco-driver training sessions were 2 hours in length and trained approximately 15-25 vehicle operators per session with the first session being piloted with senior managers. In addition to customizing the curriculum, a more intensive, hands-on training component was developed in order to facilitate hands-on learning and piloted in these four sessions. In-vehicle technologies were used as part of the "in-vehicle" training to help drivers experience the immediate impact of instituting changes to their driving habits and observe how these changes will result in meaningful reductions in fuel consumption. For example, in a group of 20 workshop participants, six vehicles were made available for use as part of the "in-vehicle" training. Half of these vehicles were outfitted with scan gauges and the other half were outfitted with CarChips®. Workshop participants were arranged in groups of 3 to 4 people and half of the participants were directed to the vehicles with the scan gauges and the other half to the vehicles with the CarChips®. Participants that started with the vehicles outfitted with the scan gauges were directed to drive as they would normally around the resort via an assigned route. Once the route was completed, they were then asked to drive in what they believe / know to be fuel efficient driving. During these exercises, one of the participants is asked to note the results of the scan gauge throughout both trips (i.e. fuel efficiency and consumption). The CarChips® within the other vehicles were programmed to "beep" when a hard brake or hard acceleration took place. Participants that started in these vehicles were asked to perform hard braking and hard acceleration in order experience what these felt like. Once participants completed the one in-vehicle exercise they were then asked to rotate with the other group and perform the second exercise. In between exercises, participants were given tire pressure gauges and asked to use them on the vehicles (see Figure 15). They were then asked how to determine the appropriate tire pressure for the vehicle.

Figure 15: Hands-on component of eco-driver training, pictured here checking tire pressure.

An instructional video was filmed in March, 2011 on eco-driver techniques for snow resorts for the purpose of sustaining the training over the long-term and was shown to an audience of over 100 participants at the 2011 OSRA Spring Annual General Meeting.

3.0 Program Results: Personal Vehicles and Buses

The EIRP for personal vehicles and buses promotes idle-free behaviour at snow resorts. Key program activities include data collection (before and after a behaviour change intervention), mapping of vehicle traffic flow, behaviour change intervention, and the promotion and communication of results. The EIRP provides an opportunity for snow resorts to help:

- Reduce greenhouse gas emissions that contribute to climate change
- Improve air quality in immediate and surrounding areas
- Reduce noise pollution and improve guest experiences
- Increase operational efficiency across the resort

3.1 Data collection Sample Size and Observed Idling Behaviours

Over the month of January (2010), the data collection team identified the average potential idling time for personal vehicles and buses per drop-off/pick-up area, as well as the total number of engines that did or did not idle. The team returned in February (2010) to encourage and measure changes in idling behaviour. Table 8 below summarizes the sample size of vehicles observed.

Table 8: Sample Size of Vehicles Observed

Snow resort	Number of Personal Vehicles Observed	Number of Motor Coaches / School Buses Observed
Alpine Ski Club	363	None observed
Beaver Valley Ski Club	467	23
Blue Mountain Resort Ltd.	411	106
Craigleith Ski Club	154	None observed
Devil's Glen	72	None observed
Georgian Peaks	235	None observed
Highlands Nordic	None observed	22
Hockley Valley Resort	73	42
Horseshoe Resort	455	56
Mansfield Ski Club	None observed	7
Mount. St. Louis Moonstone	136	65
Osler Bluff Ski Club	264	6
Total:	2,630	327

Observed Idling Behaviours:

Over the duration of the 2010 winter season, the following were idling behaviours commonly observed across snow resorts:

- Families with young children were observed taking longer to unload and load their vehicles, leading to increased potential for prolonged idling.
- During peak periods of the day the guest drop-off and pick-up areas become heavily congested, leaving the drivers to feel pressured to quickly vacate the areas. In these circumstances, many drivers were observed leaving their cars idling suggesting a perceived "quick getaway". When drivers perceive to have more time, they are less likely to leave their engines running.
- When guest drop-off/pick-up areas reach capacity, many personal vehicles were observed idling while waiting to use these areas.
- In areas where the larger A-Frame Idle-Free signs were used, there was noticeably less unnecessary idling.
- It is common practice for bus drivers to leave their engine running periodically throughout the day while their passengers are on the ski hill. This allows the vehicle interior to remain powered and heated for the comfort of both the drivers, many of whom remain in their buses throughout the day, and the returning passengers.

3.2 Impact of Unnecessary Idling on GHG Emissions

3.2.1 Impact of Personal Vehicles

In the 2010 season, before any behavioural intervention from the EIRP, we found that an average of 58% of personal vehicles at observed Ontario snow resorts were idling unnecessarily (in excess of 60 seconds). The average vehicle was observed idling for over 4 minutes, resulting in approximately 29.5 kilograms of unnecessary carbon dioxide being emitted per 100 vehicles on average. Over the course of an entire season at all snow resorts in Ontario, these figures become quite significant. For instance, assuming that 3 million skier visits arrive by personal vehicle (3 skier visits per vehicle), then over 200,000 kilograms of carbon dioxide is generated per winter season from unnecessary engine idling in drop-off and pick-up zones at snow resorts.

3.2.2 Impact of Motor Coaches and School Buses

Charter motor coaches and school buses are popular means of transportation for groups travelling to and from snow resorts. They provide a valuable service by reducing the number of personal vehicles travelling to snow resorts, thereby reducing vehicle emissions as well as reducing stress on

limited parking availability at resorts. However, the issue of unnecessary engine idling and resulting emissions has been growing concern at snow resorts.

In general, newer buses require less idling time than older buses. For example, it has been found that 10 minutes of idling prior to departure in cold weather is sufficient for most new motor coaches (Natural Resources Canada, 2005: Smart Driver for Motor Coach Handbook).

Before any behavioural intervention from the EIRP, we found that an average of 60% of buses at observed Ontario snow resorts were idling their engines unnecessarily (in excess of 10 minutes). The average bus was observed idling for a total of 70 minutes on average (45 minutes when dropping-off guests and 25 minutes when picking up guests), resulting in approximately 350 kilograms of unnecessary carbon dioxide being emitted per 100 buses on average. Assuming that half a million skier visits arrive by bus (30 skier visits/bus), then over 110,000 kilograms of carbon dioxide is generated per winter season unnecessary engine idling from school buses and motor coaches.

3.3 Behaviour Change Campaign Findings

The 18 Ontario snow resorts that actively participated in the EIRP attract approximately 2 million skier visits to their resorts annually during the winter season. These guests arrive in personal vehicles and buses and collectively generate approximately 205,000 kilograms of carbon dioxide emissions per winter season from unnecessary engine idling. By implementing the EIRP at these snow resorts over the 2010 winter season, the EIRP collectively reduced these emissions by 59,000 kilograms or 29%. Summarized below are the top three initiatives that have contributed to these reductions.

