

Unnecessary Idling of Vehicles:

An analysis of the current situation and what can be done to reduce it.



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Abstract:

Unnecessary vehicle idling is a common source of GHG emission and other air pollutants. Not only does it contribute to the global climate change but it also wastes a large amount of fuel threatens our energy future. Governments around the world have taken different kind of actions to reduce unnecessary idling of vehicles. In Canada and the USA various municipalities have bylaws to prevent vehicles users from idling. Different municipalities have included different provisions in their bylaws.

This study performs an in-depth analysis of the anti-idling bylaws in Canada and the USA, and summarises the general provisions and exemptions allowed in the bylaws. This work also attempts to determine the reasons behind idling and why these bylaws are not effective enough. New technologies which can effectively change the idling tendency of vehicle users and thereby reduce unnecessary vehicle idling are also discussed. This study identifies the policy measures that can be taken to reduce idling and offers related recommendations.

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1. Introduction:

Vehicles emit the greenhouse gas carbon dioxide (CO₂). The global climate is changing as a result of greenhouse gas emissions. The most recent reports from the Intergovernmental Panel on Climate Change concluded that:

“most of the observed increase in globally averaged temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic (human) greenhouse gas concentrations”(IPCC, 2007: Summary for Policymakers 2007). A recent publication by Natural Resources Canada and Health Canada emphasizes the potential adverse effects of climate change in Canada. It also explains how the economic, social and general well-being of this region is linked directly and indirectly to climate (Government of Canada 2007; Belanger, et al. 2008). The reports also include the need for Canadians to take actions for both mitigation (to reduce emissions of greenhouse gases) and adaptation (to prepare for the effects of climate change).

Emission of green house gases from vehicles is the most common effect of unnecessary idling. Most people think that pollution caused by idling can be ignored because there is a common belief among general people that damage caused to the environment by idling is much less than some other sources of pollution. They believe taking action to reduce or eliminate idling is not very important. But the fact is- unnecessary idling of vehicles causes a significant damage to the environment by emitting green house gases and also wastes large amounts of fossil fuels. According to Natural Resources Canada in peak winter Canadians waste 2.2 million litres of fuel due to unnecessary idling which produces over 5 million kilograms of GHGs (Natural Resources Canada 2010). If drivers of light-duty vehicles avoided idling by just three minutes a day, over the year Canadians would collectively save 630 million litres of fuel, and \$630 million in fuel costs (assuming a fuel cost of \$1.00/L). Idling can also damage the engine and thereby cause financial losses to the owner of the vehicles (Natural Resources Canada 2010).

Many countries have taken actions against unnecessary idling. Some have completely banned idling of vehicles and some have made laws or bylaws for the reduction of idling time. The purpose of this inquiry paper is to analyse the reasons for idling, analyse existing laws and bylaws, recommend policy measures to reduce idling and suggest use of several technologies that are available to reduce idling.

2. Why do people idle?

Warming up or cooling down a vehicle is the most common reason given for idling, in the winter and summer. Surveys show that Canadians also idle their vehicles for many other reasons that include:

- waiting for passengers
- stopping at railway crossings
- waiting to park
- running quick errands
- sitting in drive-through lanes
- waiting to refuel or to have the car washed
- stopping to talk to an acquaintance or friend
- preparing to leave the house

A survey of driving habits and behaviour of Canadians by Natural Resources Canada suggest that in the peak of winter, many Canadian motorists idle their vehicles for about eight minutes a day, which results in a combined total of more than 75 million minutes of idling a day. This alone uses over 2.2 million litres of fuel and produces over five million kilograms of greenhouse gases (GHGs) and is equal to the amount of fuel required to drive over 1100 vehicles for a year or to idle one vehicle for 144 years (Natural Resources Canada 2010).

Almost all the Canadian drivers do some idling everyday all through the year. Research was done by Natural Resources Canada to find out the typical idlers. It shows some interesting trends-

- The amount of idling tends to increase with the number of people in the household.
- A driver living with children is more likely to idle than one without children.
- Frequency of idling appears to decrease with age, for example- a retired person is least likely to idle.
- A person living in a rural area is more likely to idle than a driver living in an urban centre. Regionally, a person in British Columbia is the least likely to idle a vehicle.

3. Emissions Impact from Idling:

Vehicle emission is a major source of green house gases and also other air pollutants, which not only endanger the global climate but also has adverse health effect. Some of the major emissions from vehicles are – carbon dioxide, volatile organic compounds, nitrous oxides, etc (Natural Resources Canada 2010). Among these emissions carbon dioxide (CO₂) is classified as a greenhouse gas (GHGs). Green house gases increase the earth's natural "greenhouse effect" and thus contribute to the changing of the world's climate by increasing temperature and also other adverse effects. Other emissions, such as volatile organic compounds (VOCs), carbon monoxide (CO) and oxides of nitrogen (NO_x), are criteria air contaminants (CACs) and these emissions are known to contribute towards air pollution and smog, adverse health effects are a direct result of these pollutants (Natural Resources Canada 2010).

