Will Waste Diversion make a Difference in reaching Canada's Kyoto commitment?: Applying Scenarios to Predict Feasible Targets for Change.

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Overview

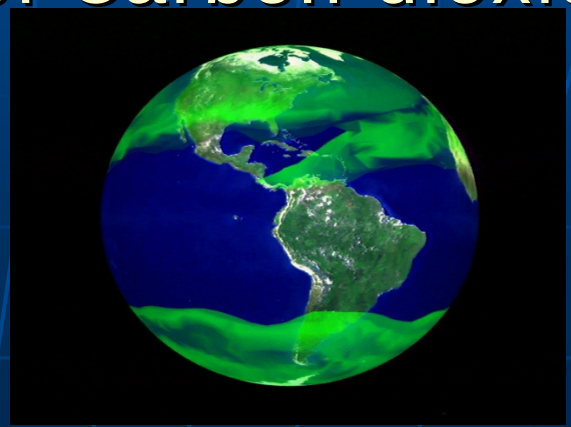
- Kyoto Protocol – just landfill gas?
- Super size waste or zero waste?: findings from the national landfill survey
- Zero wasting of organics through Composting
- Modelling scenarios – will waste diversion help us meet our Kyoto target?

Typical Landfill Gas content

- 40-60% Methane (CH_4)
- 30-50% Carbon dioxide (CO_2)
- 1-10% H_2, O_2, N_2 etc.
- 0.002-1% H_2S
- > 0.0001% Vinyl chloride

➢Methane has 21 times GWP of Carbon dioxide

NASA methane gas image



Introduction

- Kyoto Protocol

2012 – reduce GHG by 6% below 1990 levels

Could organic diversion help Canada fulfill its Kyoto agreements for the waste sector?

Landfill Gas

- GHG emissions from 97 active and 33 closed landfills
  - In 2005 methane emissions are 757 kt
  - In 2004 methane emissions are 735 kt
  - In 2003 methane emissions are 715 kt
- 52 recovery projects in Canada (30 active and 22 closed)
- Of the 757 kt of methane 318 kt (i.e. 42%) was captured in 2005
- 50% of those capturing use it for energy, remainder flared
  - 67.6 MW of electricity is produced and 2,118,920 million BTU of heat is generated

Shepard Landfill Gas Utilization Project, Calgary

To move towards Zero waste (and GHG) -We need **waste management policies** that:

- **Reduce consumption**
- **Prevent pollution**
- **Conserve resources**
- **Foster sustainable products**
- **Exploit all possible avenues for waste reduction (*i.e.*, source reduction, recycling, material substitution, education, etc.)**

Are we sustainable?

How long can this go on??

Are we sustainable?

How long can this go on??

Reduce, reuse, recycle City: Are we enroute?

- Do present waste policies and programs move towards zero waste & GHG?
  - Which ones?
  - Where?
  - Can we learn from those?

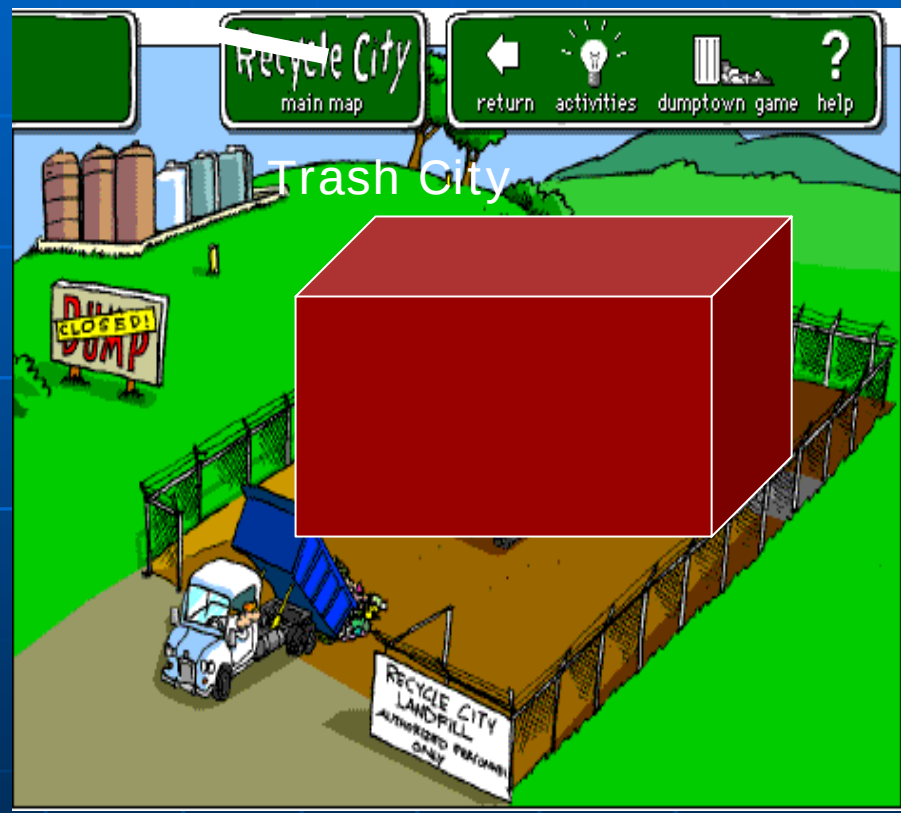
National Survey Results: Surveyed 300 landfills in 2006/07 (43% response rate)

7 provinces participated in the landfill survey

Province	Closed	Active	Total
British Columbia	9	6	15
Alberta	0	30	30
Quebec	3	15	18
Ontario	20	34	54
New Brunswick	0	5	5
PEI	0	1	1
Nova Scotia	1	6	7
	33	97	130