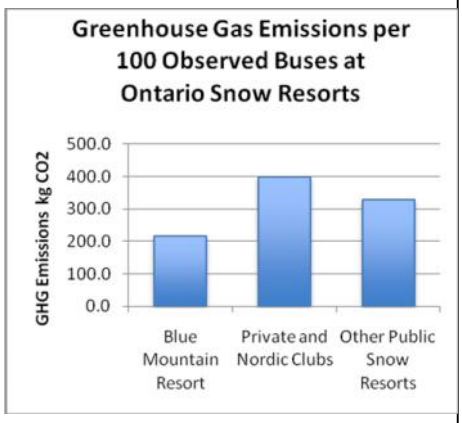
(1) Idle-Free Signage: Resorts that posted idle-free signs in highly visible locations within guest drop-off and pick-up areas were observed to have reduced incidences of idling by 15%, which equates to a reduction in carbon dioxide emissions of 30,729 kilograms.

(2) Parking Lot Attendants: Resorts with parking lot attendants can improve traffic flow, congestion and reduce idling by 15%. Such results were observed when parking lot attendants guide traffic and remind guests to turn off their vehicles when parked in drop-off and pick-up areas. This equates to a reduction in carbon dioxide emissions of 5,668 kilograms.

(3) Designated Resting Areas for Bus Drivers: Snow resorts can offer incentives to bus drivers to get them out of their buses and inside the resort, thereby reducing the need for periodic idling throughout the day. Blue Mountain Resort, for example, has had great success in doing this by offering bus drivers free shuttle rides from their buses to the Blue Mountain Inn, where drivers can spend the day in a lounge. Drivers are also given free coffee or tea vouchers and discount meal coupons. As a result of these efforts, Blue Mountain Resort has seen a decrease in the

incidences of idling of 40% compared to other observed Ontario snow resorts that offered no incentives for bus drivers to turn off their vehicles (see Figure 16). Overall the benefit to the environment equates to a savings of 130 kg of carbon dioxide per 100 observed buses.

Figure 16: Greenhouse Gas Emissions per 100 Observed Buses at Ontario Snow Resorts



4.0 Program Results: Snow Resort Fleet

4.1 Background

The goal of this component of the EIRP was to quantify and pursue opportunities to reduce CO_2 emissions that are generated by the operation of a snow resort fleet in Ontario. Using in-vehicle engine monitoring technology, baseline data was acquired on driving behaviour and engine idling. The data was then used to assess opportunities for increased fuel efficiency and emissions reductions and helped inform the development and delivery of eco-driver training for snow resort fleet drivers.

The objectives of this snow resort fleet component of the EIRP are as follows:

1. Acquire baseline data on the following driver behaviour parameters: trip duration, frequency and distance; hard acceleration and deceleration events; speed; idling time; fuel consumption; and CO_2 emissions;
2. Monitor and quantify driver behaviour in fleet vehicles that perform a range of duties across a snow resort. Departments examined included: passenger shuttles, security, grounds and maintenance, food and beverage, and mail delivery;
3. Based on the results of the aforementioned points, assess opportunities (by department) to reduce climate altering CO_2 emissions that result from the operation of a snow resort fleet;
4. Integrate the findings into eco-driver training curriculum; and,
5. Assess and measure the behavioural changes resulting from eco-driver training.

4.2 Data Collection Method and Timeline

In December 2009, 22 on-board data loggers (CarChip®) were programmed and installed into 14 light and medium class fleet vehicles at Blue Mountain Resorts Limited (BMR), three at Glen Eden Ski and Snowboard Centre and five at Horseshoe Valley Resort. Information on each vehicle was recorded, including vehicle year, manufacturer and model, as well as the engine size and fuel type (unleaded/diesel). Three identification numbers were associated with each vehicle, including an identification number randomly assigned to each vehicle by the CarChip® program (used to maintain driver anonymity when presenting results to resort staff), the vehicle's manufacturer identification number (VIN), as well as a number assigned by each resort. A vehicle master list, complete with relevant vehicle information and identification numbers is provided, by resort, in the Appendix C.

Figure 17: Installing the CarChip

The CarChips® were installed by plugging them into the On-board Diagnostic (OBD) port found under the dashboard out of sight of the driver (see Figure 17). Once installed the CarChips® read and stored all the data from the vehicle's on-board computers, continuously recording driving and engine performance. Recorded parameters included the number of daily trips taken, average and total daily trip times, average and total trip distance, average trip speed, top trip speed, and the total number of accelerations and decelerations per trip. The CarChips® were removed from each vehicle bi-weekly and the data was downloaded using a USB cable attached to a laptop. The CarChips® were then cleared and reinstalled into the corresponding vehicles to continue data logging. The DriveRight Fleet Management Software Package, was used in conjunction with Microsoft Excel, to store, view, analyze and calculate the data at varying degrees of detail. A complete list of assumptions and calculations can be found in the Appendix D. This process was repeated during the 2010-2011 winter season, and 15 CarChips were placed in 15 vehicles at BMR. Due to resource constraints, the process was not repeated at Glen Eden Ski and Snowboard Centre and Horseshoe Valley Resort.

4.3 Data Parameters

Once installed, the CarChip®, continuously reads the driving and engine performance data from the vehicle's on-board computer and stores the data on an internal memory card. Selected parameters were recorded based on their relevance to environmental performance and fuel consumption. Table 9 presents an overview of the parameters, their units, and a description including how the parameter was calculated.

Table 9: Variables Monitored and Calculated

Parameter	Description
Number of Trips	A trip is defined as the period between when the vehicles' ignition is turned on, to when it is turned off – regardless of the distance travelled.
Drive Time (hours)	Total time the vehicle is driven.
Distance Driven (km)	Total distance travelled.
Average Trip Distance (km)	Average distanced travelled in one trip.
Average Speed (km/h)	The average speed the vehicle travelled.
Average Top Speed (km/h)	An average of the highest speed the vehicle reached in each trip.
Hard Acceleration Count	Number of times the vehicle performs a speed difference of ≥30km/h in ≤2.8 seconds.
Hard Deceleration Count	Number of times the vehicle performs a speed difference of ≥30km/h in ≤2.4 seconds.

Idling	When the vehicle engine is turned on, but not moving (speed = 0 km/h), this includes all time spent stopped at traffic intersections.
Idling Time (hours)	Total amount of time the vehicle is idling.
Percentage of Idling Time (%)	Percentage of time vehicle is idling.
CO_2 Emissions from Idling (kg)	Kilograms of CO_2 emitted when the vehicle is idling[1].
Fuel Consumed from Idling (L)	Litres of fuel consumed while the vehicle is idling[2].
Fuel Cost from Idling ($CAD)	Cost of fuel consumed from idling[3].

4.4 Phase 1 Findings

The following section present baseline data by vehicle grouping from BMR and not Glen Eden and Horseshoe. Glen Eden and Horseshoe data can be found in Appendix E.