The following sections outline the impacts of GHG and CAC emissions from vehicles.

3.1. Green house gas emissions

For every litre of gasoline used, a vehicle produces about 2.3 kilograms of CO₂, the principle GHG linked to climate change (Natural Resources Canada 2010). How much fuel does a vehicle use during idling? Research shows that-

- An average 3 litre engine uses 300 millilitres of fuel for 10 minutes of idling
- An average 5 litre engine uses 500 millilitres of fuel for 10 minutes of idling (Gower and Mee 2009)

Transportation sector is one of the major contributors of GHGs in Canada, figure 3.1 shows GHG emissions from different sectors in Canada and transportation sector contributes 27% of the total GHG emissions.

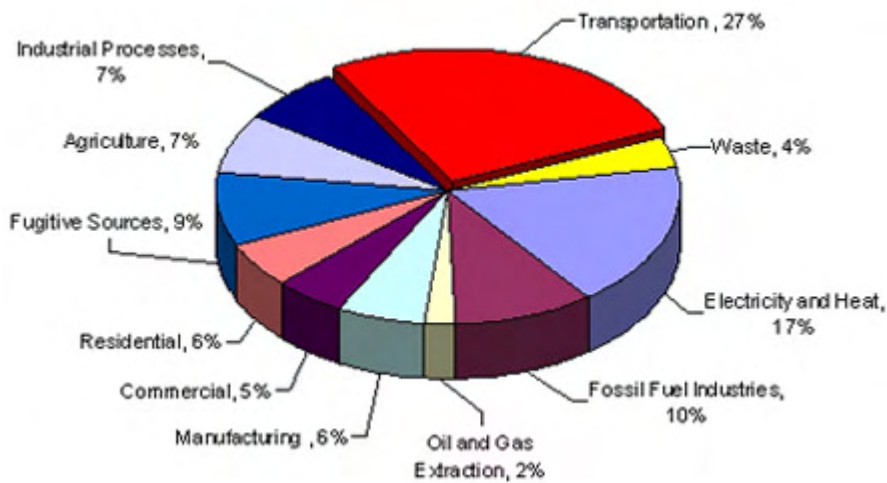


Fig: 3.1: GHG emissions from different sectors in Canada (Source: Environment Canada National Inventory Report for the Year 2005).

With internal combustion engines, no technology exists for eliminating CO₂ emissions, an unavoidable by-product of burning fossil fuels. Reducing or more preferably removing unnecessary idling is the most effective way of reducing GHGs emission and thereby reducing climate change.

3.2. Air quality emissions

Other vehicle emissions, such as volatile organic compounds (VOCs), carbon monoxide (CO) and oxides of nitrogen (NO_x) are criteria air contaminants (CACs) that contribute to air pollution and smog.

Advanced emission control technologies (e.g., catalytic converters, exhaust gas recirculation, engine monitoring sensors, computer controls and feedback systems) have dramatically reduced CACs from the tailpipes of new vehicles. In fact, today's vehicles produce 99 percent less CACs than vehicles built in the 1970's (Natural Resources Canada 2010). However, CAC emission reductions from newer vehicles have been partially offset by the growing number of vehicles on the road and the greater distances we now travel.

Within the context of idling, reduction of unnecessary idling can save a significant amount of fuel and reduce GHG emission, the effect on CAC emissions is dependent upon a variety of factors related to restarting the engine. A study completed in 2003 concluded that “there is little (CAC) impact in the choice of vehicle operation (idling or shut down) when the vehicle is stopped for durations between 10 seconds and 10 minutes”. What this means in terms of CAC emissions is that there is no substantial difference between turning the engine off and restarting it versus letting your vehicle idle, as both options produce almost same CAC emissions.

A study of diesel school buses waiting in the wintertime found that restart and immediate departure produced fewer air pollutants compared to idling (Kinsey, et al. 2007). The USEPA measured PM, NO_x, CO, and PAH from buses under idle and restart conditions and found that for periods longer than three minutes, more pollution was created by idling than by turning buses off and restarting them. In all cases they identify turning off the engine and restarting with immediate departure as a preferred approach (Kinsey, et al. 2007).

The risks from elevated pollution due to idling extend to passengers as well as to people outside the vehicles. Research shows that school buses self-pollute, meaning that emissions from the bus enter directly into the passenger compartment, even when the windows are closed. These pollutants concentrate more during idling (Environmental Defense, The Clean Air Task Force, and The Conroe Independent School District 2007; Sabin, et al. 2004). Opening the door of the bus after time spent idling, as is often done when buses are waiting to pick up children, can cause a spike in PM concentrations inside the bus.

