ANALYZING ENGINE IDLING REDUCTION OPPORTUNITIES AT THREE ONTARIO SKI RESORTS

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Executive Summary

This paper emphasizes the opportunities available to communicate the linkages between the enjoyment of skiing and snowboarding with the need to adopt more sustainable behaviours that reduce emissions responsible for climate change. During the 2009 winter season, the Engine Idling Reduction Program (EIRP) was piloted at three Ontario ski resort to gathered data on the current state of unnecessary idling behaviour at ski resorts. Data collection included a timing stage, which recorded the average idling time, and a counting stage, which recorded the total number of idling vehicles in each idle-free zone during the pre-launch phase (baseline measurement) and post-launch phase of the EIRP. A total of 6,094 personal vehicles were observed through the phases of EIRP (Blue Mountain n=3,165; Craigleith n=1,114; Glen Eden n=1,815). Between the pre and post-launch phases, a public education campaign to reduce unnecessary idling was organized, which had an estimated audience of 126,000 drivers and guests. The greenhouse gas (GHG)

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emissions generated by idling vehicles during the pre-launch and post-launch phase were then compared by converting the total GHG emissions per number of vehicles observed into the projected amount of GHG emissions per 1000 vehicles. Results revealed that when compared to the baseline conditions, the average overall incidences of idling decreased by 6.8%, reducing projected GHG emissions by 154.7 kg of CO_2 per 1000 vehicles across all three resorts. The flow of vehicles in and out of drop-off/pick-up areas was observed to impact the duration and incidences of engine idling. Opportunities exist for ski resort managers to enhance the guest experience, increase operational efficiency and decrease idling times through improved vehicle flow to and from parking areas. Suggested areas of future research include collecting data on driver attitudes through surveys, as well as gathering data during the summer months to explore whether driver behaviour is dependent on weather.

Introduction

Climate change represents one of the most significant challenges to humanity in the 21st century and is anticipated to have profound consequences for numerous societies and business sectors.[1] In particular, the highly climate-sensitive winter tourism sector is repeatedly identified in academic literature and government reports as being vulnerable to climate change, mainly due to a predicted reduction in natural snow availability.[2,3,4,5,6] According to the

[1]Intergovernmental Panel on Climate Change (IPCC). 2007. *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Parry, M.L., Canziani, O.F., Palutikof, J.P., van der Linden, P.J., & Hanson, C.E. (eds.)]. Cambridge University Press, Cambridge, UK.

[2] Ibid.

[3]Scott, D. 2005. Ski industry adaptation to climate change: Hard, soft and policy strategies. In: S. Gössling and M. Hall (eds.), *Tourism and global environmental change*. London, UK: Routledge, p. 262-285.

[4] US National Assessment Team. 2001. Climate change impacts on the United States: the potential consequences of climate variability and change. US Global Change Research Program. Cambridge University Press: New York.

[5] UNWTO-UNEP. 2003. *Climate change and tourism*. Proceedings of the First International Conference on Climate change and Tourism, Djerba, 9-11 April. Madrid: World Tourism Organization.

[6] United Nations World Tourism Organization (UNWTO). United Nations Environmental Programme (UNEP) and the World Meteorological Organization

Intergovernmental Panel on Climate Change (IPCC) fourth assessment report, current and projected rates of global GHG emissions, in particular CO_2 emissions, has and will continue to contribute to the warming of the earth's climate system.[7] The passion many Canadians have for skiing and snowboarding (e.g., US$647 million in annual ski revenues[8]) and thereby the cool climate conditions needed to enjoy this recreation, presents an innovative avenue to raise awareness of this vulnerability and foster behavioural changes that can reduce CO_2 and climate change impacts.