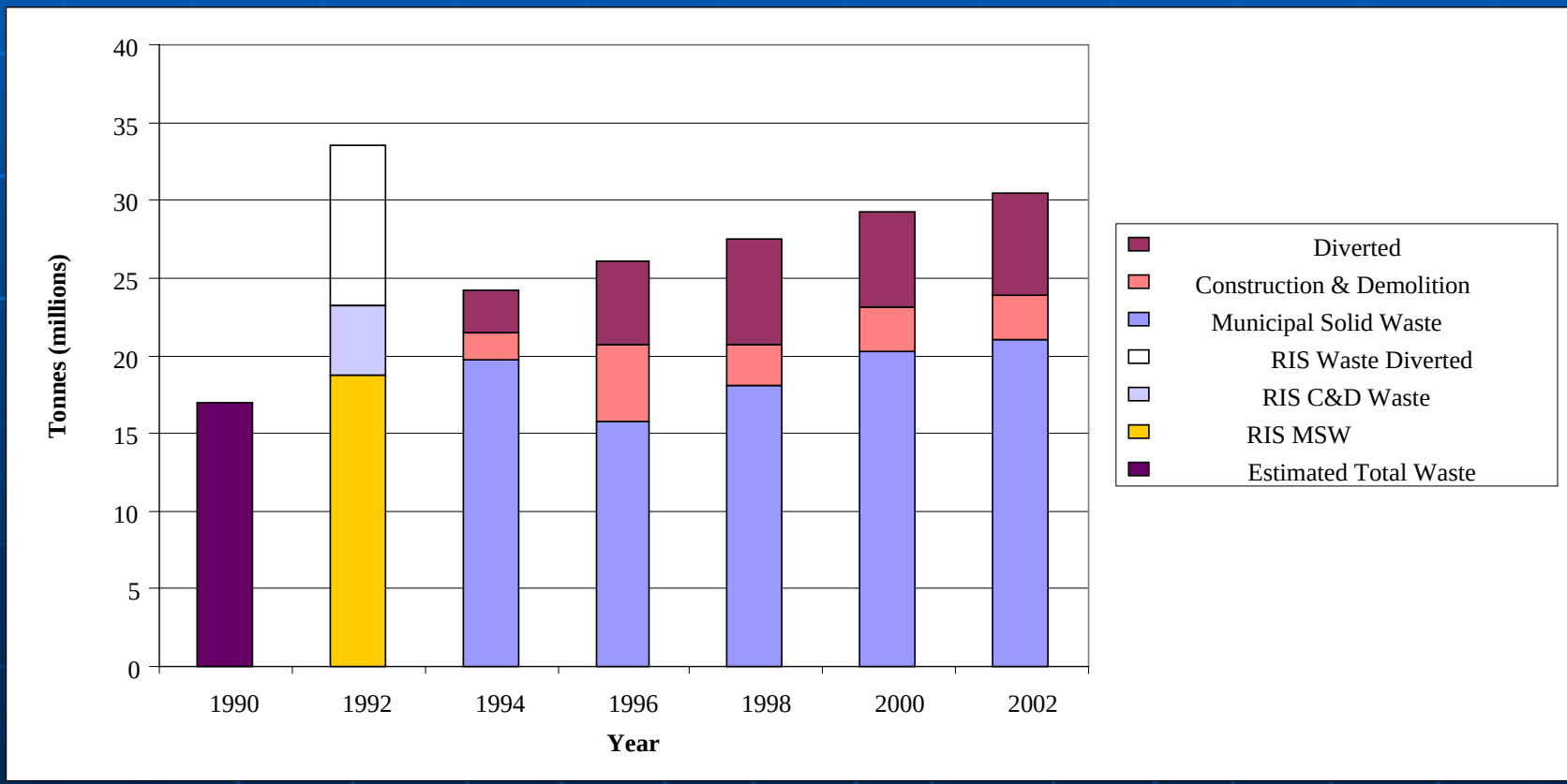
Results of the National Survey: How much did we divert in 2005?

- 88% of the total waste generated went to landfills
- 12% diverted (1.7 million tonnes)
- 6.1% composted (839,335 tonnes), saving 7.3 kt of methane gas
- 5.9 %recycled (804,975 tonnes), saving 100 kt methane gas



Growing Waste, Wasting Organics

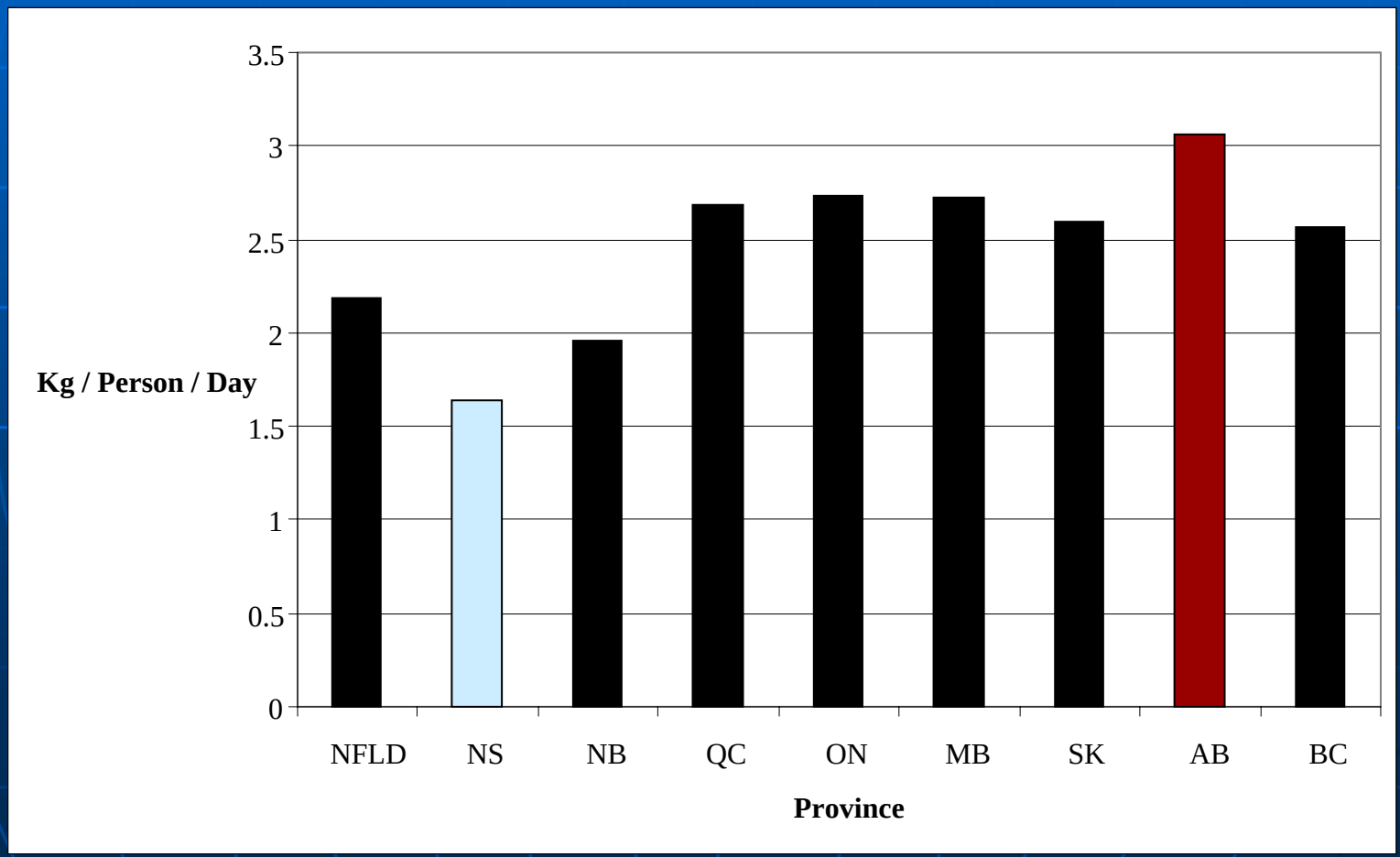
The overall quantity of waste disposal has increased by 8% between 2003 and 2005.