Self polluting is a common phenomenon in many other heavy duty vehicles. A report prepared for the USEPA studied pollutant concentrations inside and outside long-haul trucks while parked at a rest stop. Emissions from other nearby idling trucks affected outside concentrations of particulate matter, and subsequently in-cab concentrations (Doraiswamy, et al. 2005)

4. Misconceptions About Idling

Saving Fuels

The most common misconception among people is the belief that shutting vehicles off and back on consumes more fuel than idling. A recent study shows that Americans believe 4 minutes is the time when someone should shut off their vehicle engine and not idle anymore, vehicle should be idled for almost 4 minutes before turning it off to save fuel (Carrico, et al. 2009). However, Natural Resources Canada suggests that idling for more than ten seconds uses more fuel than shutting off the engine and turning it back on. The American Society of Mechanical Engineers Florida Section conducted a test which supports this conclusion (American Society of Mechanical Engineers Florida Section n.d.)

Save the Engine from wear and tear

Many people think that shutting down and restarting the vehicle frequently could cause damage to some parts of their car such as the starter and the battery (Natural resources Canada 2010). For most light-duty vehicles, the wear and tear cost of frequently turning the vehicle off and back on is estimated at about \$10 per year (Gower and Mee 2009). This expense is much less than the cost of fuels that are burnt by idling their vehicles unnecessarily.

Unnecessary idling increases maintenance costs for vehicles and reduces the time period between engines rebuilds (Natural Resources Canada 2010). Engine oil contamination can occur in gasoline or diesel engines, when idled for long periods. This contamination is more than the contamination caused while driving the vehicle. Oil contamination is more prevalent in diesel engines because of the large amount of intake air used in the diesel combustion cycle. When idling at low rpms, such as 600 rpm, the excess air in the combustion process cools the cylinder liners, resulting in incomplete combustion and condensation of unburned fuel on the cylinder walls. The lubrication effect of the engine oils are thus reduced because these deposits are eventually drawn into the engine sump where they contaminate the engine oil. According to the American Trucking Association, a truck idling for one hour suffers wear and tear equivalent to being driven seven miles (Brodrick, et al. 2002). Prolonged idling typically reduces the

operating life of engine oil by 75 percent, from 600 engine-hours to 150 engine-hours (Gower and Mee 2009)

Additionally, idling produces carbon deposits and unburned fuel residues that accumulate and can damage the engine at several vital points. Idling trucks excessively can result in more frequent servicing of spark plugs, fuel injectors, valve seats and piston crowns (Gower and Mee 2009)

Warming up the Vehicle

Most Canadians idle their vehicle to warm up the car engine during cold weathers. This a total misconception by drivers of the vehicles because with advances in technology, light-duty vehicles are best warmed up while they are driven. Heavy duty vehicles may require a limited warm-up period from a cold start, and may also need time for the engine to cool down before vehicle shut-off. Even in heavy-duty vehicles, driving appears to be an effective way to warm up. The Ontario Ministry of Transportation investigated whether idling was an effective way to warm up engines in cold weather. The tests measured the amount of time needed to raise the coolant temperature from -10°C to its normal operating temperature of 80°C. By driving the vehicle just after start-up (when the oil pressure is up), the coolant temperature rose to 80°C in just 12 minutes. By contrast, it took 30 minutes to raise the coolant temperature to that level while idling the vehicle (Natural resources Canada 2010). In addition, driving will warm the drive train, the differential oil and transmission oil, and the tires so they can roll better (Gower and Mee 2009). Also once the engine is fully warmed up; brief stops are unlikely to cause sufficient cooling to require warm-up periods. Natural Resources Canada cites studies indicating that for heavy-duty vehicles, it takes 12-14 hours for a hot engine to cool to the outside temperature (Natural resources Canada 2010).

Protecting Vulnerable Populations

For people with disabilities or limited mobility, leaving a vehicle when outdoor temperatures are extremely hot or cold in order to warm up or cool down may not be practical.

Currently, idling is permitted under the Toronto municipal bylaw when temperatures inside a vehicle are above 27° C or below 5° C (Gower and Mee 2009). Idling is also permitted if a driver or passenger can produce a doctor's note certifying that medical reasons require that temperature or humidity be maintained within a certain range. These exemptions were put into place to protect people from very hot temperatures which can arise in vehicles in the summertime or extreme cold in winter. On a typical sunny day in Canada, the temperature inside a parked vehicle can exceed 50° C in just 10-20 minutes, and opening a window provides little relief. For people who are vulnerable to extreme heat or who cannot leave their vehicle when temperatures are high (perhaps due to limited mobility), use of air conditioning is a recognized health-protective measure.

However, the temperature exemption presents a challenge to enforcement. Because enforcement officers do not have right of entry into a vehicle, there is no way for them to assess the temperature inside vehicles. As well, enforcement officers are required to record an outdoor temperature which adds to the time required and increases the complexity of issuing a warning or fine.

The exemption also allows idling on days when air quality is already likely to be poor. Air pollution is often poorest on days when temperatures are very high. From 2004 to 2006 all but one of 45 heat alerts or extreme heat alerts coincided with a day when the air quality was associated with a moderate or high risk to health (according to the air quality health index). Permitting excessive idling on hot days could exacerbate the effects of poor air quality at a time when people may already be having difficulty coping with effects of heat and air pollution (Gower and Mee 2009).

