

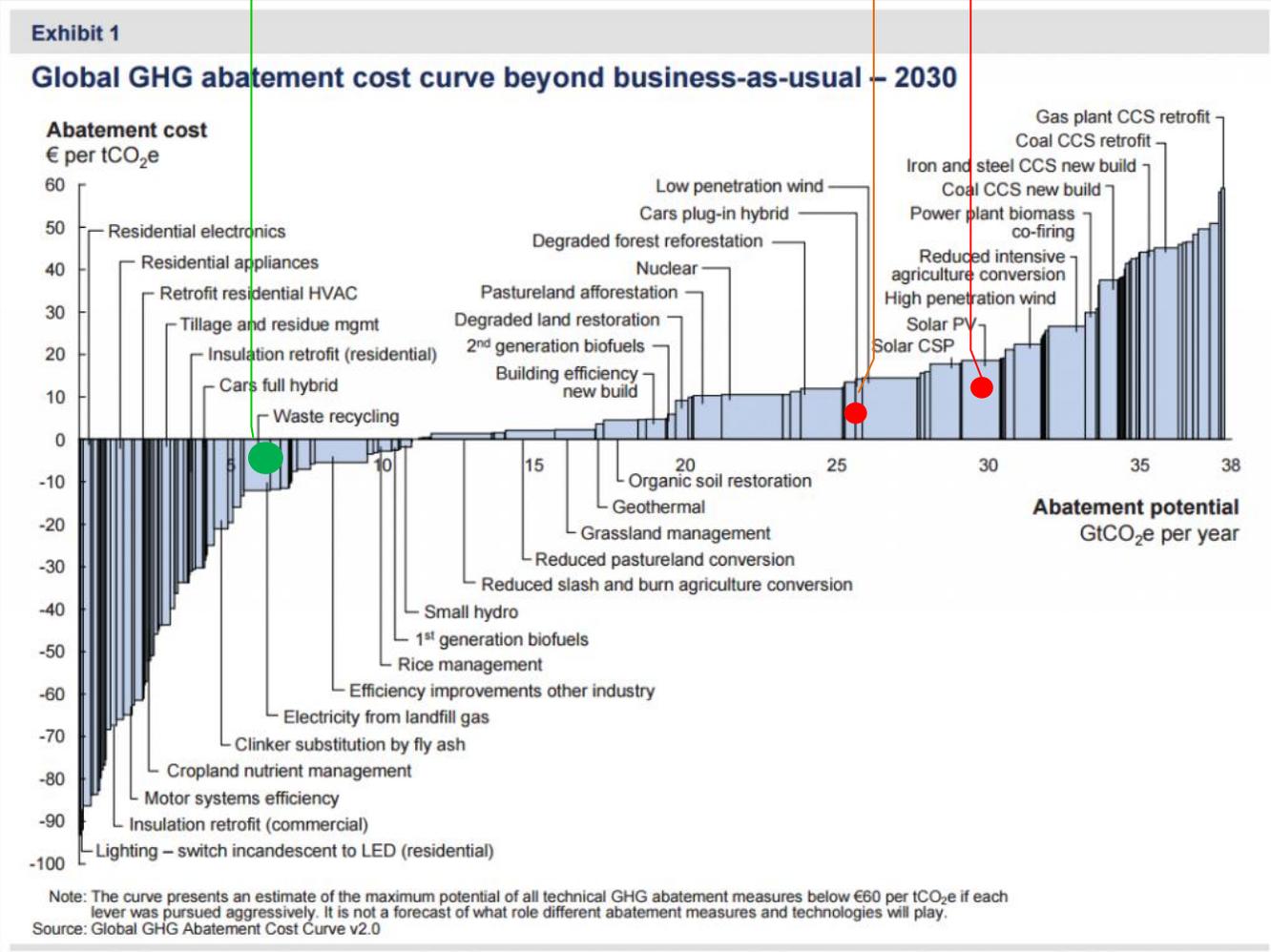
How much does it cost to reduce 1 tonne of CO<sub>2</sub> eq GHG emission ?

..... **Your Choice Makes a Big Difference** .....