Organics: To waste or not to waste?

- Canadians generate about 7Mt of organics each year of which 66% ends up in landfills (Thompson et al., 2006)
- Austria's bio-waste recycling results in only 13% of organics going to landfill
- Nova Scotia's landfill ban on organics stimulated composting programs (EEA, 2002) and reduced organic waste by 67% (33% organics go to landfill).

Canadian Provincial Per Capita Amounts of Municipal Solid Waste Generation

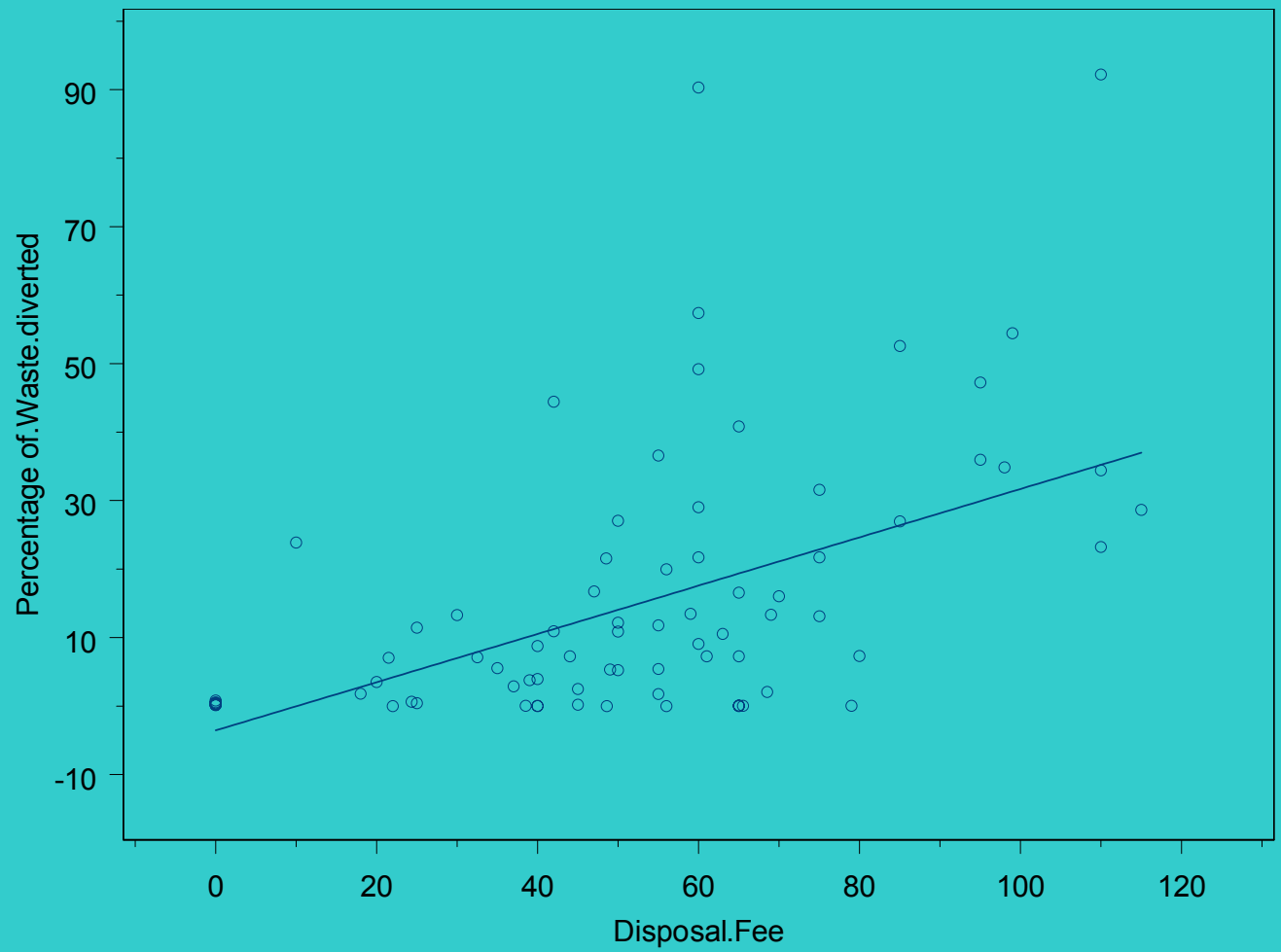


Source: Statistics Canada, 2002.

Who are the zero-waste stars to follow?

- Prince Edward Island (54%),British Columbia (29%) and Nova Scotia (22%) have highest diversion rates.
- Otter Lake landfill, Halifax, Nova Scotia - $115.00/tonne disposal fee diverted 30% of its total waste (2005).
- City of Orillia landfill, Orillia, Ontario - $110.00/tonne disposal fee diverted 35% of its total waste (2005).