Special Needs of Heavy-Duty Fleets

The reasons that heavy-duty vehicles idle may be different and depend on their function. Long-haul truckers often idle to maintain a comfortable temperature overnight or to power electronic accessories such as a television or refrigerator in their sleeper cabs. Municipal vehicles may idle their engines in order to power auxiliary equipment, including safety lights and aerial lifts. In certain types of vehicles, such as emergency vehicles, idling is needed to power equipment such as lights and tools.

Transit vehicles idle when passengers are getting on and off the vehicles. Buses need to remain on in this situation for several reasons

- To operate the bus doors.
- To illuminate the destination at the front and back of the bus for the convenience of the transit users.

Transit vehicles also frequently idle during layovers. Sometimes scheduled delays happen for the transit vehicles to adjust the time with service schedules. Transit vehicles idle during those waiting periods. Limiting idling of transit vehicles to very short times could cause emissions reductions devices on the buses to fail.

5. How Do Drive-Thrus Encourage Idling?

Every day, millions of Canadians enjoy the convenience and safety of drive-thru restaurant service. Parents with infants, people with mobility challenges, seniors - for these groups the drive-thru is a very helpful service. It's also a safe option for anyone traveling at night or in bad weather. But drive-thrus encourage drivers to idle their vehicles. Idling is a major source of emitting GHGs and burning excessive fossil fuels.

Restaurants such as McDonalds and Tim Hortons earn large amounts of money by providing drive-thru service to their customers. These restaurant owners will never want to stop or even reduce the amount of drive-thru service. Because of the awareness raised by the anti-idling community about the dangers of drive-thru, Tim Hortons decided to conduct a study on this topic. They hired a consulting firm, RWDI Consultants from Guelph. Tim Hortons asked them to run a study to determine which is worse for the environment - idling in the drive-through line, or parking your car, walking into the restaurant, and restarting your car again upon leaving. RWDI's Tim Hortons funded study finds that it is better for the environment to idle your car than it is to park and walk into the restaurant. The report was shown to the Natural Resources Minister Gary Lunn on Feb. 7, 2008. After that several changes were made to the idle-free zone website, the safe to idle time frame was raised from 10 seconds to 60 seconds. But several controversies exist relative to the study commissioned by Tim Hortons. This report has yet not been published for common use. Several contributing factors can affect the result of this study,

such as, the time of data collection, the weather condition and also the locations of the drive-thru restaurants from where these data were collected. The reliability of this report may be questioned because no verification has been done by independent experts. If the threshold time for shutting down and restarting an engine is 10 seconds of idling, then the safe idle time should remain and be published as 10 seconds.

Idling your car is non-ideal in every sense, it might take more time for a customer to drive in to the parking zone, park the car, shut down the engine then walk to restaurant, then come back to the car and start the engine again, drive out of the parking zone to the road. But this process runs systematically and makes people aware of the fact that idling a vehicle is impactful. Idling, no matter what the reason or no matter how small the time frame is, it is less than ideal because it uses fuel for no good reason. The drive-thrus encourage this unnecessary idling so no matter how financially beneficial they are to the company and convenient to the customers, they are bad for the environment. Drive-thrus should not be permitted. Even if permission is given, there should be some new policy for reducing the idling tendency of the drivers in drive-thrus and the restaurants which run these drive-thru services; they should take part in these actions.



Fig 5.1: Sample signs that can be used in drive-thrus.

Every drive-thru should have some kind of signs or posters directing drivers to shut down their engine while in queue (Figure 5.1), the effects of idling should be mentioned in short, the attendants in the drive-thru should request the drivers to shut down their engine if the delivery should take longer than usual. They can also enlighten the drivers by posting the effects of idling in their packages or coffee mugs or cold drink mugs or napkins or perhaps appropriate signage.

6. What is being done worldwide?

Engine idling and vehicle emissions are a serious contributor to greenhouse gases. Many nations around the world cite transportation as the largest producer of carbon dioxide in their countries. Engine idling reduction strategies are one example of how communities around the world can assist citizens in taking responsibility for their climate change contributions. Policies to reduce engine idling vary from community to community and country to country.

In the USA, the reduction of unnecessary engine idling is slowly permeating into the mainstream consciousness, because more research is being done and more effective policy measures are being taken; however there is much room for improvement. Currently trucks are permitted to idle for 5 minutes in each one-hour period. Many Canadian communities allow 3 minutes of idling in a one hour period. Even though North Americans are slow to catch on about the need to reduce unnecessary engine idling compared to the European community, much of the rest of the world is making strides to improve air quality and reduce greenhouse gases.

In Sweden, individuals have long refrained from engine idling when stopped in vehicle traffic. In Switzerland, there are laws that you have to turn your engine off if you are waiting at a red traffic light. Scotland and England have cracked down on engine idling through education campaigns, fines and air pollution awareness strategies. In other European countries, permissible durations of engine idling vary from 10 seconds to 3 minutes. Italy and France allow 10 seconds, while drivers can idle for 40 seconds in Germany and 60 seconds in Holland. Several cities in Taiwan have banned engine idling effective in 2008. Hong Kong, Japan and Singapore allow 3 minutes of engine idling in any one-hour period. Fines and enforcement measures varies country to country (Williams 2009).