4.4.1 Summary of 2009-2010 Season for Administration Vehicles

Administration vehicles range in vehicle types and sizes—from subcompact cars with 1.5 litre engines to trucks with 5 litre engines. This group of vehicles is used by the following departments: Cashroom, Food & Beverage, Information Technology and Housekeeping. These vehicles generally complete short trips around the resort from building to building. These vehicles are mainly driven through the daytime, with some trips in the evening.

As shown in Table 10, total drive time per day varies between 18 minutes to nearly 3 hours, with total distance varying between 9 and 74 kilometers per day. Much of this variation is due to the function that each vehicle performs at the resort. For example, the cash room vehicle is responsible for delivering mail across the resort, whereas the food and beverage vehicles are only used on an 'as needed' basis.

Table 10: Blue Mountain Resorts Limited 2009-2010 Ski Season - Administrative Vehicles

Parameter	B10	B32	B39
Number of Days recorded	79.00	102.00	76.00
Number of Trips per Day	6.24	43.72	5.89
Daily Drive Time (hours)	0.54	2.86	0.31
Daily Distance Driven (km)	21.94	74.33	9.06
Average Speed	24.76	20.62	23.79
Average Top Speed	54.63	43.86	54.29
Hard Acceleration Count per 100 km	4.96	0.96	23.82
Hard Deceleration Count per 100 km	3.06	3.02	7.55

[1] 2.289 kg/CO_2/L of gas and 2.663 kg/CO_2/L of diesel (Environment Canada, 2008).
[2] Idling time*fuel flow*60, with fuel flow = engine size* 0.6 / 60 (Environment Canada, 2008).
[3] Fuel consumed from idling*price of fuel (CAD$0.95/L, as per BMR onsite pricing).

Daily Idling Time (hours)	0.09	0.72	0.07
Daily Idling Time during 1st trip of the day	0.03	0.30	0.03
Percentage of operating time that was spent idling (%)	17%	25%	23%
Percent of total idling that occurred during first trip of the day	27%	41%	43%
Daily CO2 Emissions from Idling (kg)	0.24	2.10	0.48
Daily Fuel Consumed from Idling (L)	0.11	0.92	0.21
Daily Fuel Cost from Idling ($CAD)	$0.10	$0.87	$0.20

4.4.2 Summary of 2009-2010 Season for Grounds Vehicles

All of grounds vehicles in this study are light-duty trucks with an average engine size of 5 litres. Grounds vehicles are responsible for many maintenance duties across the resort. A main task for grounds employees is snow clearing and road maintenance all within 4 kilometers of the resort. Generally these vehicles are driven between 6am-10pm, with no set route and occasional after hour use. As shown in Table 11, average drive time per day per vehicle is consistently between 2 to 3 hours averaging 50 kilometers per day.

Table 11: Blue Mountain Resorts Limited 2009-2010 Ski Season - Grounds Vehicles

Parameter	B11	B18	B36	B60	B66	B70
Number of Days recorded	61.00	102.00	96.00	95.00	61.00	99.00
Number of Trips per Day	14.00	19.71	16.90	8.07	17.98	20.06
Daily Drive Time (hours)	2.27	2.90	3.72	1.37	1.23	3.10
Daily Distance Driven (km)	94.77	41.21	30.06	64.92	27.22	40.27
Average Speed	28.87	15.61	10.62	35.16	19.30	14.95
Average Top Speed	61.52	44.14	37.83	66.97	48.61	42.05
Hard Acceleration Count per 100 km	1.63	7.57	2.22	4.02	26.98	18.04
Hard Deceleration Count per 100 km	1.66	6.59	3.33	2.22	16.68	8.03
Daily Idling Time (hours)	0.54	1.43	2.41	0.26	0.36	1.54
Daily Idling Time during 1st trip of the day	0.09	0.41	0.53	0.06	0.06	0.54
Percentage of operating time that was spent idling (%)	24%	49%	65%	19%	29%	50%
Percent of total idling that occurred during first trip of the day	17%	29%	22%	25%	17%	35%
Daily CO2 Emissions from Idling (kg)	4.10	11.62	20.15	2.39	3.29	15.36
Daily Fuel Consumed from Idling (L)	1.79	5.08	8.80	1.04	1.44	6.71
Daily Fuel Cost from Idling ($CAD)	$1.70	$4.82	$8.36	$0.99	$1.36	$6.38

4.4.3 Summary of 2009-2010 Season for Passenger Shuttles

The passenger shuttles are a combination of large vans and mid-sized buses. The average engine size for the shuttles in this study is a 6 litre engine. Passenger shuttles are used for transporting guests around resort, as well as picking up and dropping off staff in surrounding communities. These vehicles are driven with frequent stops on designated routes and generally operate 7am-12am Sunday to Thursday and 7am-3am Friday and Saturday during the winter season. The shuttles are by far the most used vehicles in a resort fleet in that each vehicle is in operation for over 14 hours a day. As shown in Table 12, total drive time per day varies between 10 hours to nearly 20 hours, with total distance varying between 200 and 320 kilometers per shuttle per day.

Table 12: Blue Mountain Resorts Limited 2009-2010 Ski Season – Passenger Shuttles

Parameter	B01	B26	B89
Number of Days recorded	46.00	68.00	14.00
Number of Trips per Day	8.33	9.66	28.57
Daily Drive Time (hours)	10.26	12.30	19.58
Daily Distance Driven (km)	208.62	262.55	328.61
Average Speed	17.45	20.47	17.45
Average Top Speed	48.39	55.91	43.07
Hard Acceleration Count per 100 km	0.35	0.25	1.48
Hard Deceleration Count per 100 km	3.61	1.85	8.11
Daily Idling Time (hours)	2.82	3.07	8.19
Daily Idling Time during 1st trip of the day	0.54	0.56	2.26
Percentage of operating time that was spent idling (%)	28%	25%	42%
Percent of total idling that occurred during first trip of the day	19%	18%	28%
Daily CO2 Emissions from Idling (kg)	33.75	29.91	107.58
Daily Fuel Consumed from Idling (L)	14.74	13.07	47.00
Daily Fuel Cost from Idling ($CAD)	$14.01	$12.41	$44.65

4.4.4 Summary of 2009-2010 Season for Security Vehicles

Security vehicles operate 24 hours a day, 7 days a week with most kilometres accured during night shift patrol. These vehicles have no set route and perform mainly short, on resort, hauls with a few off resort hauls. The security vehicles monitored in this study are minivans. The average daily drive time is 4 hours per vehicle, per day and total distance travelled averaged 70 km per day.

Security vehicles in this study idled an average of 38% of the time, more than all other vehicles in this study. One factor that was brought to the attention of the researchers is that the security vehicles idle to power video cameras that are used for surveillance purposes.

