

# **A Primer for Trading Greenhouse Gas Reductions from Landfills**

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## ***Introduction***

In December 1997, Canada, along with 160 other countries, completed negotiations of the Kyoto Protocol under the United Nations Framework Convention on Climate Change (UNFCCC). This Protocol includes reduction targets and a timetable for six greenhouse gases. Upon ratification, the Protocol will commit Canada to a greenhouse gas reduction of 6 per cent below 1990 levels in the period 2008-2012.

Whether the Protocol is ratified or not, Canada has recognized that it has to reduce its domestic greenhouse gas emissions to help slow the phenomenon of Global Warming leading to Climate Change. Landfill gas capture and destruction (flaring or utilization) has been singled out as making a potentially significant contribution to meeting this target. Domestic greenhouse gas emission trading, or carbon trading, as a result of landfill gas capture and combustion is one tool that can be used to help meet the goal of reducing greenhouse gas emissions.

This document is an introductory level primer on domestic greenhouse gas emission trading specifically written as it pertains to the landfill gas emissions of carbon dioxide (CO<sub>2</sub>) and methane (CH<sub>4</sub>). This primer includes samples from the PERT and GERT pilot projects to help illustrate the calculation and documentation of greenhouse gas emission reductions that are available from landfill sites.

As the rules for domestic emissions trading are still evolving the information in this primer reflect the situation in the winter of 1999/2000.

## ***Emissions Trading***

Emission reduction trading, commonly referred to as carbon trading, is a relatively simple concept.

Emission trading is an economic tool which, in essence, allows for a large number of parties to meet total emission reduction requirements at lower costs by working together. Emission trading allows qualified surplus emission reductions to required limits to be traded to other parties needing to meet emission limits.

In theory, if one party can reduce emissions to a level lower at a lower cost than a second party can then the first party could maximize emission reductions and sell any surplus (beyond their regulated limits) reductions to the second party to help meet its reduction requirements. The aim is to improve the overall flexibility and economic efficiency of obtaining emissions reductions.

## Seller (Creator)

The seller of an emission reduction is one who has exceeded his regulated or voluntary emission reduction requirement, or is in possession of unused, banked or traded emission reductions, and is looking to sell these quantified emission reductions. In the case of landfills, the owners of the landfill gas would be the sellers (or creators of emission reductions). The specific reductions must be real, surplus, quantifiable and verifiable.

Creators of emission reductions have to be conservative in their creation calculations. The requirement for trading credits requires rigorous, defensible and verifiable calculations of the reductions claimed.

## Buyer (User)

The buyer of emission reductions is usually a party who has to meet a regulated or voluntary reduction in emissions. The buyer would logically try to reduce emissions from his own operations up to the point where it would be less expensive to buy emission reductions credits than to continue to invest on his own reduction efforts. Buyers tend to be large company's combusting large amounts of fossil fuels having significant inventories of GHGs emissions.

A buyer can also be an investor who believes that the value of emission reductions will increase with time. An emission reduction can, subject to the specific trading system, be bought, held (banked) and traded (sold) by anybody and at almost anytime.

## ***Types of Emissions Trading***

While there are two principal forms of emission trading, allowance trading (sometimes referred to as Cap and Trade) and an open market trading system, presently only pilot open market trading systems are in place in Canada for landfill gas reductions.

An open market trading system is one in which anyone can create an emission reduction and sell or trade this emission reduction on the market. The buyers of the reductions are parties who typically have to meet either a regulated or voluntary cap on their emissions. The advantage of an open system is that anyone can create emission reductions and sell them. This not only allows for smaller players to reduce emissions and offer them for sale, but, by allowing anyone to participate it is argued that innovation is encouraged and emission reductions are not limited to easily regulated sources. The overall effect is to reduce the total amount paid by society to meet emission reduction targets. It is closer in operation to a marketplace, a buyer beware market where much more responsibility is placed on the buyer to make sure that the emission reductions purchased are real, quantifiable, surplus, verifiable and unique.

Examples of open market emission trading are the domestic greenhouse gas emission trading projects now being piloted by PERT and GERT.