So the question arises, how is the European community able to reduce idling while the North America is so far behind? What are the contributing factors?

A simple answer could be the awareness among the citizens. Countries like Switzerland, Sweden, England and many others are running educational campaigns for the citizens to learn about the effects of unnecessary idling and teaching them how to reduce idling. Also in many countries the law enforcement departments are very strict about unnecessary idling and several types of penalties and fines have been imposed by different countries (Williams 2009). But still the question remains because North American countries are also running educational campaigns and trying to grow awareness among the people, but it is not working as efficiently as the authorities would like to. Then what could be the contributing factors that are restraining people from listening to the anti idling campaigners?

Could it be the level of education among the people in both continents? According to CIA World Facebook, the level of education and the per capita income rate in both continents is almost the same.

A major contributing factor could be the price of fuel. The price of gasoline is lower in North America than European countries. So if the level of education and per capita income are the same, as the price of fuel is higher in Europe, people there are thinking more about saving money and that is why they are trying to reduce the unnecessary waste of fuel. This in turn is making them more knowledgeable about environmental pollution and they are trying to act accordingly to save the environment to save their hard earned money. They are also switching to new technologies and new vehicles to reduce the environmental pollution and unnecessary waste of fuel. On the other hand North American countries are still enjoying the luxury of lower fuel prices, so maybe they are not much careful about the small amount of fuel they waste while they are idling their vehicles unnecessarily because they don't have to pay a high price for it. If the fuel prices were increased then they are more likely to start thinking about saving money by not wasting unnecessary waste of fuel, and they may become more aware of environmental pollution. One thing leading to another they may become more aware of many other kind of environmental pollution that they carelessly perform in everyday life (Department of Environment and Natural Resources, Government of Northwest Territories 2009)

7. Analysis of anti-idling bylaws in Ontario:

Currently several municipalities in Ontario have passed anti-idling bylaws. Some of them are stand alone bylaws and some are anti-idling provisions included in other bylaws such as noise bylaw or clean air bylaws. Currently 15 municipalities in Ontario have passed stand-alone idling control bylaws. These include: Burlington, Guelph, Huntsville, Kingston, London, Markham, Niagara Falls, Oakville, Pickering, Stratford, Toronto, Vaughan, Whitchurch/Stouffville, Windsor and Woodstock.

General provisions of the bylaw set out a certain period of time allowed for the drivers to idle their vehicles. This time limit ranges from 3-5 minutes. Some municipalities also specify areas of the community where idling is prohibited – usually residential areas, near schools, etc. Kingston, Toronto and Windsor also prohibit the idling of boats.

Exemptions are a common component in all the idling bylaws. The common features of these exemptions are as follows-

- Fire, police and medical service vehicles
- Vehicles participating in emergency activity
- Vehicles stuck in traffic
- Hot (+27°C) or cold (-5°C) weather conditions
- Passengers with a medical letter certifying their need for controlled temperature or humidity
- Mobile workshops with equipment powered by the motor, during the course of their work
- Where idling is necessary for maintenance or repair of the vehicle
- Transit vehicles while passengers are embarking or disembarking
- Transit vehicles at a layover or stopover with passengers on board
- Vehicles in a parade or other event authorized by the community
- Armoured vehicles.

The bylaws also state that if someone who is not eligible for the above mentioned exemptions and still idling their vehicle, they should be penalized. Penalties vary from municipality to

municipality. The fines vary from 100 to 380 dollars. Many existing bylaws do not specify the enforcement agency but some bylaws include a clause that identifies the agency or agencies responsible for enforcement, for example:

- By law enforcement
- Parking enforcement
- Police
- Public Health inspectorate (the City of London is the only municipality that has allocated enforcement responsibility to its public health department).

Some municipalities include anti-idling provisions in their noise control bylaws. General provisions under these laws prohibit the emission of sounds resulting from specific acts listed in the bylaw. The application of the bylaw is often restricted to certain locations and/or certain periods of time. Typically, idling is prohibited for more than 5 minutes. In several municipalities, idling provisions only apply in residential areas or quiet zones.

The following are some of the exemptions that are normally mentioned in anti-idling provisions in noise bylaws:

- Vehicle is in an enclosed structure
- Continuous operation is essential to the basic function of the vehicle or equipment
- Equipment manufacturer recommends longer idling periods
- Weather conditions justify the use of heating or cooling systems for the welfare of passengers, animals or cargo
- Low temperatures require idling after start-up
- Idling is for the purposes of flushing the radiator (where the work is performed other than for profit).

The law enforcement agencies are responsible for enforcing these bylaws and several types of penalties are mentioned for those who don't comply by these laws. Detailed analysis of these bylaws can be found in Natural Resources Canada's Energy Efficiency website. All the stand alone bylaws and anti-idling provision in other bylaws in different municipalities in Ontario were analysed for this section (Natural Resources Canada 2010).