**Residential Organic Waste Recycle**

**Electric Car**

**Solar PV**



## 1, Description: GHG emission and Organic Waste Recycle

### GHG emission reduction in Organic Waste Recycling Process Industry

Most municipals have been working on organic waste recycling for near 10 years. But only a part of the waste is recycled and diverted, more than half still ends up in landfills. Each tonne of organic waste landfill may emit 1.85 tonne CO<sub>2</sub> eq. Organic waste landfills account 4.0% of total GHG emission in Ontario.<sup>1</sup>

In residential recycling, 1.67 Mt CO<sub>2</sub>eq GHG can be reduced if new techniques are deployed in recycling process.

- 1, Ontario Residents generate **1.8 mega tonnes** organic waste each year.<sup>1</sup>
- 2, Only 42% of the waste is recycled or composted, and nearly **58%**, or **1.04 Mt** ends up in landfills.<sup>2</sup>
- 3, 1.04Mt waste will produces **1.93 mega tonnes CO<sub>2</sub> eq** GHG emission.<sup>3</sup>
- 4, Residential organic waste accounts 1.14% of total GHG in Ontario<sup>4</sup>
- 5, There were no adequate **techniques** in daily residential recycling. The "yuck factor" (odours, flies and maggots) of organic waste has held back more than 50% residents from participating recycling program.
- 6, Residential organic waste recycling rate can be boosted from 42% to 92% if this barrier is eliminated.

This will be an absolute reduction of **1.67 mega tonnes CO<sub>2</sub> eq** GHG in Ontario.

#### Notes:

- <sup>1</sup> This figure does not include leaf and yard waste, ICI and CRD waste.  
The average recycling rate is about 45% if leaf and yard waste is included.
- <sup>1</sup> Fig.2, Page 3, OWMA (Ontario waste management association) report, Dec 2015.  
Statistics Canada, CANSIM Tables 153-0043 and 153-0045.
- <sup>2</sup> Fig.2, Page 3, OWMA (Ontario waste management association) report, Dec 2015.  
Page 21, OWMA (Ontario waste management association) report, Dec 2015.
- <sup>2</sup> 45-55% residents use Green Bin, over 40-65% organic waste ends up in landfills, (page 13,14,15 Waste Watch Ottawa Report, 2017)  
52% residents use Green Bin, over 50% organic waste goes landfills, (Canfresh project, one by one Survey conducted in 2016, among 305 single house households in Nepean, Ottawa).
- <sup>3</sup> Organic waste landfill GHG factor: food waste, 1kg in weight = 1.85 **CO<sub>2</sub> eq**. 1.0 metric tonne food waste = 1.85 tonnes CO<sub>2</sub> eq.  
Table 1, Page 8, OWMA report, Dec 2015.  
Table 1, U.S. Environmental Protection Agency,
- <sup>4</sup> Fig.1, Page 2, OWMA (Ontario waste management association) report, Dec 2015.

## 2, Canfresh Organic Solution

### Direct GHG reduction in Organic Waste Recycling Process Industry by deploying Canfresh Eco Recycle in residential households

1, Most residents are positive in green bin program <sup>5</sup>. But they need clean and easy recycle techniques. Canfresh Eco Recycle first time makes organic waste recycling **as easy as blue box or black box**.

2, Canfresh team has been working on organic waste collecting and storing since 2014.

Canfresh system improves the waste recycling processes, helps residents divert more waste from landfills.

Up to **1.67 mega tonnes CO2eq** GHG reduction can be reached annually in Ontario if this system deployed.

3, Canfresh Eco Recycle is **an add-on equipment** based on the exiting green bin program.

The system regulates the temperature and humidity in the green bin to prevent waste from rotting,  
to kill larva and flies.

Canfresh makes everyday recycling **easy, clean and convenient**.

4, Direct benefits from Canfresh Eco Recycle system.

(estimation based on **each Canfresh** unit for one household of three persons, in 10 years' equipment life span.)