Table 13: Blue Mountain Resorts Limited 2009-2010 Ski Season - Security Vehicles

Parameter	B31	B63
Number of Days recorded	21.00	58.00
Number of Trips per Day	36.62	20.50
Daily Drive Time (hours)	5.08	3.17
Daily Distance Driven (km)	90.48	49.64
Average Speed	19.27	18.61
Average Top Speed	49.57	49.87
Hard Acceleration Count per 100 km	11.53	16.95
Hard Deceleration Count per 100 km	12.95	22.33
Daily Idling Time (hours)	1.78	1.36
Percentage of operating time that was spent idling (%)	35%	43%
Daily CO2 Emissions from Idling (kg)	7.45	8.51
Daily Fuel Consumed from Idling (L)	3.26	3.72
Daily Fuel Cost from Idling ($CAD)	$3.09	$3.53

4.4.5 Opportunities for Improved Efficiency

Based on the summary results from the 2009-2010 monitoring season, a number of opportunities for improved efficiency were identified and outlined in Table 14 below. First and foremost, for those vehicles that have a morning warm-up routine, there are opportunities to reduce the amount of warm-up time during the first trip of the day. Further, for those vehicles with a high percentage of operating time spent idling, i.e. over 30%, there are opportunities to reduce. In terms of smarter driving style, there are also opportunities to reduce the number of hard accelerations and hard decelerations.

Table 14: Summary of Opportunities for Improvement

Vehicle Grouping	Opportunities for Improvement	Performance Indicators
Administration	) Reduce first trip of the day idling	) Average daily idling time first trip of the day: 7 minutes) Average percent of total idling that occured during the first trip of the day: 37%
Grounds	) Reduce first trip of the day idling) Reduce unnecessary idling throughout the day	) Average daily idling time first trip of the day: 17 minutes) Percent of total idling that occured during the first trip of the day: 24%) Percent of operating time spent idling: 39%
Passenger Shuttles	) Reduce first trip of the day idling) Reduce unnecessary idling throughout the day	) Percent of total idling that occured during the first trip of the day: 25%) Percent of operating time spent idling: 33%
Security	) Reduce frequency of hard accelerations and hard decelerations) Reduce unnecessary idling	) Average hard acceleration count per 100 km: 14) Average hard deceleration count per 100 km: 17) Percent of operating time that was spent idling: 38%

4.5 Eco-driver Training of Snow Resort Drivers

The data on driver behaviour presented in the previous section was incorporated into eco-driver training and was used to illustrate typical driver behaviour amongst snow resort fleet.

As shown in Table 15, over 60 staff from 8 departments were trained in the 2 hour intensive eco-driver training course with in-vehicle training. Participants rated the training sessions on three scales:

- Interesting and engaging: 97% indicated excellent or good
- Well organized: 100% excellent or good
- Useful in my daily life: 98% excellent or good

Table 15: Snow Resort Employees that Received Intensive EcoDriver Training

Department	Number of Employees Trained	Vehicles in CarChip Study	Total Number of Employees with Access to Vehicles	Percent of Drivers Trained
Cashroom	1	Vehicle 32	2	50%
Food and Beverage	12	Vehicles 53, 61 & 76	17	71%
Grounds	11	Vehicles 18, 36 & 70	24	46%
Housekeeping	9	Vehicle 20	18	50%
IT	7	Vehicle 24	8	86%
Security	13	Vehicles 12 & 31	25	52%
Shuttles	10	Vehicles 4, 13, 14, 22 & 26	17	59%
Risk Management	1	N/A	N/A	N/A
BMR Total	64	16 Vehicles	111	58%

4.5.1 Exit Survey

An exit survey (see Appendix F) was completed by all 64 eco-driver participants at the end of the training session. Eighty-nine percent of participants indicated that they planned on implementing some eco-driving techniques, with 77% planning on reducing their idling time at work by an average of 13.4 minutes/day and 44% planning to reduce their speed at work by an average of 9 kilometers per hour.

Participants were also asked what they were willing to commit to in terms of incorporating eco-driver techniques at work and at home. The most popular commitments made at work include: reduce start-up idling (92%), reduce hard starts (87%) and check tire pressure (68%). The most popular commitments made at home include: check tire pressure (73%), regular tune-ups (73%) and combine errands (71%). The least popular commitments were: make an effort to carpool (42% at work and at home), ride/walk for errands (40% for work and 65% for home) and reduce use of

drive-thrus (39% for work and 56% for home). These less popular commitments are not surprising given the required changes in behaviour needed.

4.5.2 Follow-up Survey

A follow-up survey (see Appendix G) was circulated 4 weeks after participants had undergone eco-driver training. From the same list of commitments, the most common changes made at work since the training include: combine errands (73%), and reduce hard starts and stops (73%). The least common changes made at work since the training include: ride or walk short errands (36%), reduce drive thrus (27%), carpool (18%) and transit (9%). The most common changes made at home since the training include: combine errands (82%), reduced hard starts and stops (73%) and reduce use of drive thrus (55%). The least common changes were ride or walk (45%) and carpool (18%).

4.7 Phase 2 Findings

After the eco-driver training sessions, the CarChips were reinstalled in fleet vehicles to help determine the effectiveness of the training sessions.

4.7.1 Summary of 2010-2011 Season for Administration Vehicles

The administration vehicles made numerous improvements over the 2010-2011 season in comparison with the 2009-2010 season. The average speed decreased 20.4% and average top speed decreased 12.2%.

Parameter	B30	B32	B53	B61	B76
Number of Days recorded	75.00	80.00	62.00	54.00	25.00
Number of Trips per Day	18.73	40.71	23.92	12.00	5.56
Daily Drive Time (hours)	2.81	2.15	1.76	0.41	0.27
Daily Distance Driven (km)	50.95	60.32	26.38	10.80	6.35
Average Speed	17.02	20.72	15.08	21.41	17.53
Average Top Speed	48.92	44.68	39.60	46.68	43.78
Hard Acceleration Count per 100 km	3.90	0.70	1.22	7.55	5.67
Hard Deceleration Count per 100 km	2.83	2.05	0.73	6.86	3.78
Daily Idling Time (hours)	1.01	0.37	0.65	0.09	0.08
Daily Idling Time during 1st trip of the day	0.11	0.05	0.20	0.01	0.03
Percentage of operating time that was spent idling (%)	36%	17%	37%	21%	30%
Percent of Idling that occurred during first trip of the day	11%	13%	31%	17%	44%
Daily CO2 Emissions from Idling (kg)	8.29	0.85	6.62	0.66	0.76

Daily Fuel Consumed from Idling (L)	3.62	0.37	2.89	0.29	0.33
Daily Fuel Cost from Idling ($CAD)	$3.44	$0.35	$2.75	$0.27	$0.31

In terms of acceleration and deceleration, the administration fleet went from 10 hard accelerations per 100km driven in '09-'10 to only 4 per 100 km in the 2010-2011 season. This is a 61.6% decrease. There was also a 28.5% decrease in hard decelerations. During the baseline year there were 5 hard decelerations per 100km and in the second year of the study there were only 3 hard decelerations per 100km. Not only does a decrease in hard accelerations and decelerations improve fuel efficiency, it is also an important driving behaviour in terms of safer driving.