8. Analysis of anti-idling bylaws in BC:

Unlike Ontario, municipalities in British Columbia don't have any stand alone bylaws to date. But they do have provisions for an idling policy to be included in other bylaws such as noise and clean air bylaws as well as in parking and traffic control bylaws. Some municipalities are still working on idling policies. General provisions in those bylaws include that no vehicle can idle more than a certain period of time. The time frame varies from municipality to municipality and ranges from 5 to 15 minutes depending on the reason of idling and type of vehicle. Fines for not complying by these laws range from 100 to 250 dollars.

There are certain conditions when vehicles can exempted from not idling. Some of the common exemptions are-

- buses, fire apparatus, police, or emergency medical service vehicles while engaged in operational activities, including training and patient transfer activities;
- commercial motor vehicles participating in an emergency activity;
- commercial motor vehicles that remain motionless because of an emergency, traffic conditions (including congestion and signals), weather conditions, or mechanical difficulties over which the driver has no control;
- commercial motor vehicles where idling is required as part of the repair process or to prepare the vehicle for service;
- armoured vehicles where a person remains inside the vehicle while guarding the contents of the vehicle or while the vehicle is being loaded or unloaded;
- commercial motor vehicles engaged in a parade or race or any other such event authorized by Council;
- Mobile workshops.

Bylaws are not strongly enforced in many municipalities as there is much confusion about the exemptions applied in the bylaws and also in many cases no law enforcement agencies have been assigned to look after enforcement of these bylaws. But BC is taking this matter very seriously and they are working on making a strong anti-idling policy in many municipalities.

Detailed analysis of these bylaws can be found in Idle Free BC website. All the bylaws which include anti-idling provisions in them are included in this website (Idle Free BC 2010).

9. Analysis of anti-idling bylaws in USA:

The USA is taking idling of vehicles very seriously and many anti-idling bylaws have been made and enforced state-wise. Almost all the states in USA now are either adopted stand alone anti-idling bylaws or have provision of anti-idling included in other bylaws. Enforcement of these anti-idling bylaws has been strengthened and different kind of penalties and fines have been clearly mentioned in those bylaws. But most of these bylaws don't include private vehicles in them, mostly diesel operated vehicles, school buses and fleet vehicles are included and these are the main focus.

General provisions in these bylaws allow specific type of vehicles for certain period of time. The time frame for idling ranges from 5 to 15 minutes depending on the reason for idling and the type of vehicle and also the region. Different penalties are included in those bylaws for non-compliance, and it ranges from 50 to 600 dollars. Lower fines for first time non-compliance are common and if happens repeatedly then higher penalties are imposed.

Similar to bylaws in Canadian municipalities several exemptions are included and some of the common exemptions are as follows-

- If refrigeration or warming is required to control the inside temperature of the vehicle
- In case of loading or unloading equipments need to run
- Construction or repair works
- If the engine need to run because of repairing the vehicle,
- Lighting and other fixtures need to run.
- Fire trucks, ambulance, police cars are exempted from the law while performing duty.

The law enforcement agencies are responsible for enforcing these laws and in many bylaws specific agencies are assigned the responsibility for enforcement of the laws. A list of idling control bylaws of different States in the USA can be USEPA website. The website includes all the bylaws and the provisions and exemptions in them in details (USEPA 2009).

10. Why are these anti idling bylaws not working?

Despite anti-idling bylaws being present in many municipalities, residents are not fully complying with these laws and because of some of the exemptions provided in the bylaws make it difficult for the law enforcement agencies to enforce the laws. Some of the problems will be discussed below.

- **Provisions vary in different bylaws by different municipality.** Personnel from several municipalities in the Greater Toronto Area commented on the inconsistency of bylaws among neighbouring municipalities and the difficulties that drivers have in knowing what the rules are and at what arbitrary place on the map these rules change (Natural resources Canada 2010). More consistent bylaws across regions, and similar enforcement practices and penalties would increase the impact and effectiveness of idling control bylaws.
- **Exemptions provided are creating confusions.** The exemptions in the Toronto bylaw were the result of a significant process of public consultation. At the time of enactment, each exemption had a rational justification. However, in practice, the large number of exemptions results in a very uneven application of the bylaw and excuses many highly visible vehicles from the requirement to reduce idling. This limits the emission reduction impact of the bylaws. It also creates a feeling among some citizens that the law is unfair, because it is not applied to all idling vehicles.
- **Temperature Exemptions.** The Toronto bylaw, and several others exempt vehicles from idling limits where the inside temperature of the vehicle is above 27°C or below 5°C. At least six bylaws passed in recent years provide an exemption when the outside temperature is above 27°C or below 5°C. Three jurisdictions have done away with the temperature exemption altogether, and the model bylaw proposed by the GVRD makes no mention of a temperature exemption. Markham's bylaw provides for an exemption when the temperature is below 0°C or above 30°C. The temperature exemptions create several problems. First, enforcement personnel point out that it is almost impossible for a bylaw officer to determine the inside temperature of a vehicle. It is possible to determine the outside temperature, but the outside temperature exemption still requires an enforcement officer to check the temperature during the time of the idling offence,

which complicates enforcement. Smog days often occur when the temperature is above 27°C and so the idling control bylaw cannot be enforced on the days when it would be most important to do so for air quality purposes (Natural resources Canada 2010).