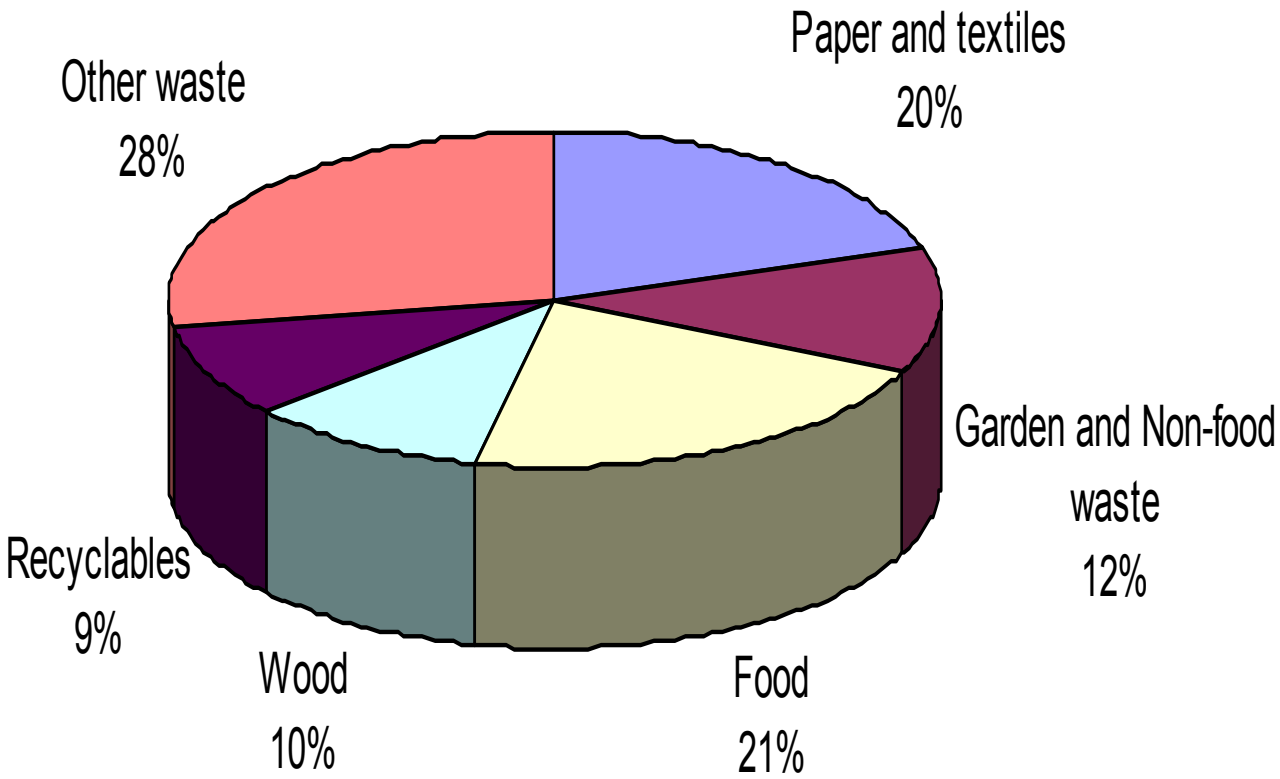
Waste diversion versus Disposal fees

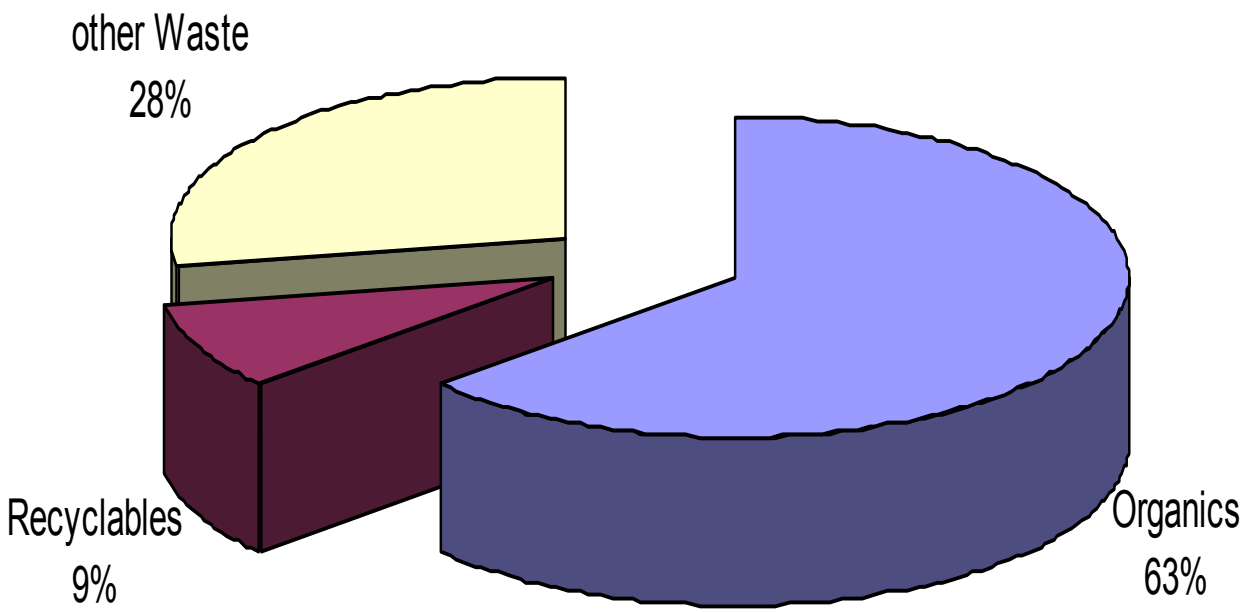


Higher disposal fees = higher waste diverted

Why aren't we doing more?: Comments from landfill managers

- Recycling/organics
  - High transportation costs key issue
  - Landfills serving rural communities have limited business opportunities to recycle products: why separate without markets?
  - "Funding is a main constraint limiting waste diversion activities".
- Landfill gas
  - "Not enough methane is generated in order to make it feasible to set up and operate LFG capture systems"


Paper and textiles
20%
Other waste
28%
Garden and Non-food
waste
12%
Recyclables
9%
Wood
10%
Food
21%


other Waste
28%
Recyclables
9%
Organics
63%

What is the solution to waste?

Solutions are available BUT first need:

- Political will
- Legal framework,
- Collection system,
- Financial commitment,
- Reuse and recycling systems.
- Design for the environment incentives.

Halifax Regional Municipality -- 67% of Organics Composted – over 50% of total waste diverted

Organics Green Cart

Collected every two weeks (even if not full)

Place the following items in your organics green cart:

Food Waste: Fruit & vegetable peelings, table scraps, meat, fish, dairy products, cooking oil & fat (cool, wipe with paper towel, place in green cart), bread, rice, pasta, bones, coffee grounds, filters, tea bags, eggshells.

Use boxboard or one sheet of paper to wrap wet food waste.

Yard Waste: Excess leaves, brush and plants.

Boxboard & Soiled Paper: Cereal boxes (remove inner liner), shoe, cracker & cookie boxes, paper towel rolls, food napkins, paper towels, tissue boxes (remove plastic) and soiled paper.

Other: Sawdust & wood shavings.