Table 16: Seasonal Comparison of Driver Behaviour for Administration Vehicles - Average per Vehicle

Parameter	'09-'10 Average	'10-'11 Average	Absolute Difference	% Difference
Number of Trips per Day	18.62	20.19	1.57	8.4%
Daily Drive Time (hours)	1.23	1.48	0.25	19.9%
Daily Distance Driven (km)	35.11	30.96	-4.15	-11.8%
Average Speed	23.06	18.35	-4.70	-20.4%
Average Top Speed	50.93	44.73	-6.20	-12.2%
Hard Acceleration Count per 100 km	9.91	3.81	-6.11	-61.6%
Hard Deceleration Count per 100 km	4.54	3.25	-1.29	-28.5%
Daily Idling Time (hours)	0.30	0.44	0.14	48.0%
Daily Idling Time during 1st trip of the day	0.12	0.08	-0.04	-30.9%
Percentage of operating time that was spent idling (%)	22%	28%	6%	28.2%
Percent of total idling that occurred during first trip of the day	37%	23%	-14%	-38.3%
Daily CO2 Emissions from Idling (kg)	0.94	3.44	2.50	265.9%
Daily Fuel Consumed from Idling (L)	0.41	1.50	1.09	265.9%
Daily Fuel Cost from Idling ($CAD)	$0.39	$1.43	$1.04	265.9%

With regards to idling, there was a slight increase with vehicles idling 8.4 minutes more per day than they did in the first year of the study. This is likely due to increased activity on the resort and more congestion, and therefore more time spent idling. One limitation of this study is the inability to separate out different types of idling. All idling is recorded, and therefore when a vehicle is stopped while in the movement of traffic, or waiting for visitors to cross the road, this is all considered idling. This study can, however, isolate idling that occurs during the first trip of that day. Idling that occurs during the first trip of the day is higher than during all other trips of the day, presumably because drivers are warming their vehicles. In the 2009-2010 season each vehicle idled 7.2 minutes during the first trip of the day. In the 2010-2011 season each vehicles idled only 4.8 minutes, indicating a 30.9% reduction in unnecessary idling during the first trip of the day.

4.7.2 Summary of 2010-2011 Season for Grounds Vehicles

The grounds vehicles made some improvements over the 2010-2011 season in comparison with the 2009-2010 season. Total drive time per day increased by nearly two hours per vehicle, per day. The 2010-2011 season was much snowier than last season, and therefore the grounds vehicles were a great deal busier maintaining the roads and parking lots to keep them safe and functional.

Parameter	B18	B36	B70
Number of Days recorded	55.00	60.00	57.00
Number of Trips per Day	11.50	30.41	17.30
Daily Drive Time (hours)	3.29	7.16	2.75
Daily Distance Driven (km)	41.24	72.18	36.26
Average Speed	14.89	10.92	14.70
Average Top Speed	44.37	39.01	43.05
Hard Acceleration Count per 100 km	4.77	1.69	10.30
Hard Deceleration Count per 100 km	3.56	2.74	4.21
Daily Idling Time (hours)	1.71	4.09	1.43
Daily Idling Time during 1st trip of the day	0.63	0.63	0.36
Percentage of operating time that was spent idling (%)	52%	57%	52%
Percent of total Idling that occurred during first trip of the day	37%	15%	25%
Daily CO2 Emissions from Idling (kg)	14.77	32.42	13.29
Daily Fuel Consumed from Idling (L)	6.45	14.16	5.81
Daily Fuel Cost from Idling ($CAD)	$6.13	$13.45	$5.52

Average speed decreased 34.9% and average top speed decreased 16.0%. In terms of acceleration and deceleration, the grounds fleet went from 10 hard accelerations per 100km driven in '09-'10 to only 6 per 100 km in the 2010-2011 season. This is a 44.5% decrease. There was also a 45.4% decrease in hard decelerations. During the baseline year there were 6 hard decelerations per 100km and in the second year of the study there were only 4 hard decelerations per 100km. Not only does a decrease in hard accelerations and decelerations improve fuel efficiency, it is also an important driving behaviour in terms of safer driving.

Table 17: Seasonal Comparison of Driver Behaviour for Grounds Vehicles - Average per Vehicle

Parameter	'09-'10 Average	'10-'11 Average	Absolute Difference	% Difference
Number of Days recorded	85.67	57.33	-28.33	-33.1%
Number of Trips per Day	16.12	19.74	3.62	22.4%
Daily Drive Time (hours)	2.43	4.40	1.97	81.0%
Daily Distance Driven (km)	49.74	49.90	0.16	0.3%
Average Speed	20.75	13.51	-7.24	-34.9%
Average Top Speed	50.19	42.15	-8.04	-16.0%
Hard Acceleration Count per 100 km	10.07	5.59	-4.49	-44.5%
Hard Deceleration Count per 100 km	6.42	3.50	-2.92	-45.4%

Daily Idling Time (hours)	1.09	2.41	1.32	121.5%
Daily Idling Time during 1st trip of the day	0.28	0.54	0.26	91.2%
Percentage of operating time that was spent idling (%)	39%	55%	16%	39.6%
Percent of total idling that occurred during first trip of the day	24%	22%	-2%	-7.3%
Daily CO2 Emissions from Idling (kg)	9.48	20.16	10.67	112.6%
Daily Fuel Consumed from Idling (L)	4.14	8.81	4.66	112.6%
Daily Fuel Cost from Idling ($CAD)	$3.94	$8.37	$4.43	112.6%

With regards to idling, there was a slight increase with vehicles idling 16% more minutes more per day than they did in the first year of the study. This is likely due to increased activity on the resort and more congestion, and therefore more time spent idling. One limitation of this study is the inability to separate out different types of idling. All idling is recorded, and therefore when a vehicle is stopped while in the movement of traffic, or waiting for visitors to cross the road, this is all considered idling. This study can, however, isolate idling that occurs during the first trip of that day. Idling that occurs during the first trip of the day is higher than during all other trips of the day, presumably because drivers are warming their vehicles. In the 2009-2010 season 24% of all idling occurred during the first trip of the day. During the 2010-2011 season only 22% of all idling occurred during the first trip of the day. This is a very moderate decrease, but given that overall idling increased, it is clear that warm-up idling times have decreased.

4.7.3 Summary of 2010-2011 Season for Passenger Shuttles

The passenger shuttles showed substantial and numerous improvements over the 2010-2011 season in comparison with the 2009-2010 season.