- **Transit Vehicles on Layover or Stopover have different idling provisions.** Typically, transit vehicles are allowed to idle for 10 or 15 minutes while on a layover or stopover. Some bylaws limit this idling to times when passengers are on the bus. Others prohibit this idling when it is "substantially for the convenience of the operator," which may be difficult to determine. Diesel-powered transit vehicles can consume large amounts of fuel when idling, and create significant exhaust emissions (Natural resources Canada 2010).
- **Idling time allowed.** After much research, it has been proved that idling a vehicle for 10 seconds is the threshold limit for shutting down the engine and starting again. Yet existing bylaws allow idling by the general public for three, five, and in some instances, ten minutes, and allow transit vehicles to idle for ten or fifteen minutes. This is too much flexibility provided for the idlers and will not really help the cause of reducing idle time.
- **Inconsistent Idling Provisions in Idling control and Noise Bylaws.** A few jurisdictions have a stand-alone bylaw as well as anti-idling provisions in a noise or other bylaw. In at least two municipalities, the provisions differ in respect to the amount of time the idling is allowed – with 3 minutes allowed in the idling control bylaw versus 5 minutes in the noise bylaw (Natural resources Canada 2010). This could result in difficulties enforcing the shorter time limit.

11. Use of technology to reduce idling:

There are several technologies available now that can remove those causes which are mainly used by idlers to justify their idling. One of the main reasons for idling the vehicle is warming up the engine during winter. Now there are several technologies available to remove this problem. Separate heating equipment is available to heat the engine without starting the engine of the vehicle, with this heating equipment taking power from the battery of the vehicle or from some other electric source.

One of the biggest idlers is truck drivers and they do have valid reasons for idling. They drive long periods of time and when they rest they need heating or cooling depending on the weather and also need some sort of enjoyment for which they need to run the radio or television inside the truck. But to run all these equipments and heating or cooling equipment whichever applies according to weather conditions, they need to turn on the engine. Also during many operations vehicles need to use lights for direction purposes and for that they need to start the engine. But due to the current provisions in many anti-idling bylaws, truckers cannot idle their vehicle for more than 5 to 15 minutes in an hour period. But they still idle their vehicle because they fall under the exemptions according to many bylaws. Diesel driven vehicles consume a large amount of fuel while idling. In the USA 840 million gallons of diesel is wasted per year due to idling long haul trucks (Stodolsky, Gaines and Vyas 2000)

But these problems can easily solved by using several technologies available now.

- **Battery-Electric Auxiliary Power Systems**

Using advanced battery packs, battery-electric auxiliary power systems provide heating, cooling, and electrical power to ancillary cab appliances. These systems are designed so that the primary engine charges the batteries during normal road operation. However, certain systems equipped with the capability to "plug in" also allow operators to use shore power to charge the battery and/or power the system. The battery packs require approximately 2-6 hours of charge time and can run the air conditioning system for up to 12 hours per full charge. The option to "plug in" is available at participating layover locations (California Environmental Protection Agency 2009)

- **Vehicle-Battery Systems**

Vehicle-battery systems are less expensive alternatives more commonly used in day cab applications. Currently, vehicle-battery systems on the market offer either cab heating or cab cooling, but not both. Some examples of vehicle-battery systems include heated coolant recirculation systems, evaporative cooling systems, and window fans. Although these systems typically offer limited services, they can be paired with other devices. For example, pairing an evaporative cooling system with a fuel-fired heater can provide a more complete climate control package (California Environmental Protection Agency 2009)

- **Truck Stop Electrification (On-Board Power Infrastructure)**

By installing on-board electrical hardware and an electrically-powered climate control system, drivers can "plug in" their vehicles and draw electricity directly from the power grid. The electricity can be used to provide cab heating and cab cooling, to power cab appliances, and to charge the vehicle's battery. Access to the grid is achieved through outlet pedestals installed at participating layover locations (California Environmental Protection Agency 2009)

- **Truck Stop Electrification (Off-Board Power Infrastructure)**

For an hourly fee, providers may offer heating, cooling, television service, telephone service, and internet service through a duct that attaches to the vehicle through an adapter (one-time purchase) fitted into the vehicle's side window opening. Electrical outlets are also provided for powering ancillary cab appliances such as microwaves and televisions. Since direct heating and cooling are provided, vehicle operators can avoid the costs of purchasing and installing on-board electrical and climate control equipment. Service is available at participating layover locations (California Environmental Protection Agency 2009)

- **Thermal Energy Storage Systems**

A Thermal energy storage system stores cooling energy from the vehicle's air conditioning system during normal road operation. The stored energy can be used to cool the cab at a later time when the engine is off. This system only provides cooling, but can be paired with a fuel-fired heater for a more complete heating and cooling package (California Environmental Protection Agency 2009)