4.1, Directly reduce GHG by up to **3.83 tonnes CO2 eq** / each unit

4.2, Save **\$242** in direct landfill cost. ( \$118/ per tonne in weight ) . <sup>6</sup>

4.3, Save **\$548** in compost bags in 10 years. ( save 15-20 cents each day compare to using compost bags )

4.4, Store organic waste up to **2-4 weeks** .

4.5, **Clean and easy to use**. No odours, no flies, no vermin. A great improvement in the quality of living .

5, Canfresh costs about \$52 / per tonne CO2eq reduced, that is 1/3 to 1/5 of the cost in electric car GHG reduction.

6, Potential **1.67 mega tonnes CO2eq** GHG reduction annually in Ontario.

#### Notes:

<sup>5</sup>, 45-55% residents use Green Bin, over 40-65% organic waste ends up in landfills, (page 13,14,15 Waste Watch Ottawa Report, 2017)

52% residents use Green Bin, over 50% organic waste goes landfills, (Canfresh project, one by one Survey conducted in 2016, among 305 single house households in Nepean, Ottawa).

<sup>5</sup>, Residential organic waste recycling rate is about 42% in Ottawa if leaf and yard waste not included.

( Leaf and yard waste recycling rate is 90% to 95% in most cities ).

Source: Composting by households in Canada. Environstats by Iman Mustapha, Environment Accounts and Statistics Division.

<sup>6</sup>, Waste landfill cost, **\$118 - \$134** / each metric tonne in weight in Ontario. The Canadian Press · Posted: Oct 01, 2017

( \*\* no official data source in landfill cost in 2018 )

3, Canfresh is commercially available and approved for use in Canada & USA by authorities

The Canfresh Eco Recycle system,

designed and manufactured according to Canada and US Safety Regulations,  
and Natural Resources Canada Energy Efficiency Code.

Over 100 units were manufactured and tested in 2016.

- 1, UL SDT. 474
- 2, CSA SDT. C22.2. NO. 92
- 3, Energy Efficiency Valuation Canada:  
     $\geq 1.35\text{L (water) / kWh}$   
    Natural Resources Canada EEV
- 4, Intertek certification: 4007884
- 5, Canada Patent App No. 2924886  
    US, 15/078177
- 6, Registered with Canada NRCan/RNCan, Natural Resources Canada energy efficiency data base
- 7, Canada Trademark registration: 1763924  
    US Trademark registration: 5130328

4, List of main performances achieved.

	Projects and End User Conditions	Project Monitoring lasted time (in days )	Assessment / evaluation criteria
2016	In residential kitchens	180 days	<input type="checkbox"/> 1, energy consumption <input type="checkbox"/> 2, recycle rating improvement <input type="checkbox"/> 3, odours <input type="checkbox"/> 4, noise <input type="checkbox"/> 5, user's experiences feedback
2016	In offices	180 days	<input type="checkbox"/> 1, energy consumption <input type="checkbox"/> 2, recycling rate improvement <input type="checkbox"/> 3, odours <input type="checkbox"/> 4, noise <input type="checkbox"/> 5, user's experiences feedback
2017	In residential Garages	180 days	<input type="checkbox"/> 1, energy consumption <input type="checkbox"/> 2, recycling rate improvement <input type="checkbox"/> 3, odours <input type="checkbox"/> 4, vermin <input type="checkbox"/> 5, flies, maggots <input type="checkbox"/> 6, user's experiences feedback
2017	Rain and sun shielded outdoor conditions.	120 days	<input type="checkbox"/> 1, energy consumption <input type="checkbox"/> 2, recycling rate improvement <input type="checkbox"/> 3, vermin <input type="checkbox"/> 4, safety <input type="checkbox"/> 5, user's experiences
<p>* Project Assessment / Evaluation Criteria. 1-5, 1-6.</p> <p style="text-align: center;">All results are met the designing / targeting performances</p>			

## 5, GHG Emission Reduction Potential and Outcomes

### a) Description of base case and baseline emissions (in tonnes of CO<sub>2</sub>e)

- 1, Total Ontario residential organic waste = **1.8 mega** tonnes in weight. ( 2013, leaf and yard waste no included)
- 2, Up to **58%** residential organic waste ends up in landfills = **1.04 mega** tonnes in weight in landfills. <sup>note 1, 2</sup>
- 3, **1.04 mega** tonnes in weight = **1.93 mega tonnes CO<sub>2</sub> eq** in GHG emission in landfills.