Parameter	B4	B13	B14	B22	B26
Number of Days recorded	63.00	34.00	54.00	59.00	62.00
Number of Trips per Day	7.97	6.85	40.28	37.19	6.11
Daily Drive Time (hours)	10.91	11.68	12.45	12.58	11.37
Daily Distance Driven (km)	237.87	247.60	266.00	263.93	238.84
Average Speed	19.92	19.18	19.62	18.89	19.25
Average Top Speed	55.85	54.45	52.47	52.29	54.61
Hard Acceleration Count per 100 km	1.15	0.31	0.52	0.36	0.24
Hard Deceleration Count per 100 km	0.96	0.46	1.19	0.81	0.26
Daily Idling Time (hours)	2.62	2.65	3.58	3.82	2.60
Daily Idling Time during 1st trip of the day	0.50	0.62	0.15	0.24	0.57
Percentage of operating time that was spent idling (%)	24%	23%	29%	30%	23%

Percent of Idling that occurred during first trip of the day	19%	23%	4%	6%	22%
Daily CO2 Emissions from Idling (kg)	25.74	26.90	30.74	33.45	26.19
Daily Fuel Consumed from Idling (L)	11.24	11.75	13.43	14.61	11.44
Daily Fuel Cost from Idling ($CAD)	$10.68	$11.16	$12.76	$13.88	$10.87

Though there was a slight increase average speed (5%) and a slight increase in average top speed (9.8%), these speeds are still lower than posted speed limits (19.37kmh, 53.93kmh). In terms of acceleration and deceleration, the shuttles had no change in their hard accelerations and still recorded 1 hard acceleration per 100km. There hard decelerations did, however, decrease from 5 per 100km to only 1 per 100 km. This is an 83.7% decrease and is the best acceleration and deceleration record of all fleets at BMR. Not only does a decrease in hard accelerations and decelerations improve fuel efficiency, it is also an important driving behaviour in terms of safer driving, especially when transporting guests.

With regards to drive time, total drive time per day decreased by 2.25 hours per vehicle, per day, over and 1.5 hours of this was in reduced idling. The number of trips per vehicle, per day did increase by 4 trips, but this is likely because drivers were turning off their vehicles to reduce idling. In terms of idling during the first trip of the day, the shuttle vehicles drivers performed phenomenally. Idling during the first trip of the day decreased from just over one hour to less than half an hour, a 62.8% decrease. With an average of 14% of total idling occurring during the first trip of the day, this is a substantial decrease that indicates shuttle drivers have heeded advice provided during the eco-driver training sessions and reduced their idling times.

Table 18: Seasonal Comparison of Driver Behaviour for Shuttle Vehicles - Average per Vehicle

Parameter	'09-'10 Average	'10-'11 Average	Absolute Difference	% Difference
Number of Trips per Day	15.52	19.68	4.16	26.8%
Daily Drive Time (hours)	14.05	11.80	-2.25	-16.0%
Daily Distance Driven (km)	266.59	250.85	-15.74	-5.9%
Average Speed	18.46	19.37	0.91	5.0%
Average Top Speed	49.12	53.93	4.81	9.8%
Hard Acceleration Count per 100 km	0.69	0.51	-0.18	-25.9%
Hard Deceleration Count per 100 km	4.52	0.74	-3.78	-83.7%
Daily Idling Time (hours)	4.69	3.05	-1.64	-34.9%
Daily Idling Time during 1st trip of the day	1.12	0.42	-0.70	-62.8%
Percentage of operating time that was spent idling (%)	33%	26%	-8%	-22.5%
Percent of total idling that occurred during first trip of the day	24%	14%	-10%	-42.9%
Daily CO2 Emissions from Idling (kg)	57.08	28.60	-28.48	-49.9%
Daily Fuel Consumed from Idling (L)	24.94	12.50	-12.44	-49.9%

Daily Fuel Cost from Idling ($CAD)	$23.69	$11.87	$(11.82)	-49.9%

The shuttle vehicles are likely a better indication of the impact of eco-driver training because they were heavily routine based. Routes are the same from year to year, as are the drivers. This would be similar to how eco-driver training would influence the general public, as often people drive set routes; to and from work, to and from school, sports, groceries and other regular locations. The only other vehicle in the fleet that has a set route is the cashroom vehicle, which also showed an improvement across most driver performance parameters.

4.7.4 Summary of 2010-2011 Season for Security Vehicles

Table 19: Blue Mountain Resorts Limited 2010-2011 Ski Season - Security Vehicles

Parameter	B12	B31
Number of Days recorded	14.00	44.00
Number of Trips per Day	26.57	24.64
Daily Drive Time (hours)	4.75	4.82
Daily Distance Driven (km)	62.39	56.48
Average Speed	17.61	16.86
Average Top Speed	49.98	48.22
Hard Acceleration Count per 100 km	23.70	10.78
Hard Deceleration Count per 100 km	8.01	9.09
Daily Idling Time (hours)	2.65	2.65
Percentage of operating time that was spent idling (%)	56%	55%
Daily CO2 Emissions from Idling (kg)	12.47	11.36
Daily Fuel Consumed from Idling (L)	5.45	4.96
Daily Fuel Cost from Idling ($CAD)	$5.17	$4.71

The security vehicles made some improvements over the 2010-2011 season in comparison with the 2009-2010 season. Total drive time per day did increase by 16% per vehicle, per day, and average speed decreased 9% and average top speed decreased 1.2%. In terms of acceleration and deceleration, the security fleet went from 14 hard accelerations per 100km driven in '09-'10 to 17 per 100 km in the 2010-2011 season. This is a 21.1% increase. There was, however, a 51.5% decrease in hard decelerations. During the baseline year there were 18 hard decelerations per 100km and in the second year of the study there were only 9 hard decelerations per 100km. Still substantially more than any other department, this reduction in hard decelerations indicates that some improvement has been made.

Table 20: Seasonal Comparison of Driver Behaviour for Security Vehicles - Average per Vehicle

Parameter	'09-'10 Average	'10-'11 Average	Absolute Difference	% Difference
Number of Days recorded	39.50	29.00	-10.50	-26.6%
Number of Trips per Day	28.56	25.60	-2.96	-10.3%
Daily Drive Time (hours)	4.13	4.79	0.66	16.0%
Daily Distance Driven (km)	70.06	59.43	-10.63	-15.2%
Average Speed	18.94	17.24	-1.71	-9.0%
Average Top Speed	49.72	49.10	-0.62	-1.2%
Hard Acceleration Count per 100 km	14.24	17.24	3.01	21.1%
Hard Deceleration Count per 100 km	17.64	8.55	-9.09	-51.5%
Daily Idling Time (hours)	1.57	2.65	1.08	69.1%
Percentage of operating time that was	38%	55%	17%	45.7%

spent idling (%)				
Daily CO2 Emissions from Idling (kg)	7.98	11.91	3.93	49.3%
Daily Fuel Consumed from Idling (L)	3.49	5.20	1.72	49.3%
Daily Fuel Cost from Idling ($CAD)	$3.31	$4.94	$1.63	49.3%

With regards to idling, there was an increase with vehicles idling more than an hour more per day than they did in the first year of the study. This could be due to increased activity on the resort and more congestion, and therefore more time spent idling. One limitation of this study is the inability to separate out different types of idling. All idling is recorded, and therefore when a vehicle is stopped while in the movement of traffic, or waiting for visitors to cross the road, this is all considered idling.