### ***What is PERT and GERT? VCR, ÉcoGESte and the Clean Air Registry?***

The Pilot Emission Reduction Trading (PERT) and the Greenhouse Gas Emission Reduction Trading (GERT) are two pilot emission trading projects designed to explore and develop the concept of emission reduction trading in Canada. Voluntary Challenge Registry Inc. (VCR Inc.), ÉcoGESte and the Clean Air Registry, are the keepers of an inventory of emission reductions that have been created. These registrars of emission reductions play a vital role by keeping track of emission reductions in Canada so that they are not double counted or traded more than once. They also provide some assurance to the seller and buyer as well as the regulators that claimed emission reductions are legitimate.

#### **Pilot Emission Reduction Trading (PERT)**

PERT was the first major emissions trading project in Canada. PERT was started in 1996 as an industry led, Ontario based emission reduction trading project. The initial focus of PERT was NO<sub>x</sub> and VOC emissions in southern Ontario but expanded to include CO, SO<sub>2</sub> and CO<sub>2</sub> in 1997. By 1999 almost 14 thousand tonnes of NO<sub>x</sub> and over one million tonnes of carbon dioxide emissions had been registered as emission reductions from that project. Though an Ontario based project, PERT does trade emissions from other jurisdictions that affect the provincial airshed. The greenhouse gas emission airshed is considered to be global, so greenhouse gas reductions created in other jurisdictions are allowed under PERT.

#### **Greenhouse Gas Emission Reduction Trading (GERT)**

The Greenhouse Gas Emission Reduction Trading Pilot (GERT) is designed to test the effectiveness of emission reduction trading for greenhouse gases in the Canadian context. Launched in June 1998, this pilot is a multi-stakeholder partnership between the Canadian federal government, a number of provinces, industry, labour and environmental groups. GERT trades only greenhouse gases. The project has developed a trading rule and is encouraging emission reduction creations and trades.

## The Registries: VCR Inc., ÉcoGESSte and Clean Air Registry.

VCR Inc. is a stand-alone, not-for-profit corporation dedicated to encouraging private and public sector organizations to voluntarily limit their net greenhouse gas emissions, as a step towards meeting Canada's climate change goals. VCR's mission is to provide the means for promoting, assessing and recognizing the effectiveness of the voluntary approach in addressing climate change. ÉcoGESSte is the voluntary registry in Quebec.

VCR Inc. records the ownership and movement of greenhouse gas registered emissions reductions (RERs) for the GERT pilot project.

PERT, as a trading project for NO<sub>x</sub>, SO<sub>x</sub>, VOCs as well as greenhouse gases, is using the Clean Air Emission Reduction Registry for its emission trading. A private company, Clean Air Action Corporation (CAAC), developed this registry. For the purposes of the PERT pilot project, Clean Air Action Corporation volunteered the use of their registry. The registry is also being used by a number of state level trading programs including Connecticut, Massachusetts, New Jersey, and Texas where CAAC is involved in the trading process. The Registry has information on credit availability, and when registry clients permit, price information can also be released.

The Registry also records important information on all the emission reductions listed - pollutant, quantity, location, generation season (ozone or non-ozone), creation and use histories, and information on the protocols used to generate the credits. It also contains account balance information on each series of reductions and for each company or individual that has created or owned an emission reduction.

### ***Landfill Emissions***

The landfill emission reductions most commonly traded today are the greenhouse gases. Landfill gas is mainly composed of methane and carbon dioxide in close to a 50/50 mixture with some other trace emissions. Accounting for quantities of greenhouse gases emissions is done in equivalent tonnes of CO<sub>2</sub> where one tonne of methane reduction is equivalent to 21 tonnes of CO<sub>2</sub> in terms of global warming potential. Since the organics in landfills which lead to the generation of methane are considered coming from renewable biomass, the collection and combustion of landfill gas can be considered to reduce the greenhouse gas emissions from landfill by 100%, on a global basis.

Greenhouse gas emission reductions are considered to be a global issue, meaning that a reduction in CO<sub>2</sub> anywhere in the world is equivalent to the same reduction anywhere else. But associated co-benefits such as odour control, safety from explosion and asphyxiation, reduced emissions of volatile organic compounds which contribute to smog formation and reduced stress on vegetation at landfills are local in nature.