### b) Estimate of the annual GHG reductions that the project is expected to generate, and how long the GHG reductions are expected to last

Value:

**1.67 mega** tonnes CO<sub>2</sub> eq can be reduced annually if recycling rate boosted from 42% to 92%. (2050 goal Ontario)

Description:

Canfresh survey showed that recycling rate can reach 92%-95% if an effective, easy and clean solution deployed in the garage of each single house household.

The GHG reduction will last for **30 years or more** until more efficient and advanced techniques are adapted.

### c) Estimate of GHG emission reductions (in tonnes of CO<sub>2</sub>e) for 2020, 2030 and 2050 that the project is expected to generate

2020	2030	2050
up to 460 tonnes CO <sub>2</sub> eq @ 1500 households	0.15 mega tonnes CO <sub>2</sub> eq @ 0.4 million households	1.52 mega tonnes CO <sub>2</sub> eq @ up to 4 million households

### d) Estimate of cost / tonne of GHG reduced

In residential recycling:

	cost	Notes	Life Span
Operation Cost	\$0.022 tonne CO <sub>2</sub> eq cost / per tonne CO <sub>2</sub> eq reduced	210kWh /year	
Equipment Cost	\$ 55.09 / per tonne CO <sub>2</sub> eq reduced @ >100,000 units	\$211 / each	10 years

\*\* In places such as restaurants, costs will be **less than \$20 / per tonne CO<sub>2</sub> eq reduced** due to larger recycling volumes.

\* Direct emission reduction:

1 unit Eco Recycle for 1 household of 3 persons. Average organic waste generated annually: 138kg / person, 414kg / each household.  
If Recycling rate increases from 42% to 92% after Eco Recycle deployed, landfill waste reduction: 207kg / year/ household.  
Total reduction in 10 years life span is **2.07 tonne in weight = 3.83 Tonne CO<sub>2</sub> eq.** / per household

\*\* Additional GHG reduction from replacement of chemical fertilize by organic fertilizer produced:

1 tonne food waste = 0.2 tonne organic fertilizer = 0.01 tonne chemical fertilizer = **0.13CO<sub>2</sub> eq** GHG reduction.  
Each Eco Recycle unit will further reduce **0.269 tonne CO<sub>2</sub> eq** in 10 years life span.

e) Description of the GHG emission quantification methodology used for the estimates generated above .

1, Ontario residential organic waste total = 1.8 mega tonnes in weight each year, 13million population in Ontario.

Each person generates an average of 138 kg organic waste in weight each year <sup>1</sup> .

Each household of three generates 138kg x 3 = 414kg organic waste in weight each year.

2, Organic waste GHG factor: 1 kg in weight = 1.85 kg CO<sub>2</sub> eq. ( or 1 tonne in weight =1.85 tonne CO<sub>2</sub>eq )

( 95% residential organic waste is food waste, leaf and yard waste not included in this project)

Electricity GHG factor: 1kWh electricity = 0.043 kg CO<sub>2</sub> eq. (factor = 0.043 kg CO<sub>2</sub> /kWh)

3, One Eco-Recycle unit for one household, an average of 3 persons / each household.

Present recycled waste: 173.9 kg/ each household annually before using Eco Recycle. ( at 42% rate )

Estimated recycle target: 380.9 kg/ each household annually after using Eco Recycle. ( at 92% rate )

An increase of 207kg / each household annually , 2.07 tonnes / each household in 10 years. <sup>2</sup>

4, Energy Cost in operation ( data based on Ottawa climate conditions, 2016-2017 )

0.7kWh /day @ 12°C, 1.4kWh/ day @26°C or higher, an average of 210kWh/ year, 2100kWh / 10 year.

210kWh = 9.02kg CO<sub>2</sub> eq, 2100kWh = 90.3kg CO<sub>2</sub> eq= 0.0903 tonne CO<sub>2</sub> eq.