There are approximately 3.5 million skier visits[9] annually to Ontario snow resorts, with many guests arriving by personal vehicle. Each resort has pick-up/drop-off zones (maximum 15 minute parking areas) that enable drivers and guests to conveniently unload or load their skiing and snowboarding equipment and/or pick-up passengers. Common to these zones are idling vehicles that generate CO_2 emissions. To date, there is very limited research documenting the frequency and duration of personal vehicle idling[10,11,12,13] with no published studies that explore vehicle idling at ski resorts.

(WMO). 2008. *Climate change and tourism: Responding to global challenges.* Prepared by Scott, D., Amelung, B., Becken, S., Ceron, J.P., Dubois, G., Gössling, S., Peeters, P., & Simpson, M.C.), Madrid and Paris: UNWTO.

[7] IPCC 2007

[8] Statistics Canada, 2005. *Table 361-0002 – Summary Statistics for Arts, Entertainment and Recreation by North American Industry Classification System* (Annual – Skiing Facilities) http://cansim2.statscan.ca/cgi-win/CNSMCGI.exe

[9] Skier visits is a common metric used in the industry and indicates the alpine skier/snowboarder volume at ski resorts. A skier visit qualifies as one person visiting a ski resort for all or any part of a day or night for the purpose of skiing as determined by the number of lift tickets issued

[10] Carrico, A.R., Padgett, P., Vandenbergh, M.P., Gilligan, J. & Wallston, K.A. 2009. Costly myths: An analysis of idling beliefs and behaviour in personal motor vehicles. *Energy Policy* 37, 2881-2888.

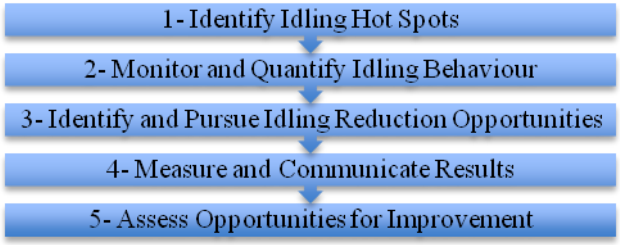
[11] Lura Consulting, 2002. Anti-idling campaign: final report. Report Prepared for the Canadian Petroleum roducts Institute and Natural Resources Canada Office of Energy Efficiency. Downloaded August 20, 2008 from http://www.cppi.ca/pdf/AntiIdling.pdfwww.cppi.ca/pdf/AntiIdling.pdfS.

[12] Lura Consulting, 2005. The carrot, the stick, and the combo: a recipe for reducing vehicle idling in Canadian communities. A Report Prepared for Natural Resources Canada and the Clean Air Partnership.

[13] McKenszie-Mohr Associates, 2003. Anti-idling final report. Report Prepared for Earthcare Sudbury. Retrieved online April 27, 2008 from

In response to growing interest among members of the Ontario Snow Resort Association (OSRA) to monitor, quantify and reduce engine idling practices, a five-step Engine Idling Reduction Program (EIRP) was piloted at three Ontario ski resorts: Blue Mountain Resorts Limited (Blue Mountain), Craigleith Ski Club (Craigleith), and Glen Eden Ski and Snowboarding Centre (Glen Eden) (Figure 1). During the 2009 ski season, the pick-up/drop-off zones at the three resorts (e.g., 15 minute parking areas) were identified as idling hot spots (step one) and are the focus of this research. The launch of the program consisted of raising awareness on the benefits of idling reduction at the resorts by posting signage, distributing information and pledge cards, printing idling reduction reminder images on parking passes, stickers and vinyl window decals, publishing the campaign on the resorts' websites and setting up information booths during various resort events (e.g., "keep winter cool"—Blue Mountain; clean air exhibit—Craigleith; parking lot education campaign—Glen Eden) (step three). Data on personal vehicle idling was gathered before (step two) and after (step four) the launching of the EIRP to quantify the effectiveness of the pilot at reducing idling. The results of this pilot are the basis for this paper, including an assessment of how the EIRP can be improved for future implementation (step five).