- **Diesel-Fuelled Auxiliary Power Systems**

Diesel-fuelled auxiliary power systems use small diesel engines to generate power for cab heating, cab cooling, and operating ancillary cab appliances. These units can also be used to heat the engine block in cold weather and recharge the vehicle's battery. Because of the engine's smaller size, operating a diesel-fuelled auxiliary power system uses only a fraction of the fuel that would be used by idling the vehicle's primary engine (California Environmental Protection Agency 2009)

- **Fuel-Fired Heaters (Fuel Operated Heaters)**

Fuel-fired heaters provide heat to the cab and the engine block, and use only a fraction of the fuel that would be used by idling the vehicle's primary engine. They can also be paired with other cooling technologies for a more complete heating and cooling package (California Environmental Protection Agency 2009)

Also fleet operators can use GPS tracking devices which are now available with the option of calculating idle times of the vehicle and which gives information to the driver about how much time he is idling in a certain period of time and also sends information to a central unit from where the fleet operators can gather information about idling time of their fleets. So they can act accordingly to reduce the idling of their fleet and also drivers will be more careful because of the observation done by some central unit.

12. Policy implications:

Governments around the world are now thinking more seriously about idling. There is no alternative to a good policy for this purpose and governmental bodies in Canada need more efficient and easily enforceable policies for reducing idle time. Though many municipalities around Canada have bylaws and policies for reducing unnecessary idling, they are not unified and different municipalities have different provisions and different allowable idle times. Also there are too many exemptions and exemptions also vary in different municipalities. People move within different cities for jobs or other purposes and it is hard for them to know the laws of different areas and also law enforcement agencies have a difficult time to enforce anti-idling bylaws because these differences in bylaws in different municipalities.

So a harmonized anti-idling law is needed for successfully reducing the unnecessary idling of vehicles. Also the policy should include all type of vehicles in those laws, and provisions for different vehicles should be mentioned clearly. Also exemptions should be simplified and minimized as in many cases idlers misuse the exemptions provided and get away from getting penalized.

In addition, the allowable idle time varies in different municipalities. If a central anti-idling bylaw is not a possibility in the near future, at least a common allowable idle time should be

accepted by all the municipalities and policies and laws should be amended that way. Also the current allowable idle times are much too flexible and are far higher than the threshold time of 10 seconds. The allowable idle time should be reduced to a reasonable amount and is proposed to be within 10 to 30 seconds. The allowable idle time can be proposed by a federal law as the threshold value of idling versus shutting and restarting the engine does not change much in different places, so it will be much more convenient for the law enforcement agencies if the federal government proposes a constant allowable idle time to be followed by the whole country. The federal government can also propose some of the exemptions, but exemptions which depend on the weather condition or traffic condition or some other factor which differs from province to province should be left for the provincial government and the provincial government can propose those exemptions. The law enforcement agencies responsible for enforcing the laws and penalties for breaking the law should be proposed by individual municipalities. The law enforcement situation, traffic condition, economic condition, law & order situation- these factors need to be considered while proposing the enforcement of these bylaws and penalties, so the municipal government should propose those.

13. Recommendations:

- A unified allowable idle time should be proposed by the Federal government and adjusted to a more justifiable limit; it is proposed that the limit should be within 10 to 30 seconds.
- Rather than trying to justify and analyse the exemptions provided in different bylaws, use of technology to reduce idling for those exemptions should be made compulsory. Every diesel-driven truck should be equipped with the necessary equipment so that it can run heating or cooling or other necessary functions by separate units which can provide power without needing to start the engine. As the fleet operations take place nationwide- these provisions should be proposed by the federal government to avoid province to province to differences.
- Idling the vehicle for heating or cooling should be banned by the provincial government and vehicle owners should use separate heating or cooling equipment to warm up their engine.

- Fleet operators should be encouraged by the provincial governments to use GPS tracking devices to control the idling of their fleet vehicles.
- Educational campaigns should be run by the owner of drive-thru restaurants for the enlightenment of the users of these drive-thru services about the effects of idling. They should be asked to put signs or posters about the effects of idling in the drive-thru where every driver who passes by can see the posters or signboards. They should also be asked to put anti-idling signs or pictures in their packages or coffee mugs or drink mugs.
- People will be more aware about reducing their fuel use if the price of fuel is increased and they will then start caring about that small wastage of fuel during idling their vehicles.

14. Conclusions:

Idling wastes fuel for unnecessary reasons, there is an input of energy without any reasonable output that can be justified. Idling emits greenhouse gases which pollute the climate, affect public health and contribute to climate change. The waste of fuel also means the waste of money. If idling can be removed then we can reduce green house gas emissions and the burning of fossil fuels to a great extent.

The proper application of policies along with use of helpful technologies can greatly help the cause of reducing unnecessary idling. Every province should work on making their own anti-idling policy and that common policy should be implemented in every municipality in that province. Also a more justifiable time frame should be selected for allowable idling time. The current practice of allowable idling time is much higher than the threshold time of 10 seconds.

Idling of any kind is impactful on the environment and our energy future. Claims by different groups that say that idling in the drive-thru queue is better than parking the car and then starting again and driving out of the parking lot is better should be critically examined.

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