5, Cost / CO<sub>2</sub>eq reduced: Equipment cost of each Canfresh unit; \$211.

GHG reduction from landfills = 2.07 tonne in weight x 1.85 = **3.83 tonne CO<sub>2</sub> eq** <sup>3</sup> in 10 years life span.

Cost = \$ 211 / 3.83 Tonne CO<sub>2</sub> eq. reduced = **\$ 55.09 / per tonne CO<sub>2</sub> eq. reduced.**

( This is more cost-effective compare to cost / per CO<sub>2</sub>eq reduced estimation in electric / hybrid car of \$300 )

Notes:

<sup>1</sup> This figure does not include leaf and yard waste, does not include ICI and CRD waste.

<sup>1</sup> Fig.1, Fig.2, Page 2, 3, OWMA (Ontario waste management association) report, Dec 2015.  
Statistics Canada, CANSIM Tables 153-0043 and 153-0045.

<sup>1</sup> Page 21, OWMA (Ontario waste management association) report, Dec 2015.

Of the 3.7 Mt of food and yard waste generated in Ontario, (1.8 Mt organic waste and 0.7 yard waste from residential, 1.2 Mt organic waste from ICI and CRD). 1.4 Mt organic waste is being diverted to anaerobic digesters (200 Kt), on-farm digesters (175 Kt), open windrow composting (520 Kt) and contained composting (485 Kt), backyard composting (200Kt) is not included.  
At least 1.48Mt (metric) organic waste ends up in landfill.

The above figure portrays the estimated waste generation by type for Ontario and is based on a data from Statistics Canada, Waste Diversion Ontario, and industry sources for 2012-2014.

<sup>2</sup> 45-55% residents use Green Bin, over 40-65% organic waste ends up in landfills, (page 13,14,15 Waste Watch Ottawa Report, 2017)

52% residents use Green Bin, over 50% organic waste goes landfills, (Canfresh project, one by one Survey conducted in 2016, among 305 single house households in Nepean, Ottawa).

<sup>3</sup> Table 1, Page 8, OWMA report, Dec 2015. U.S. Environmental Protection Agency, "Documentation for Greenhouse Gas Emission and Energy Factors Used in the Waste Reduction Model (WARM)", prepared by ICF International for the US EPA Office of Resource Conservation and Recovery, Washington, March 2015.

- f) Description of any non-GHG benefits resulting from the project and how long they are expected to last. Co-benefits may include the following:

Non- GHG benefits, based on Each Eco Recycle, 10 years life span.

1. Save **\$242** in direct landfill cost. ( \$118/ 1.0 tonne in weight) .<sup>6</sup>
2. Save 50% -75% cost in collection labours, save up to 50% cost in waste transportations.  
by making curbside weekly collection to bi-week or monthly .
3. Save over **\$548** cost in compost bags in 10 years.  
save 15-20 cents each day compare to using compost bags in green bin program.
4. A great improvement in quality of living .  
Store organic waste up to **4 weeks** .  
Clean and easy recycle. No odours, no flies, no vermin.
5. Make organic waste commercial processing more efficient.  
by increasing recycling volumes, decreasing water or moisture content in the waste .  
when use Canfresh Eco recycle system.
6. Possibly create 2 job positions in Circular Economy for each 1000 units Canfresh Eco Recycle deployed.  
( \$100,000 annual productivity for each full time job position)

Note 1,

<sup>6.</sup> Waste landfill cost, **\$118 - \$ 134/** each metric tonne in weight in Ontario. The Canadian Press. Posted: Oct 01, 2017  
( \*\* no official data source acquired in waste landfill cost )

## Market Potential

- 1, There are more than **4 million** units green bins used in waste recycle in Ontario.  
Waste-Free Ontario Act will make residential organic waste recycling a mandate.  
The market demands for "**clean, easy recycle**" solution for organics will be boosting in the coming 5-20 years.
- 2, Canfresh Eco Recycle is the most reliable and most practical solution in residential daily recycling.
- 3, Canfresh Eco Recycle is cost-effective. It benefits environment, government and residents.