4.8 Overall Impact and Opportunities for Snow Resort Fleet

4.8.1 Summary of Monitored Fleet Vehicles: 2009-2010 vs. 2010-2011

Across the recorded parameters it is evident that the range of variation among the vehicles is quite large. Much of this variation is due to the function that each fleet vehicle performs at the resort. For example, vehicle 10 is a public shuttle and is driven throughout the duration of operating hours, whereas vehicle 4 is utilized on an on-call basis when tech-support is required by resort staff. Moreover, speeds vary substantially across the sample of vehicles because some vehicles are required to stay on resort (maximum posted speed limits of 60km) compared to others that leave the resort and drive on highways (maximum posted speed limit between 80 and 100km).

However, variation amongst parameters that are of particular relevance for eco-driver training (speed, acceleration, deceleration, idling) are much smaller. It is among these parameters that it becomes increasingly clear that opportunities can be sought to introduce behavioural driving changes that can reduce fuel consumption and limit harmful idling emissions. Further opportunities to improve the economic and environmental performance across the fleet include reducing the number of hard accelerations and hard decelerations, which uses approximately 33-40% more fuel than if the driver accelerated and decelerated gradually (Ericsson 2001, NRCan 2009a, Saboohi & Farzaneh 2009, Thew 2007). Idling is another driving behaviour that can be addressed as when the vehicles engines were turned on, they idled for more than 34% of the time. This leads to an average daily total of more than 135kg of CO_2 and consumes over 54L of fuel or approximately 24% of BMR total daily fuel consumption.

Table 21: Average per Vehicle - All Snow Resort Fleet Vehicles

	'09-'10	'10-'11	Absolute Difference	% Difference
Number of Days recorded	69.86	53.20	-16.66	-23.8%
Number of Trips per Day	18.30	20.65	2.35	12.8%

Daily Drive Time (hours)	4.91	5.94	1.04	21.2%
Daily Distance Driven (km)	95.98	111.84	15.86	16.5%
Average Speed	20.50	17.57	-2.92	-14.3%
Average Top Speed	50.05	47.86	-2.19	-4.4%
Hard Acceleration Count per 100 km	8.63	4.86	-3.77	-43.7%
Hard Deceleration Count per 100 km	7.21	3.17	-4.04	-56.1%
Daily Idling Time (hours)	1.76	2.00	0.24	13.6%
Daily Idling Time during 1st trip of the day	0.39	0.29	-0.11	-27.0%
Percentage of operating time that was spent idling (%)	34%	36%	2%	6.6%
Percent of Idling that occurred during first trip of the day	24%	18%	-5%	-22.1%
Daily CO2 Emissions from Idling (kg)	17.64	16.30	-1.34	-7.6%
Daily Fuel Consumed from Idling (L)	7.71	7.12	-0.59	-7.6%
Daily Fuel Cost from Idling ($CAD)	$7.32	$6.76	$(0.56)	-7.6%

4.8.2 Forecast to 100 day season, for entire BMR fleet (55 vehicles)

The average operating season for BMR is 100 days between the months of December and March, depending on weather. Based on the average daily totals, this equates to over 57 tons of CO2 emissions and nearly 25,000L of fuel from idling in addition to the extra emissions and fuel consumed from speeding and hard acceleration/deceleration. There are 55 vehicles at BMR, and the average operating season is 100 days. To take into account the fact that the vehicles monitored in this study are driven more than most other vehicles on resort, we multiplied the daily average by 35 vehicles instead of 55 vehicles.

The average operating season for BMR is 100 days between the months of December and March, depending on weather. Based on the average daily totals, this equates to over 61 tons of CO2 emissions and nearly 27,000L of fuel from idling in addition to the extra emissions and fuel consumed from speeding and hard acceleration/deceleration. There are 55 vehicles at BMR, and the average operating season is 100 days. To take into account the fact that the vehicles monitored in this study are driven more than most other vehicles on resort, we multiplied the daily average by 35 vehicles instead of 55 vehicles.

Table 22: Projected Total for BMR Fleet (2009-2010)

	Average per vehicle per day	For 35 vehicles	Over a 100 day season
Number of Trips	18.3	640.6	64062.3

Daily Drive Time (hours)	4.9	171.7	17172.3
Daily Distance Driven (km)	96.0	3359.2	335921.9
Average Speed	20.5	717.4	71735.9
Average Top Speed	50.1	1751.8	175178.6
Hard Acceleration Count per 100 km	8.6	301.9	30189.8
Hard Deceleration Count per 100 km	7.2	252.4	25245.0
Daily Idling Time (hours)	1.8	61.6	6159.6
Daily Idling Time during 1st trip of the day	0.4	13.8	1379.6
Percentage of operating time that was spent idling (%)	34%	-	-
Percent of Idling that occurred during first trip of the day	24%	-	-
Daily CO2 Emissions from Idling (kg)	17.6	617.4	61744.6
Daily Fuel Consumed from Idling (L)	7.7	269.7	26974.5
Daily Fuel Cost from Idling ($CAD)	$6.97	$244.00	$24,400.01

Table 23: Total for Whole Fleet at BMR (2010-2011)

	Average per vehicle per day	For 35 vehicles	Over a 100 day season
Number of Trips	20.6	722.7	72273.3
Daily Drive Time (hours)	5.9	208.0	20804.4
Daily Distance Driven (km)	111.8	3914.4	391437.9
Average Speed	17.6	615.1	61510.3
Average Top Speed	47.9	1675.3	167527.1
Hard Acceleration Count per 100 km	4.9	170.0	17000.9
Hard Deceleration Count per 100 km	3.2	110.9	11094.2
Daily Idling Time (hours)	2.0	70.0	6997.4
Daily Idling Time during 1st trip of the day	0.3	10.1	1006.7
Percentage of operating time that was spent idling (%)	36%	-	-
Percent of Idling that occurred during first trip of the day	18%	-	-
Daily CO2 Emissions from Idling (kg)	16.3	570.5	57046.7
Daily Fuel Consumed from Idling (L)	7.1	249.2	24922.1
Daily Fuel Cost from Idling ($CAD)	$6.76	$236.76	$23,676.01

4.8.4 Weather

One important variable that needs to be taken into consideration is the differences in weather between the baseline season and the post-training season. Weather data were retrieved from Environment Canada's historical weather database (Environment Canada, 2011). The weather data for both the 2009-2010 and the 2010-2011 season were retrieved for months December-March. In the 2009-2010 season there was 161.5cm of snowfall and the average minimum temperature were -8.1°C. The average maximum temperature for the season was 0.2°C and 13.4cm or rainfall occurred. Conversely, during the 2010-2011 season there was 220cm of snowfall and the average minimum temperature were -11.5°C. The average maximum temperature for the season was -1.7°C and 8.6cm of rainfall fell.