Not for the Green Cart:

- No ashes
- No waxed/film packaging or frozen food containers or packaging
- No corrugated cardboard (e.g. pizza boxes)
- No plastic bags (including 'biodegradable')
- No glass
- No decorations or wire wreaths
- No newspapers, magazines
- No paper or Styrofoam drinking cups
- No rocks, logs or tree trunks
- No soil/sods

HALIFAX
REGIONAL MUNICIPALITY

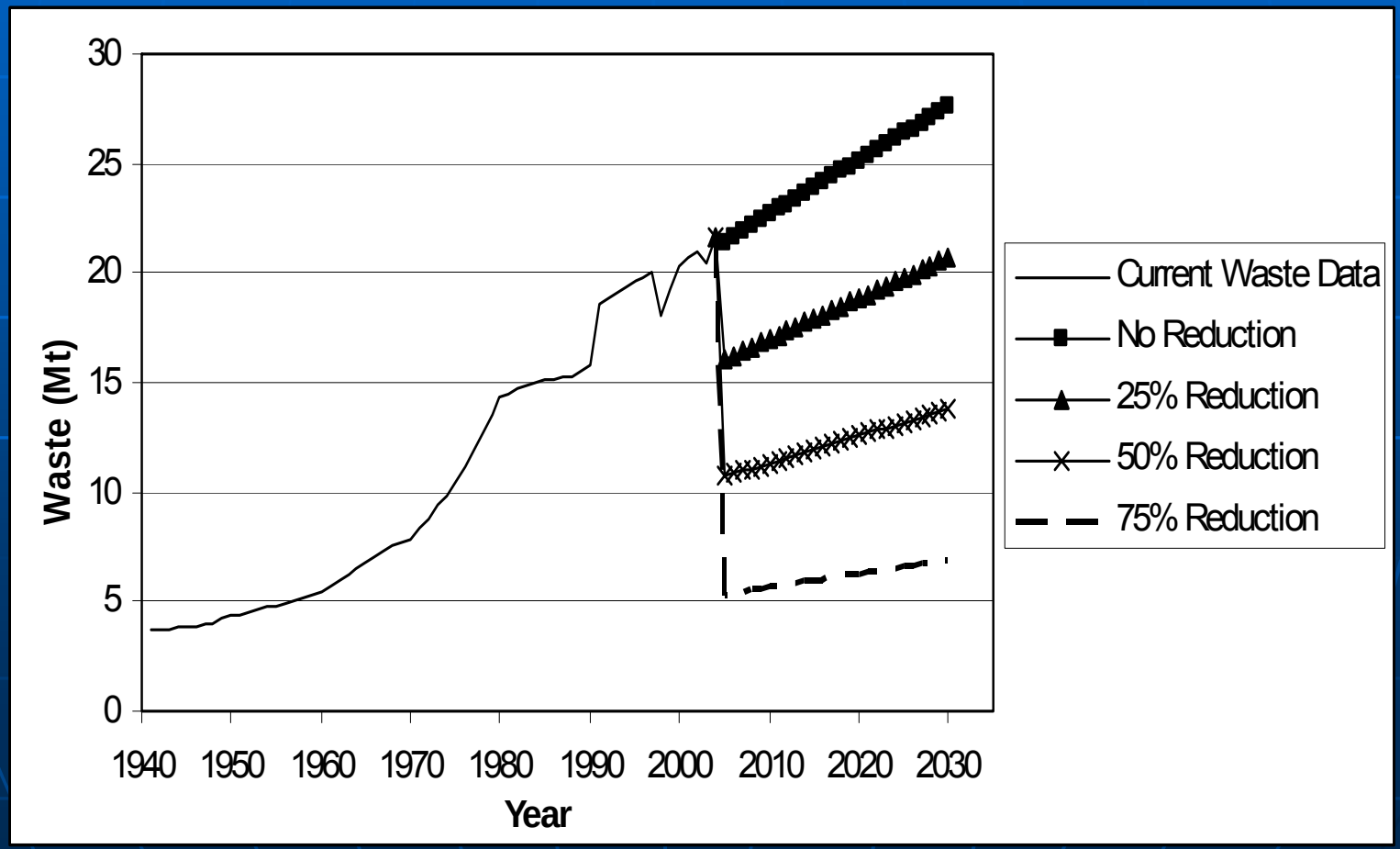
Policies/Programs to Divert Organic Materials

1. Subsidizing composters for residents
2. Collecting yard waste
3. Curb side pickup of food and yard waste
4. Ban organics from landfills
5. Refusal to pick up garbage (clear bags) that contains organics
6. School composting requirements
7. Education programs

Steps in Method

1. Calculated waste for all landfills in Canada for every year from 1940 to 2004 from available Canadian waste data (Levelton, 1991 for 1940 to 1990 and Statistics Canada 1994, 1996, 1998, 2000, 2002 and RIS 1992).
2. Projected waste line from 2005 to 2030 assuming "business as usual" (e.g., recycling initiatives, population growth, and consumption would continue at the same rate).
3. Reduced "business-as-usual" waste amounts (actual and projected) by 25%, 50% and 75% to see the impact of waste diversion strategies after 2004.
4. The Scholl Canyon model was employed to estimate the potential methane emissions from 2005 to 2030 for waste amounts to determine if Kyoto targets could be reached and sustained.

Waste Disposal based on historical data and projections for different waste diversion rates (0 to 75%) starting in 2005.



Estimating Methane Production using Scholl Canyon Model

The Scholl Canyon Model – estimates methane production/energy potential in landfill gas over time.

$$dL/dt = KLo \sum_{i=1}^{n} r_i \, e_i^{\,-Ki\,ti}$$

Where:

L = amount of gas left to generate per unit weight of refuse (ft^3/lb)

Lo = total volume of methane ultimately to be produced (ft^3/lb)

n = number of years considered

ti = time from placement year i (years)