Supposing government rebate this program in **100% cost** (equipment, installation and business cost),

The main positive results are as followings:

- 3.1, A **1.67 mega tonnes** CO2 eq GHG reduction at a low cost of **\$55.09 / per tonne CO2 eq.**
- 3.1, All the rebate cost can be recovered by means of "**Social Cost of Carbon**" reduction. <sup>note 7</sup>
- 3.2, **7600-8000** full-time job positions will be created in Ontario <sup>note 8</sup>. ( sales, installation and services)
- 3.3, Save **\$ 118 / per tonne waste** in landfill reduction.

Government will be benefit directly in rebate from this recycle solution.

- 4, Canfresh will benefit most residents in daily recycling practice.
  - 4.1, Save compost bags. That is \$55- \$73 saving per year, per household.
  - 4.2, Make every day recycling easy, clean and healthy.
- 5, Total potential market in Ontario  
About 4 million units in residential recycle. 40,000 units in commercial and industrial recycle (estimated).
- 6, Sectors of the economy : **Circular Economy**
- 7, Geographical applicability: All Ontario, most of Canada, all of USA.

<sup>note 7</sup> Social cost of carbon: \$ 78.4/ per tonne CO2 eq. in 2050

<sup>note 8</sup> Based on the estimation of \$100,000 productivity annual for each full time job position.

**b) Market potential**

**Comparison:**

Electric car GHG reduction, the cost is over \$300/ per tonne CO2 eq reduced. (\*\*note).  
Canfresh solution cost-effectiveness is better than electric car rebate program.

\*\* note 1:

Canada Fuel Association. <http://www.canadianfuels.ca/Perspectives-2018/The-high-price-of-lower-emissions>

\*\*note 2,

Total cost each unit / total number of units to be installed.

Estimated total cost each unit reaches \$ 410 at 15,000 units. (cost including installation, sales and services)

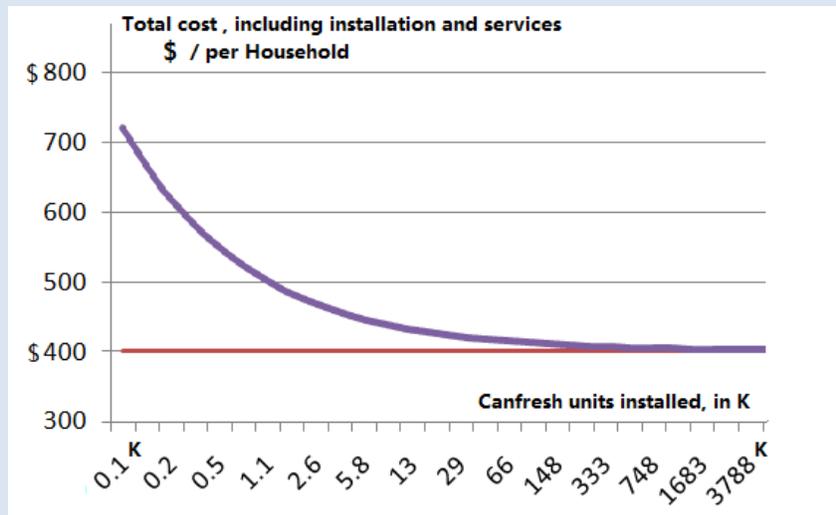


Fig.1, Canfresh costs (in \$) is related to the units number installed. (in 1,000 units)

c) Cost-effectiveness Analysis

Cost-effectiveness Q factor: basic motivations to both government and end users.

1, Market transformation drives: government.

If 100% cost is rebated by government or municipal, cost-effectiveness Q analysis is as follow:

- 1.1. Each Eco Recycle unit for one household of 3 persons. life span = 10 years.
- 1.2. 138kg / per person, annually residential organic waste generated.
- 1.3. Equipment cost \$ 211 each and will last for 10 years.
- 1.4. Direct reduction in landfill cost \$118 / per tonne waste in weight.
- 1.5. Gross profit for distributors or sales, \$120 each sale. (business cost)
- 1.6. Installation cost \$79 per installation.

where in: R = recycling rate increased, SCC= social cost of carbon per tonne CO2 eq in dollars  
Equivalence cost-effectiveness : Q