Destroying landfill gases can also reduce other emissions such as volatile organic compounds which may then be eligible for trading under PERT. While greenhouse gases can be traded in both GERT and PERT, only PERT allows for the trading of other emissions, mostly smog causing emissions. Some of the unique issues involved in emissions trading that apply to smog gases include the impact of the local airshed, directionality, distance, and ozone seasons. Refer to the PERT pollutant schedule available from the PERT web site for the pollutant trading schedule that illustrates the local constraints for trading smog emissions in Ontario.

### ***Emission Reductions***

To be eligible and counted as an emission reduction created at a landfill, a reduction has to be real, quantifiable, surplus, verifiable, and unique. While GERT and PERT are substantially similar, there are subtle differences to eligibility criteria between the two Canadian pilot trading projects. Refer to the specific trading rules of each pilot for details for creating emission reductions. Generally emission reductions have to be:

**real:** an emission reduction is real if it is a reduction in actual emission rate, resulting from a specific and identifiable action or undertaking which is not a mere change in activity level, (e.g. due to typical business fluctuations).

**quantifiable:** an emission reduction is quantifiable if the total amount of the reduction can be determined, and the reduction is calculated in a reliable and repeatable manner.

**surplus:** an emission reduction is surplus if it is not otherwise required of a source by current regulations or other obligations (e.g. a voluntary commitment). In most cases landfill owners have installed landfill gas recovery in the absence of regulations.

**verifiable:** an emission reduction is verifiable if other parties are able to audit and confirm the source data used to develop the emission reduction.

**unique:** credits shall only be created and registered once from a specific reduction activity and time.

## ***Four Steps in the Creation of an Emission Reduction***

### **Step One: Establish your baseline**

Examine your operations and see what your present and past emissions have been. This is important in establishing a “baseline” emission level against which any reductions will be measured. A baseline is the level of emissions that were taking place for a pre-selected year before any measures were undertaken. The year for the baseline is either established by the trading system, by the regulatory authority or is a voluntary selection.

For greenhouse gas emissions, the baseline should be post 1990 to be in agreement with the obligations of the Kyoto GHG reduction protocol. But in most circumstances another year is chosen. For example, if a landfill site has been closed for some years and a new collection and destruction system is put in place, then a baseline of emissions based on the year before the new system was installed may be more appropriate.

Creation requirements, depending on the trading project being used to register the credits, may dictate baseline years. For example, under PERT, emission reductions typically have had to be made in the past 5 years (except for greenhouse gases which may go back to 1990 to coincide with the Kyoto protocol) while under GERT, the reduction has had to have been made since January 1, 1997.

### **Step Two: Undertake action to reduce emissions**

Take a proactive stance on early emission reductions. Delaying making emission reductions not only may be a lost opportunity to earn credits but it also harms the environment.

The reduction in emissions at a landfill have to be real, quantifiable, verifiable and surplus to be able to be counted for emission trading. In landfill operations, the capture and destruction of landfill gases either by flaring or utilization are the predominant means of reducing GHG emissions.

Ensure that you have assigned the rights to the emissions reductions in all contracts. Whether you are a landfill owner or landfill gas project developer, you should make sure that gas rights agreements and/or other project contracts clearly spell out who has the rights to any potential future emissions reductions. Otherwise, you may face a legal battle over ownership of the reductions in the future.

### **Step Three: Calculate the emission reduction**

Having established a baseline and having implemented a reduction measure, the calculations have to be done to quantify the GHG reductions that have taken place as a

result of your action. These calculations can be performed by your staff or by consultants in the area of emission reduction. The better the quantification, the higher the value of the emission reductions. Calculations have to be verifiable and well documented by the seller.

First, perform an inventory of landfill methane emissions and reductions. This includes collecting data on your landfill gas flare and utilization systems, including the date these projects went into service and the gas flow at the flare, engine, or pipeline.

Continue to maintain good records of your landfill methane emissions reductions at the flare or energy recovery system. Once you have performed an inventory, you should monitor your flares and energy recovery systems and regularly record the gas quantity and quality that is being combusted. Remember that an emission reduction calculation has to be verifiable so complete records have to be maintained as well as a history of the landfill operation.