Figure 1. Five Steps to an Engine Idling Reduction Action Plan



Personal Vehicle Idling

Engine idling can be defined as a situation in which a vehicle is turned on, but is not moving. Carrico et al. identifies three

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http://www.city.greatersudbury.on.ca/CMS/index.cfm?app=div_earthcare&lang=en&currID=898&parID=897S.

circumstances where individuals idle their personal vehicle, including to warm the engine, waiting for something unrelated to traffic (e.g., a passenger or at a drive-thru), and while commuting (e.g., at a stop sign).[14] While the latter idling circumstance is difficult to avoid for functional and safety purposes, the first two idling circumstances can be deemed as unnecessary idling. Natural Resources Canada[15] and the US Environmental Protection Agency[16] recommend that to reduce emissions, a car should not idle beyond 30 seconds[17]. Given this, the EIRP focused on those vehicles that unnecessarily idled for 30 seconds or more.

There are numerous misconceptions that lead to increased idling among drivers. Respondents to a survey administered by Natural Resources Canada claimed to idle because they believed it is beneficial to warm the engine before driving[18]. Respondents reported that they idle their vehicle in order to reach a comfortable temperature inside their vehicle and because they believed idling used less fuel than restarting the vehicle. It was also noted that respondents did not believe that idling produces unnecessary pollution and believed that idling was better for the engine and the starter[19]. These responses indicate that there is a strong need for public education regarding engine idling.

Very few studies quantify the frequency and duration of the public's unnecessary idling. In Canada, the results of a national telephone survey found drivers unnecessarily idled on average for 39 minutes per week.[20] In a local survey (Sudbury, Ontario) the same investigators found that 43% of drivers reported that they idled within the past 24 hours for an average of 3.3 minutes, or approximately 23 minutes per week. When idling behaviour was observed in various

[14] Carrico et al. 2009
[15] Natural Resources Canada, 2008. Idling wastes fuel and money. Retrieved August 19, 2008 at /http://www.oee.nrcan.gc.ca/transportation/idling/wastes.cfm?attr=8S.
[16] Environmental Protection Agency, 2004. Your car and clean air: what you can do to reduce pollution. Fact Sheet OMS-18, 420-F-93-00. Retrieved February 9, 2009 from /www.epa.gov/otaq/consumer/18-youdo.pdfS.
[17] After the 2009 winter season, Natural Resources Canada changed its recommendation to 60 seconds to balance factors such as fuel savings, emissions and component wear.
[18] Natural Resources Canada 2008
[19] Ibid
[20] McKenzie-Mohr Associates 2003

parking lots within Sudbury (e.g., grocery stores, shopping malls, schools) up to 55% of waiting vehicles were idling for over 3 minutes.[21] In the United States, the first and only published study surveyed 1300 drivers, with results indicating that the average individual idled for over 1 hour and 52 minutes per week, accounting for over 93 MMt of CO_2 or 1.6% of all US emissions.[22]

Fortunately, past idling reduction campaigns have been met with success. In public school parking lots in Sudbury, a 34% decline in idling vehicles was observed after a public education campaign, with a further decline of 1.2 minutes in the average time spent idling.[23] Similarly in Mississauga, a decline of 4.5 minutes in average time spent idling was realized.[24] Additionally at public school parking lots in Waterloo a reduction of between 32% and 49% in idling vehicle time was achieved through idling reduction campaigns which implemented signage and public education.[25] While published results on idling outreach campaigns may be limited, evidence suggests that a viable opportunity to reduce personal vehicle emissions at Ontario ski resorts is possible.