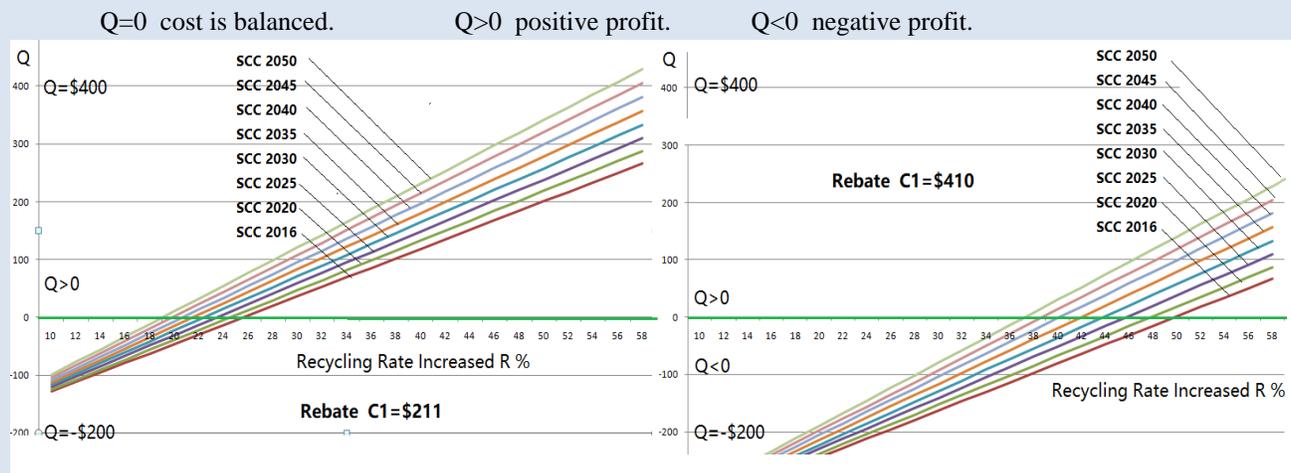
$$Q = \text{total equivalence benefits} - \text{total cost } C1$$

$$Q = \text{Landfill cost reduction } (\$118 \times 1.38 \text{ t} \times 3 \times R) + \text{Carbon cost recovery } (1.38 \text{ t} \times 3 \times R \times 1.85 \times \text{SCC}) - \text{total cost } C1,$$

where in C1=equipment \$211, (equipment only)  
or C1=\$410, (equipment \$211+ installation \$79 + cost in sales \$120)

$$Q = 488.52 R + 7.66 \times R \times \text{SCC} - C1$$

Fig. 2. shows the profit margin Q regarding different Rs and SCCs.



----- Fig. 2, Equivalent profit margins via Rebate, based on different initial cost, R and SCC -----

2, Potential benefit: the residents, end users.

Save 1 or 2 compost bags each day, that is \$548-730 in 10 years. ( 15-20 cents/ per bag )

Notes: SCC ( social cost of carbon central value ) in Canadian dollars

2016	2020	2025	2030	2035	2040	2045	2050
\$40.7	\$45.1	\$49.8	\$54.5	\$59.6	\$64.7	\$69.7	\$74.8

Updated Canadian SCC Estimates for Period 2010-2050, (2012, per tonne CO2, discounted at 3%). Social Cost of Greenhouse Gas Estimates, March 2016, Environment and Climate Change Canada, August 2015, the U.S. Environmental Protection Agency (USEPA)

d) Commercial and industrial recycling models are available soon

In commercial and industrial sector, bigger size models ( 60 -200 gallons or more in storage volume) is preferred.

Commercial and industrial models are also possible on customers' specific demands.

And the cost-effectiveness is much higher than in residential sector, so less the risk in practice

Visit our website at:

<https://allcanfresh.com/odourless-recycle-bin/>

<https://ecohome21.com/eco-recycle-solution/>

Watch Canfresh video at:

[https://www.youtube.com/watch?v=9\\_C0q0E9T0Y](https://www.youtube.com/watch?v=9_C0q0E9T0Y)