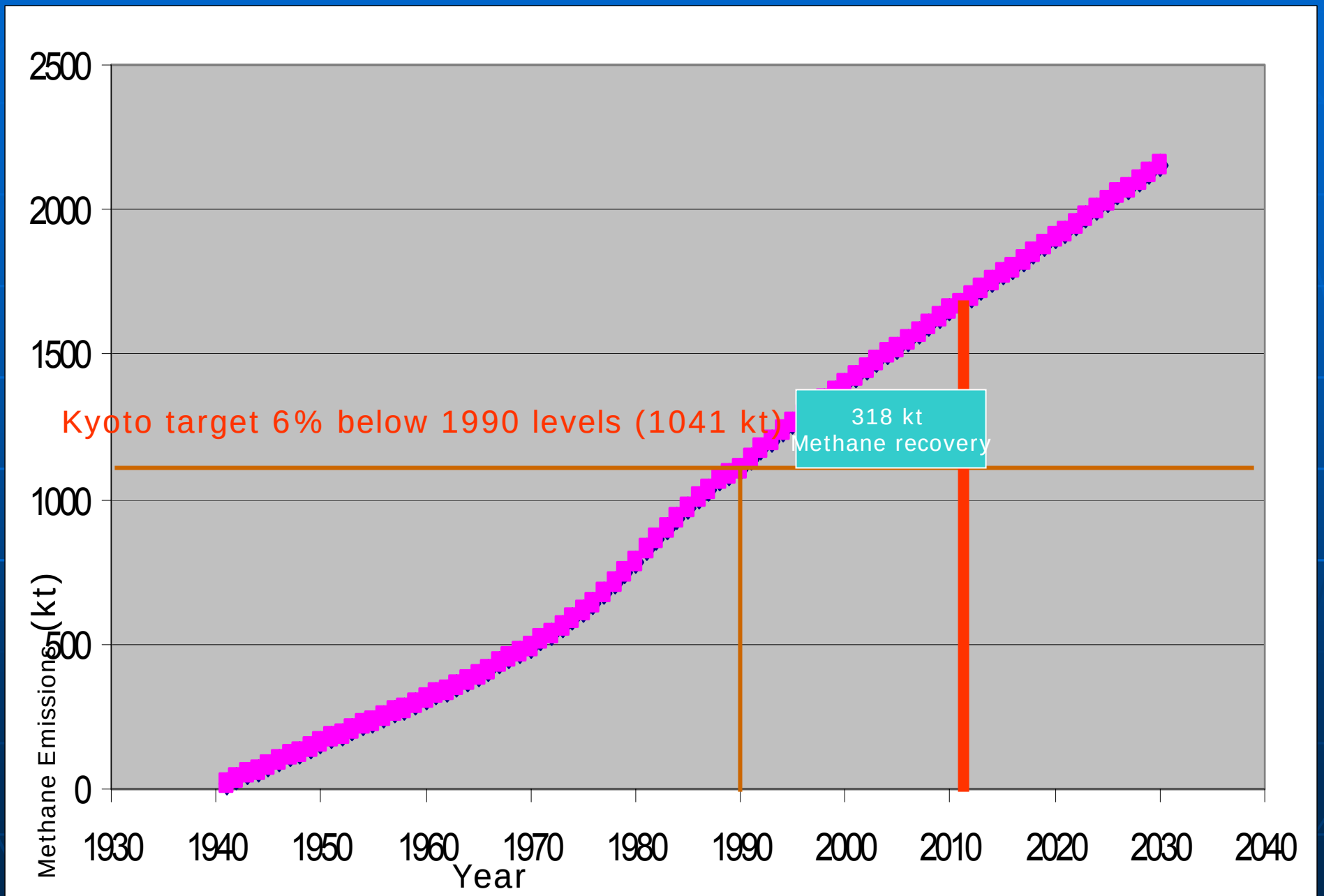
Ki = the decay rate constant each year

ri = a ratio of the tonnage of all previous years accumulated to the landfill's maximum capacity of landfill

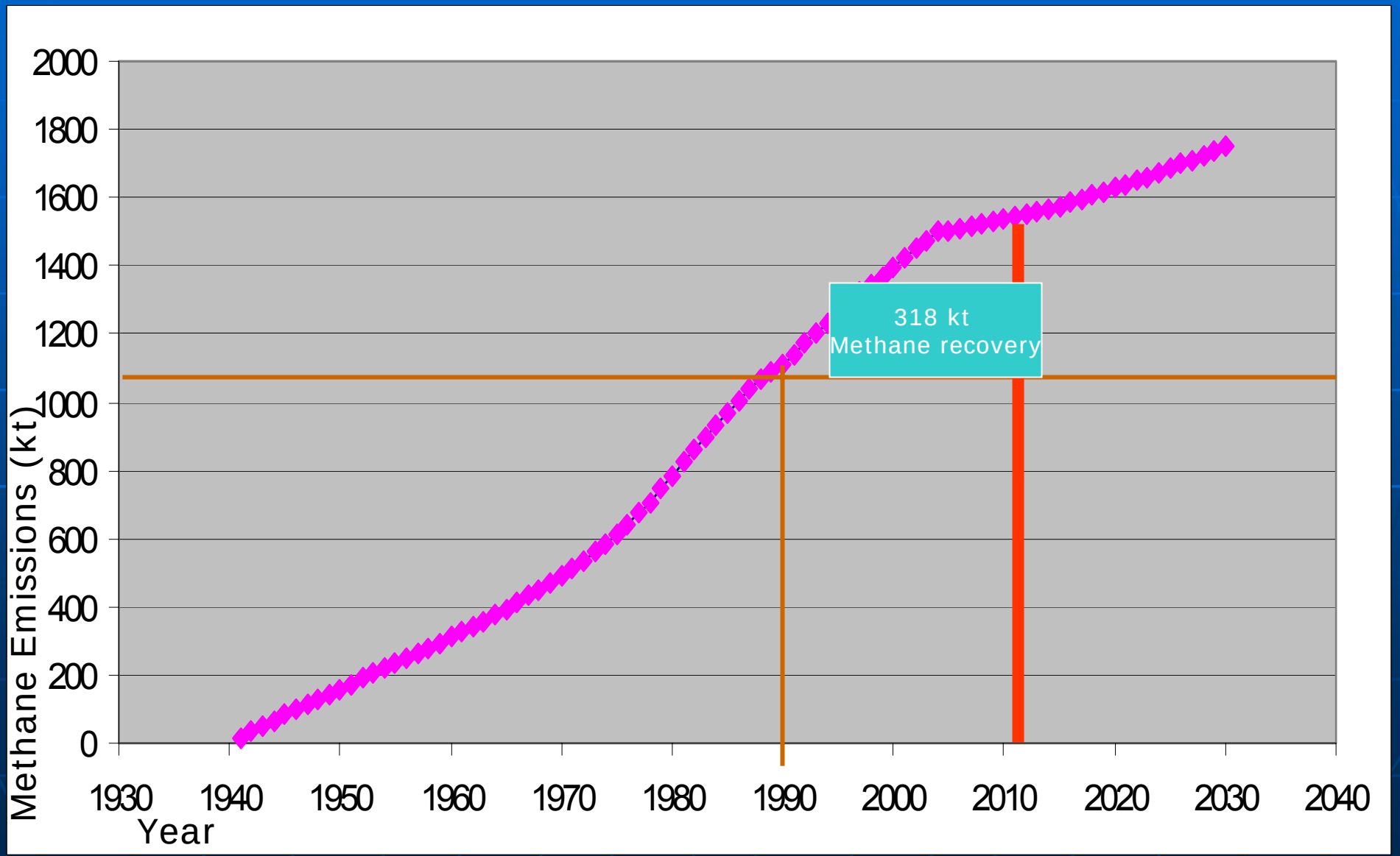
PROVINCIAL METHANE EMISSIONS (KT)