Methods

The goal of the pilot phase of the EIRP was to quantify personal vehicle idling and pursue significant reductions in unnecessary idling practices among visiting drivers at participating ski resorts. During the 2009 winter season, the pick-up/drop-off areas at Blue Mountain, Craigleith and Glen Eden (e.g., 15 minute parking areas) were identified as idle-free zones and served as the location for collecting data on the total estimated idling time at each resort. To quantify this, a timing stage, which recorded the average time personal vehicles spent in the idle-free zones (January 9-10, 2009) was multiplied by the results of the counting stage, which observed the total number of idling vehicles in each idle-free zone during the

[21] Ibid
[22] Carrico et al. 2009
[23] McKenzie-Mohr Associates 2003
[24] Lura Consulting 2002
[25] Reduce the Juice, 2009. Driving home an emissions free future. Waterloo Project I: Anti-idling Campaign 2008. Retrieved February 9, 2009 from http://www.reducethejuice.ca/main/ documents/waterloo2008_executive_summary.pdf

pre-launch phase (January 15-18, 2009 baseline measurements) and post-launch phase of the EIRP (February 19-22, 2009). To calculate total CO_2 emissions, total estimated idling time was multiplied by GHG emissions per minute of idling (0.0700 kg CO_2/minute[26]). The GHG emissions generated by idling vehicles during the pre-launch and post-launch phase were then compared by converting the total GHG emissions per number of vehicles observed, into the projected amount of GHG emissions per 1000 vehicles. A total sample of 6,094 personal vehicles were observed and recorded (Blue Mountain n=3,165; Craigleith n=1,114; Glen Eden n=1,815).

Results

At Blue Mountain, two drop-off/pick-up zones were identified. At the first location, South Base, average time spent in the idle-free zone by visiting drivers was 6.14 minutes, with 48% of the drivers were observed idling in the zone during the pre-launch phase (n=673). At the second location, Grand Central, drivers averaged 3.88[27] minutes in the drop-off/pick-up zone, of which 60% idled (n=584). At Craigleith, the average idling time of personal vehicles was 3.8 minutes, with baseline idling incidences of 58% (n=488). Visiting drivers at Glen Eden averaged 4.77 minutes in the idle-free zones, with 59% idling during the pre-launch phase (n=813).

Therefore, of the personal vehicles that were in the drop-off/pick-up zones at the three participating ski resorts, 48% to 60% were observed to be idling. Based on these incident rates and the average duration of idling, it is estimated that 136 to 264 kilograms of CO_2 emissions are generated through unnecessary engine idling for every 1000 personal vehicles parked in a drop-off/pick-up zone. Table 1 highlights the projection that over the course of one winter ski season, 1,714 to 4,277 kilograms of CO_2 emissions are generated due to the unnecessary idling of personal vehicles in these drop-off/pick-up zones.

[26] Abraham, Neil. Natural Resources Canada's Office of Energy Efficiency (Transportation Energy Use Division), Ottawa, ON, personal communication, 2008.
[27] Times were recorded in terms of complete minutes (eg., 3 minutes) or half minutes (e.g., 3.5 minutes), which is why irregular numbers are arrived at when calculating the average.

Table 1. Projecting GHG emissions generated at ski resort drop-off/pick-up zones due to unnecessary personal vehicle idling over the ski season

Average daily personal vehicles idling in pick-up/drop-off zones	Approximate days in a ski season	Total average personal vehicles in pick-up/drop-off zones in a season	Estimated idling GHG emissions emitted over a ski season
180	70 - 90	12,600 - 16,200	**1,714 - 4,277 kg CO_2**