Because methane generated in landfills is considered to come from organic biomass the collection and combustion of landfill gas can be considered to reduce greenhouse gas emissions by 100%. To calculate the amount of greenhouse gas reductions at a landfill:

1. meter the gas collected and combusted,
2. determine the quantity of methane in the gas (landfill gas is typically 50% methane),
3. convert from volume of methane to tonnes of methane (the density of methane is 0.717 kg/cubic metre at Standard Temperature Pressure (0°C)), and
4. multiply the tonnes of methane combusted by 21 to get the amount of greenhouse gas reduction in tonnes of equivalent carbon dioxide (eCO<sub>2</sub>).

#### **EXAMPLE**

1. Landfill gas flow: 1 000 cubic feet per minute (cfm) = 40 781 cu.m/day of LFG
2. Methane concentration @ 50% = 20 390 cu.m./day of methane
3. 20 390 cu.m/day of methane x 0.717 kg/cu.m. = 14 620 kg of methane/day = 14,6 metric tonnes of methane/day
4. 14,6 metric tonnes of methane/day x 21 (Global Warming Potential of methane) = 307 tonnes of carbon dioxide equivalent/day or 112 064 tonnes of eCO<sub>2</sub>/year

#### **Step Four: Submit the emission reduction to a trading project and registry**

Once you have collected data and completed calculations of eligible greenhouse gas emission reductions and/or other emission reductions, submit them to the trading project, PERT or GERT, using the appropriate trading rules. Submitters are the creators/sellers of the reductions with or without the inclusion of a buyer of the reduction.

The emission trading pilot project will review the emission reduction calculations before submitting the reductions for posting on an emissions registry such as the VCR Inc. or Clean Air Registry. Emission reductions might be registered at multiple projects/registries but can only be traded once. The sale or trade takes place between the buyer and seller in private negotiations either before or after review by the pilot.

It is up to the buyer of the emission reductions to satisfy themselves that the reductions created are legitimate (buyer beware). These emission reductions will then be submitted to a regulatory authority such as the Provincial Ministries of the Environment in lieu of reducing emissions at a regulated facility. The regulatory authority will have the final say in whether the emission reductions are acceptable.

#### ***Costs of Emission Trading***

The cost of cataloguing and calculating credit creations will also vary but should not be overwhelming, typically less than \$5,000. As a rule, the better the documentation the easier, more straight forward and cheaper the cost of validating and registering the reductions with a trading pilot or registry will be.

At the present time, landfill gas reductions can be brought to GERT and PERT by the creators of the emission reductions and/or their agents.

Now that landfill owners and operators have the opportunity to sell emission reductions, some marginal landfill gas operations can become economical and even profitable.

#### ***Issues That Arise When Trading Emission Reductions***

While each trading pilot has specific interpretations and wording for issues surrounding greenhouse gas emissions trading, some issues common to both projects include:

**OWNERSHIP** - Who has actual full claim to the emission reduction - the one taking the reduction actions or others who may be connected to the reduction initiative?

**LIABILITY** - Who is responsible when a purchaser of credits use them for compliance and a regulatory agency questions them?

**PRICE DISCLOSURE** - Should financial information (prices requested and paid) in a trade be public, or should only summary information (e.g. averages) be made available?

**QUALITY OF CREDITS** - How does the buyer determine the quality (acceptable to a regulator) of the credits being purchased? Is there a need for the regulatory agency to be involved and should this occur at creation, at transfer, or use of the credits?

**TIMELINESS OF INFORMATION** - If credits were created a long time ago, are they as acceptable to the regulatory agency now? What if the source of credits goes out of business after another company has purchased the credits but before those credits have been used?

**UNCERTAINTY** – How should the uncertainty be dealt with in respect to the possibility that the quantity of credits claimed may not reflect the actual quantity of emissions reduced, either intentionally or unintentionally through measurement errors, inaccurate modeling of emissions, inappropriate assumptions of emission, etc.? Governments have the last say on whether they will accept the emission reduction credits.

**CONFIDENTIALITY** - Does refusal for full review or verification of credit creation information, for proprietary reasons, limit the quality of credits?