	1941	1942	1943	1944	1945	1946	1947	1948	…..2029	2030
NFLD	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	16.4217	15.8912
PEI	0.2219	0.4225	0.6168	0.8028	0.9831	1.1603	1.3299	1.4899	3.3208	3.2542
NS	1.2130	2.3873	3.5291	4.6192	5.6667	6.6488	7.5627	8.4626	10.4707	9.9005
NB	0.9489	1.8689	2.7454	3.5784	4.3864	5.2016	5.9594	6.7247	15.6468	14.9434
QUE	6.5410	12.9270	19.1819	25.2639	31.2136	37.2130	42.8067	48.4824	313.6100	310.9338
ONT	4.7382	9.4248	13.9799	18.4297	22.7640	27.1611	31.2947	35.5058	336.9647	334.8267
MAN	0.5663	1.1142	1.6478	2.1713	2.6819	3.1892	3.6746	4.1628	36.3096	36.1327
SASK	0.6700	1.2896	1.8882	2.4723	3.0415	3.6004	4.1448	4.6813	34.0508	33.7285
ALB	0.6518	1.2713	1.8845	2.5036	3.1087	3.5758	4.0138	4.4854	90.7821	90.5907
BC	1.6935	3.3796	5.0585	6.7307	8.3965	10.1280	11.7065	13.3548	99.1070	97.0395
NWT	0.0115	0.0227	0.0338	0.0446	0.0553	0.0696	0.0837	0.0975	2.1314	2.1289
YUK	0.0048	0.0095	0.0141	0.0186	0.0230	0.0303	0.0374	0.0444	1.0151	1.0128
CAN TOTAL	17.2609	34.1174	50.5801	66.6352	82.3207	97.9783	112.6141	127.4914	959.8308	950.3827