After the launch of the public education campaign, reductions in the incidences of idling were observed among most of the idle-free zones. At South Base in Blue Mountain, incidences of idling decreased by 3% (n=536), resulting in a decrease of 12.91 kg of CO_2 or a 6.4% decrease in projected GHG emissions per 1000 vehicles. At Craigleith, observed idling in the post-launch phase decreased by 7% (n=509), leading to a reduction of 20 kg of CO_2 or 13.2% decrease in projected GHG emissions per 1000 vehicles. The most substantial decrease was observed at Glen Eden, with a 13% decrease in idling incidences (n=547), leading to a reduction of 109.5 kg of CO_2 or 41.6% decrease in projected GHG emissions per 1000 vehicles. The one exception was Grand Central at Blue Mountain, to which, incidences of idling increased by 2% (n=394), resulting in an increase of 9.87 kg of CO_2 or a 6.3% increase in projected GHG emissions per 1000 vehicles. Despite this exception, the behaviour changes recorded between the pre and post-launch EIRP phases delivered reductions on average of over 13% in CO_2 emissions per 1000 personal vehicles within the pick-up/drop-off zones at the three participating ski resorts. For the scenario presented in Table 1, a behaviour change campaign that achieves a 6% reduction in CO_2 emissions per 1000 personal vehicles is equivalent to an emissions reduction of 101 to 259 kilograms of CO_2 over the course of a ski season.

Discussion

Public education is essential for behavioural change, especially. Behaviours are learned through agents of socialization;

school, family media and peer groups.[28] Research that explores effective means to promote voluntary behavioural change indicates that this change may be attributable to the notion that drivers of vehicles can easily control the situation (few to no situational barriers that hinder the ability to self determine when to turn off ones engine) and result in both social ("the right thing to do") and economical (reduces fuel consumption) benefits.[29,30,31,32]

Flamm et al. indicated a strong relationship between environmental knowledge and environmental attitudes/behaviour.[33] Drivers with a greater understanding of the impact vehicle emissions have on the environment are more likely to alter their driving behaviours in a way that minimizes their emissions by way of vehicle choice, driving behaviour and idling behaviour.[34] These findings suggest to policy-makers that the gap between knowledge and behaviours needs to be addressed.[35] The connection between knowledge of environmental impacts and behaviours needs to be highlighted through social marketing public education campaigns such as those implemented at Blue Mountain, Glen Eden, and Craigleith.

Increasingly, those that deliver public education campaigns are turning to community-based social marketing (CBSM) for assistance. Doug McKenzie-Mohr's work on CBSM highlights that behaviour change is achieved most effectively when initiatives are delivered at the community level when barriers are removed at the

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[28] Haustein, S., Klöckner, C., & Blöbaum A. (2009). Car use of young adults: The role of travel socialization. *Transportation Research* 12, 168–178.

[29] Conner, M. & Armitage, C.J. 1998. Extending the theory of planned behavior: a review and avenues for further research. *Journal of Applied Social Psychology* 28, 1429–2464.

[30] Kaiser, F.G., Wolfing, W., & Fuhrer, R. 1999. Environmental attitude and ecological behavior. *Journal of Environmental Psychology* 19, 1–19.

[31] Schultz, P.W., Oskamp, S., & Mainieri, T. 1995. Who recycles and when? A review of personal and situational factors. *Journal of Environmental Psychology* 15, 105–121.

[32] Wall, G. 1995. Barriers to individual environmental action: the influence of attitudes and social experiences. *The Canadian Review of Sociology and Anthropology* 32, 465–491.

[33] Flamm, B. 2009. The impacts of environmental knowledge and attitudes on vehicle ownership and use. *Transportation Research* 14, 272–279.

[34] Ibid

[35] Ibid

same time as benefits are enhanced to encourage participants to take part in the wanted behaviour change.[36] This kind of marketing emphasizes direct, personal contact among community members along with the use of the following tools which can be used on their own or in combination: prompts (remind people to engage in a more sustainable behaviour); commitments (have people commit or pledge to engage in sustainable activities); norms (establish community norms that a particular behaviour is the right thing to do); and, use vivid communications tools with engaging messaging and images[37]. As elaborated upon in examples below, some of these tools were used in the campaign conducted at Blue Mountain, Glen Eden, and Craigleith.