**SURPLUS** – Has the seller/creator of the emission reductions met all its obligations before selling emission reductions?

**ADDITIONALITY** – Additionality is the issue of whether the action which created the emission reduction would have taken place anyway (without the incentive of emissions trading).

### ***Economics of Selling***

In the emission reduction open trading marketplace, the price of credits will be determined by the supply/demand for the credits. Reductions will also be valued according to the quality of the creations. Therefore, a well-documented and rigorously documented credit creation will command a better price than a weak creation. Nobody knows what the future value of emission reductions will be. Indeed, except for specific time periods of the pilot projects (such as the recognition of reductions created under PERT's "Letter of Understanding" and GERT's "Memorandum of Understanding"), no one can even guarantee that today's reductions will be recognized tomorrow much less how much they will be worth.

So the decision as to whether to buy, sell or hold is completely up to the parties. How they read the market, what they are using the credits and revenue for, what regulations

and emission targets they are subject to now and what they may be in the future will affect their decision.

### ***More Information***

#### **GERT (Greenhouse Emission Reduction Trading)**

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#### **VCR Inc. (Voluntary Challenge Registry Inc.)**

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## **Canadian Climate Change Sites**

<http://climatechange.gc.ca/>  
<http://nccp.ca>

## **Provincial Ministries of Environment**

See local directories

## **IPCC**

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## **Appendix A - Frequently Asked Questions**

### **1. Why would I do anything now and not later when it may be required?**

One reason to consider implementing emission reductions in landfill sites immediately is to capture the opportunity to create emission reductions as soon as possible. By not taking immediate action, the emissions escape into the atmosphere damaging the environment. It also means that an opportunity may be missed for the sale of these credits.

### **2. Won't legislation force the capture and use of emissions anyway?**

Perhaps, but by implementing early measures for the capture and destruction of the global warming potential of the landfill gas immediately, the benefits to the atmosphere start immediately. As well, any emission reductions created before being legislated are considered surplus and may be eligible for emission trading or for use in a future compliance program.

### **3. Won't I just have to meet higher standards later on so am I not making it more difficult to meet further standards?**

No. Industry and government are working out a baseline protection system of recognizing any measures taken before legislation is in place. This protects proactive firms from being penalized for capitalizing on the opportunity to reduce emissions before they are required. This concept is called "baseline protection" and means emission reductions will be used to reconstruct baselines if there are any future legislated reductions.

Conversely, a system of "credit for early action" encourages early implementation of emission reduction strategy. Credit for early action is a system to recognize any steps taken by owners in reducing emissions before required by regulation.

### **4. What options are there for landfill gas reduction?**

As with most control initiatives there are a number of ways of reducing emissions or their potency. With landfill gas, the most used method is to collect the gases and burn them. This method of flaring the landfill gas is often employed for odour control or to reduce the possibility of explosion. Done properly, flaring destroys the methane in landfill gas. One tonne of methane combusted is equivalent to 21 tonnes of carbon dioxide reduction.

When the combustion of the landfill methane is done for electricity generation, space heating or other utilization, it may be possible to claim additional credits for this offset of fossil fuel use. Landfill gas can also be used for heating facilities, it can be cleaned and piped into natural gas distribution systems or used as stock material in manufacturing.

## **5. What is the future of emissions trading?**

As Canada and the rest of the world commit to reducing greenhouse gases, which lead to global warming, increased attention is being paid to developing and implementing emission trading. Various countries, including Canada and the United States, are in the process of exploring the role of credit for early action, baseline protection legislation and emission trading may play in future domestic and international emission trading.

It appears that greenhouse gas emission trading could become a tool, one among many initiatives, used to meet the challenge of addressing greenhouse gas emissions.

**Appendix B – Global Warming Potential of Greenhouse Gases**

<b>Greenhouse Gas</b>	<b>Global Warming Potential</b>
Carbon Dioxide (CO <sub>2</sub> )	1
Methane (CH <sub>4</sub> )	21
Nitrous Oxide (N <sub>2</sub> O)	310
HFC's	140-11,700
Perfluorocarbons (PFC's)	7,000-9,200
Sulphur Hexafluoride (SF <sub>6</sub> )	23,900