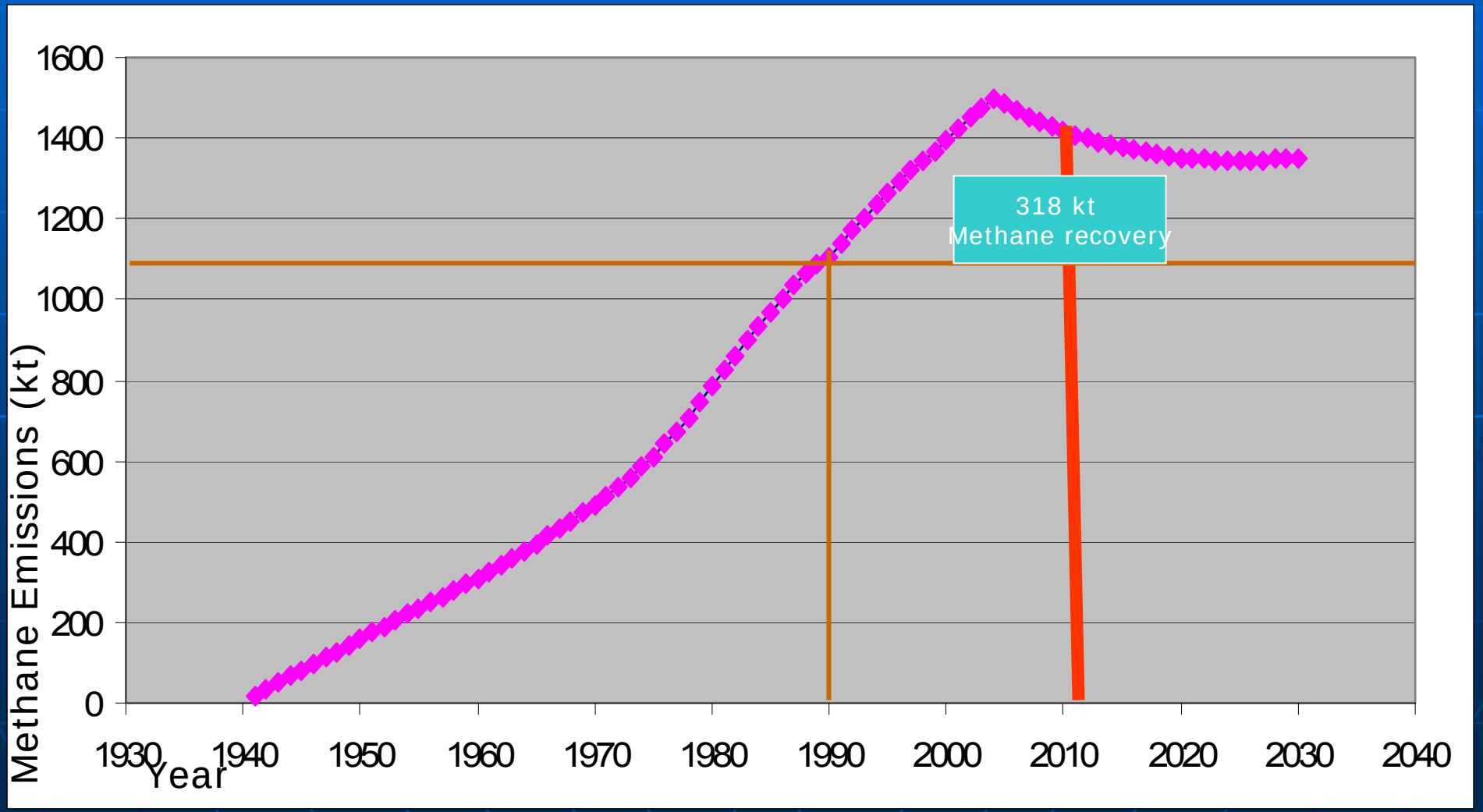
GHG Emissions from 1940 to 2030



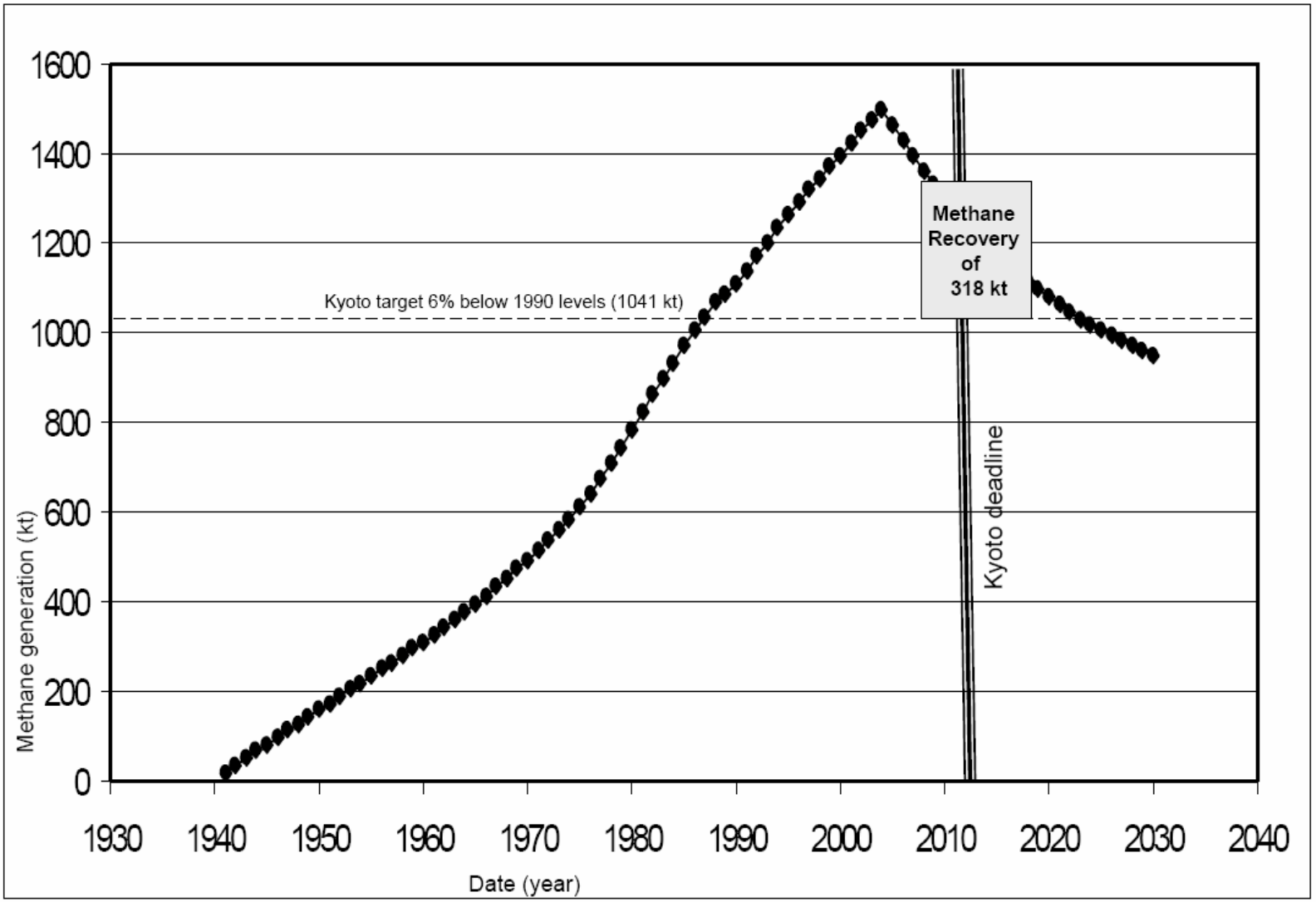
GHG Emissions from 1940 to 2030
25% Diversion



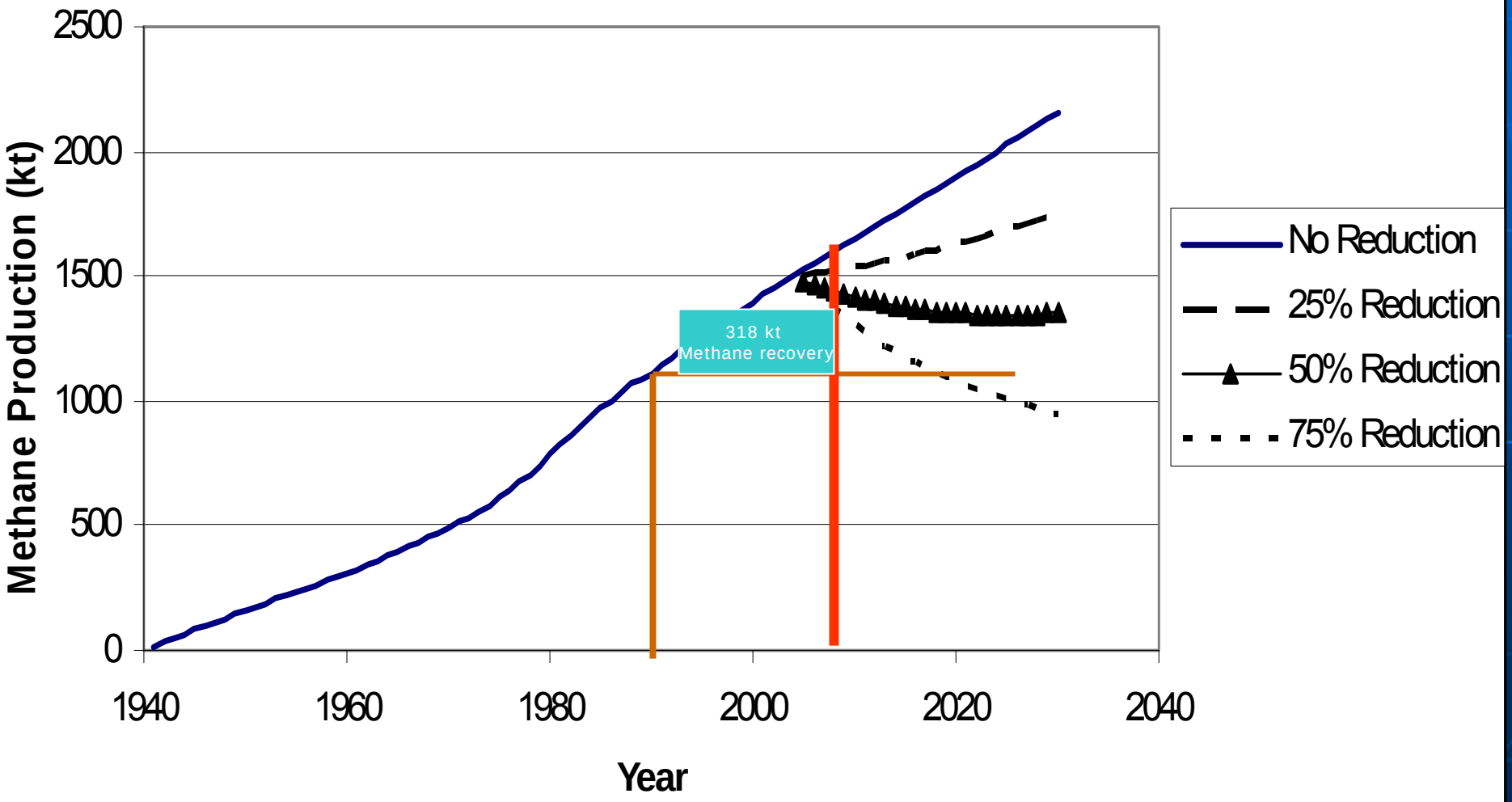
GHG Emissions from 1940 to 2030
50% Diversion



75% Diversion of Organics



Waste Diversion's Impact on Methane Emissions from Canadian Landfills from 2005-2030 based on the Scholl Canyon model.



Conclusion

- Clearly, waste diversion reduces methane emissions and for the long term.
- All diversions result in observable methane reductions, which could be supplemented by methane recovery to reach targets.
- At 75% waste diversion, the goal of 6% methane generation below 1990 levels would be reached in 2012 with current methane recovery.
- For Canada to fulfill Kyoto commitments requires organic waste diversions be accompanied by waste reduction, methane recovery or flaring.