There were several prompts used to remind drivers to turn their engines off, the most prominent one being the posting of Idle-Free parking signs. When surveying guests that chose to turn off their engine at Blue Mountain (n=217) and Craigleith Ski Club (n=155), 25% of respondents indicated that seeing the signage had reminded them to turn off their engine, while 36% noted it was common practice not to idle, and others also indicated that they turn off their engine due to environmental concerns (19%) or to save fuel (10%). It is important to note that Blue Mountain had signage present before the pre-launch of the campaign and therefore it does serve to explain why the signs did not impact differences in idling during the pre-launch and post-launch phases. At Glen Eden and Craigleith signage was first posted between the pre-launch and post-launch phases contributing to the significant declines of idling incidences.

Norms were used successfully at both Glen Eden and Craigleith and were met with limited success at Blue Mountain. These findings can be partially attributed to the fact that the nature of visitors is different at the three resorts. Glen Eden attracts repeat weekday and weekend visitors and therefore guests receive continual reminders from signage and parking attendants, thereby forming a norm. Similarly, Craigleith is a private ski club with its members arriving at the club on a repeat basis throughout the ski season. In

[36] McKenzie-Mohr, D. 2000. Fostering sustainable behavior through community-based social marketing. *American Psychologist* 55, 531-537.

[37] Ibid

general, this dynamic contributes to a strong sense of community and naturally private clubs such as Craigleith lend themselves to continual communication on the importance of idling reduction with their members. The dynamic between guest and Blue Mountain is quite different, as Blue Mountain caters to its guests as a vacation destination, making the formation of a norm difficult. For example, those visitors parking or dropping visitors off at the Grand Central drop-off/pick-up area are predominately casual visitors who do not come to the resort on a regular basis, but rather once a year as a vacation. Given this dynamic, the opportunities to communicate and remind guests of the importance of idling reduction is limited. Blue Mountain's South Base drop-off/pick-up area did realize some declines in incidences of idling and much of this can be attributed to the nature of the guests that arrive at this location. Upon closer examination, a significant portion of the guests using South Base are repeat guests, as many locals use this area for dropping their children off for ski/snowboard lessons and there are many repeat racing events that are held in this area of Blue Mountain, which again lends itself to reaching guests on a repeat basis throughout the winter season.

Future Research

Several areas of further research have been uncovered through the insights and data gaps encountered during the pilot phase of the EIRP. In terms of data collection, future projects may benefit from recording the type and size of the personal vehicle and examine whether there is a correlation between these factors and idling behaviour. In addition, a survey targeted at drivers that idle their vehicles would generate further insights as to behavioural motivations for doing so. Additionally at ski resorts where summer activities exist, data could be collected on idling behaviour to explore whether driver behaviour is different during warmer temperatures.

In terms of the further establishing the act of turning of the engine when in park as social norm, an avenue to incorporate reminders to reduce idling and thereby foster long-term change exists with provide ski clubs and other resorts that have a strong sense of community. A similar outreach effort can be made through enrolment programs offered at resorts (e.g., weekly lessons, racing

events, school trips) as another means to achieve long-term behaviour change.

The flow of vehicles in and out of drop-off/pick-up areas was observed to impact the duration and incidences of unnecessary 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.

Conclusion

This paper contributes to the limited research that examines the frequency and duration of personal vehicle idling, and is the first known publication to explore unnecessary idling at ski resorts. Based on the results of the EIRP piloted at three Ontario ski resorts, a unique and valuable opportunity does exist to foster behavioural changes among visiting ski resort guests that can reduce unnecessary emissions—an average decrease of over 13% in CO_2 emissions per 1000 personal vehicles. The 'turn-key' five-step action plan through which the EIRP was grounded was well received for its clear outcomes and goals, minimizing the time and effort required by ski resort managers. The flexibility of the action plan also provides freedom to enable each ski resort to identify, pursue and customize its own actions for reducing engine idling, further lending itself to be transferable in other settings (e.g. schools) where vehicles flow in and out of drop-off/pick-up areas. The ultimate goal of this work is to make the action of shutting an engine off while parked a social norm.

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