Table 24: Weather for Both Winter Seasons

Variable	'09-'10 Season	'10-'11 Season	Difference
Average Minimum Temperature (°C)	-8.13	-11.47	-3.34
Average Maximum Temperature (°C)	0.19	-1.67	-1.86
TOTAL Snowfall (cm)	161.5	220	58.50
TOTAL Rain (cm)	13.42	8.64	-4.78

This information is very important, as there is a relationship between driver behaviour and weather and with 58.5cm more snowfall in the 2010-2011 season, and average minimum temperatures being 3 degrees cooler, this has likely had an impact. Drivers idle their vehicles more when it is cold out, and when they are clearing snow from the windshield. With so much more snow, as well as cooler temperatures, it is important to note that the CarChip data have not been altered to take into account these important factors.

Environment Canada (2011). Orangeville Ministry of Environment - Ontario. http://www.climate.weatheroffice.gc.ca/climateData/dailydata_e.html?Prov=XX&timeframe=2&StationID=4991&Day=1&Month=12&Year=2009&cmdB1=Go

4.8.5 Skier Visits

In terms of skier visits, in the 2009-2010 season BMR had 730,000 and in the 2010-2011 season BMR had 750,000. This represents a moderate increase in activity at the resort during the winter

months and as a result would lead to the resort's fleet being used more frequently and for longer durations over the 2010-2011 season.

4.9 Data limitations

There are two key limitations of the CarChip® as they are applied in this study. The first relates to idling. There are three circumstances in which individuals may idle their vehicle, including to warm the engine, waiting for something unrelated to traffic (e.g., a passenger), and while commuting (e.g., at a stop sign, traffic lights, railway crossing) (Carrico et al. 2009). This latter idling circumstance is difficult to avoid for functional and safety purposes and can therefore be deemed necessary idling and should not be included in the daily average and total idling time. Unfortunately the CarChip® quantified idling at every point when a vehicle was at zero kilometers per hour.

The second limitation is the inability to calculate specific fuel consumption and CO_2 emissions for the parameters of speed, hard acceleration and hard deceleration. The CarChips® are not programmed to measure the exact degree of speeding, but rather to identify the duration of speeds over 110 kilometers per hour. Without such data, the precise decrease in fuel efficiency cannot be arrived at. This is similar for the acceleration and deceleration parameters, to which the CarChip® is unable to capture precise data on the speed and time difference at which the incident occurred. Although this data would be helpful, value remains in identifying the frequency of their occurrence as behavioural changes can target the reduction of these events.

Driver behaviour and snow resort activity are both highly influenced by weather. Research has shown that when it is colder outside, people warm their vehicles more in the morning (Matthews et al, 2011). This research project has not assessed the impact of weather on driver behaviour, but it is important to note that changes in temperature and precipitation will have a fundamental impact on driver behaviour, particularly in a situation such as that at a snow resort where employees are working outside in very harsh conditions.

Additional limitations include the fact that not all employees at the resort were trained. Though many indicated that they would pass on the information learned at the training sessions to a friend, there is no evidence to indicate this actually happened. Additionally, due to employee turn-over, it is not always the same drivers from year to year.

In the 2009-2010 baseline season the cost of fuel at BMR was $0.78/litre. In the 2010-2011 season this price of gasoline rose to $0.95/litre. In order to make comparisons between the two seasons, the fuel price of $0.95/litre was used.

Another limitation of the study is that many of the vehicles that were originally monitored were not available for the second year of the study as they had either been retired, or moved for use by a different department. It is for this reason that vehicles are grouped in four main groups. Researchers attempted to monitor vehicles that had the same function, even though the vehicles were different. This change in vehicles from year to year can contribute to different fuel efficiency numbers because of differing engine sizes. In some cases fuel efficiency was improved because a newer, more fuel efficient vehicle was purchased. In other cases fuel efficiency may have decreased because the department may have brought in a larger vehicle.

5.0 Evaluation of Program and Recommendations

Snow resort managers and staff serving as liaisons for the EIRP as well as members of the research and data collection team were asked to provide their feedback on the EIRP (e.g. What parts of the project worked well? What improvements could be made for next time? etc). Below is a summary of the received feedback.

5.1 Lessons Learned and Recommendations

Approach and delivery:

- The EIRP's "turn-key" approach has minimized the time and effort required by snow resort managers to participate in the program.
- Within the five step framework to developing an engine idling reduction action plan, there was sufficient freedom for each snow resort to customize its plan, allowing each resort to identify and pursue idling reduction opportunities suited to their circumstances.
- The positive messaging of the EIRP was well received by snow resort guests and staff.

Data collection:

- The duties involved with collecting data were given a high level of importance to the EIRP.
- The data collected for the EIRP contributed to providing a clear and relevant picture of the current state of engine idling behaviours at snow resorts.

Operational efficiency:

- The flow of vehicles in and out of drop-off/pick-up areas was observed to impact the duration and incidences of engine idling. From an operational efficiency perspective, it is recommended that the flow of vehicles be examined on a regular basis and where possible, measures be taken to ease congestion during peak times.
- One resort has made available hand-pulled sleds for transporting ski and snowboard equipment from the parking lot to the main lodge, resulting in reduced vehicle congestion and emissions. This system has the potential to be replicated at smaller resorts.
- Tire pressure check-ups and air stations are useful capital investments to make for resorts with operating larger sized fleet.

Behaviour change campaign:

- In-shuttle information highlighting "interesting facts" from the data collected during the vehicle monitoring study would be a way to highlight the leadership taken by BMR to reduce its impact.
- Ecodriver training for new hires and re-fresher training is needed on an annual basis.
- Staff outreach and recognition: monthly updates and employee recognition are useful in keeping staff motivated and on-track.

- The A-frame signs were a welcomed addition to the suite of behaviour change tools. Many snow resort operators indicated their preference for using these signs and that they served effective reminders to drivers to turn their engines off once parked.
- Snow resorts can most effectively influence behavioural changes in regular weekday visitors, such as families with children in instructional programs. They may therefore wish to target this group when communicating the importance of reducing idling (i.e. through snow school newsletters, e-mails, bulletins, posters, etc)
- Rising fuel costs and partnering with bus companies as a way of making it more economical to travel to a snow resort.
- Snow resorts could champion "winter ecodriving practices".
- Many private snow resorts have had great success with implementing carpooling programs. Carpooling effectively reduces the number of personal vehicles travelling to resorts, reducing both emissions and stress on limited parking facilities at resorts.
- Snow resorts can offer incentives to bus drivers to get them out of their buses and inside the resort, thereby reducing the need for periodic idling throughout the day.
- When advising guests on booking a bus for a ski trip, stress the importance that the chosen bus company has idling reduction practices in place. Suggest that groups communicate their preference that the bus not idle and that the cab temperature need not be fully heated upon re-entering the bus at departure time.

6.0 References

7.0 Appendices