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Waste Management in a Low Carbon Economy

Jennifer Baron

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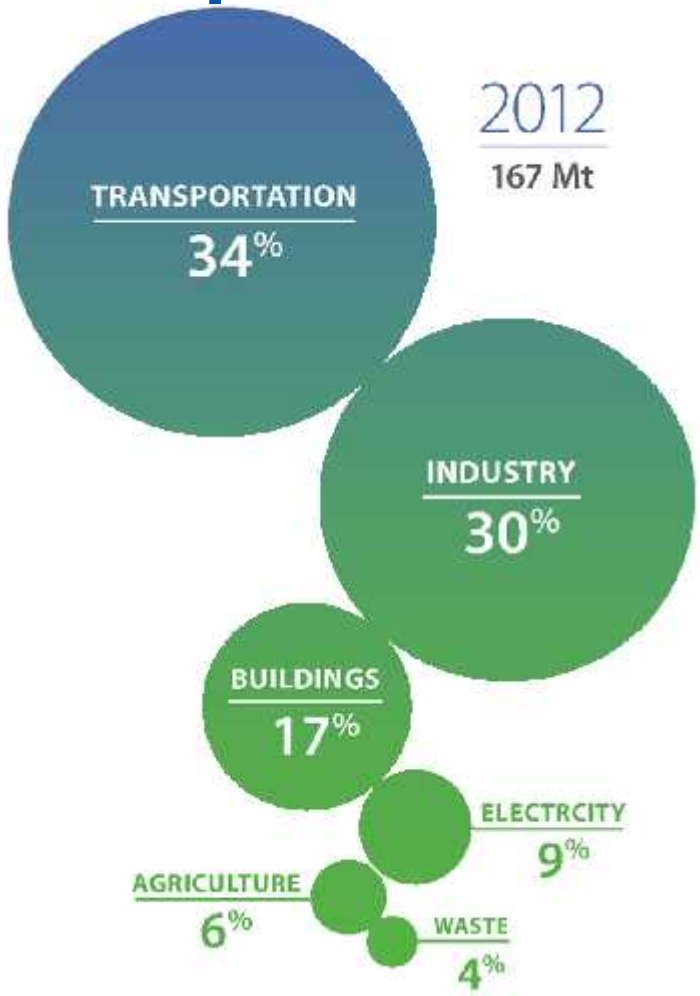
How Important is Waste?



Source: MOECC (2014) Ontario's Climate Change Update

- From an inventory standpoint, not very important
- Only 4% of Ontario's GHG Inventory

However, the inventory approach misses a bigger picture

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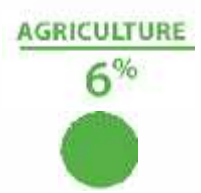
What if we look *across* sectors?

Recycling & EfW
- Reduced vehicle miles

Recycling
- Reduced electricity consumption

EfW & LFGTE
- Displaced fossil electricity

Recycling
- Avoided raw material process & energy emissions



Composting & AD
- Soil Carbon
- Fertilizer savings

EfW
- District heating potential

Recycling, EfW
- Avoided landfill methane

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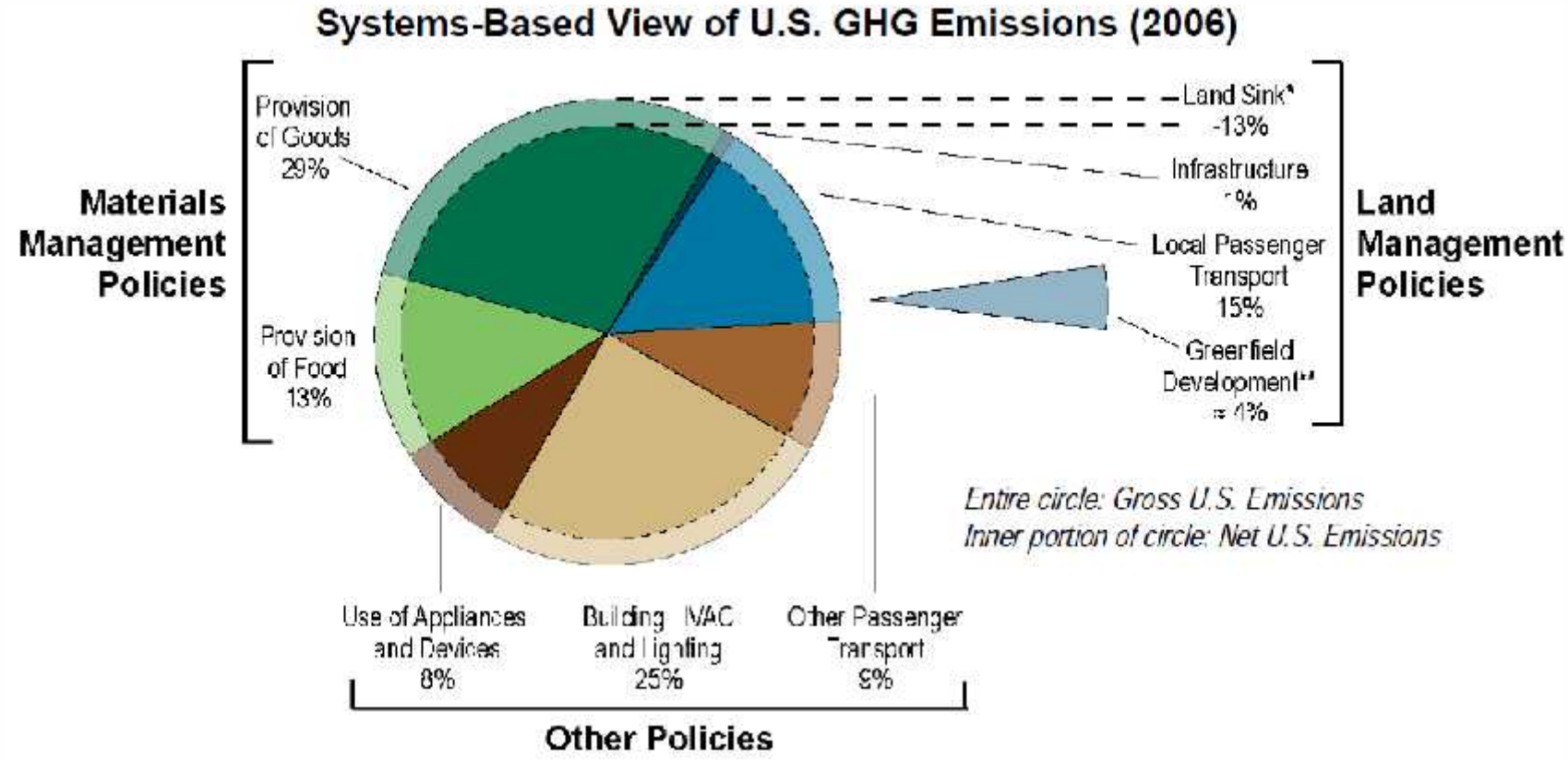
A Different Perspective:

Significant Potential for GHG Reductions



Source: U.S. EPA (2009) Opportunities to Reduce Greenhouse Gas Emissions through Materials and Land Management Practices

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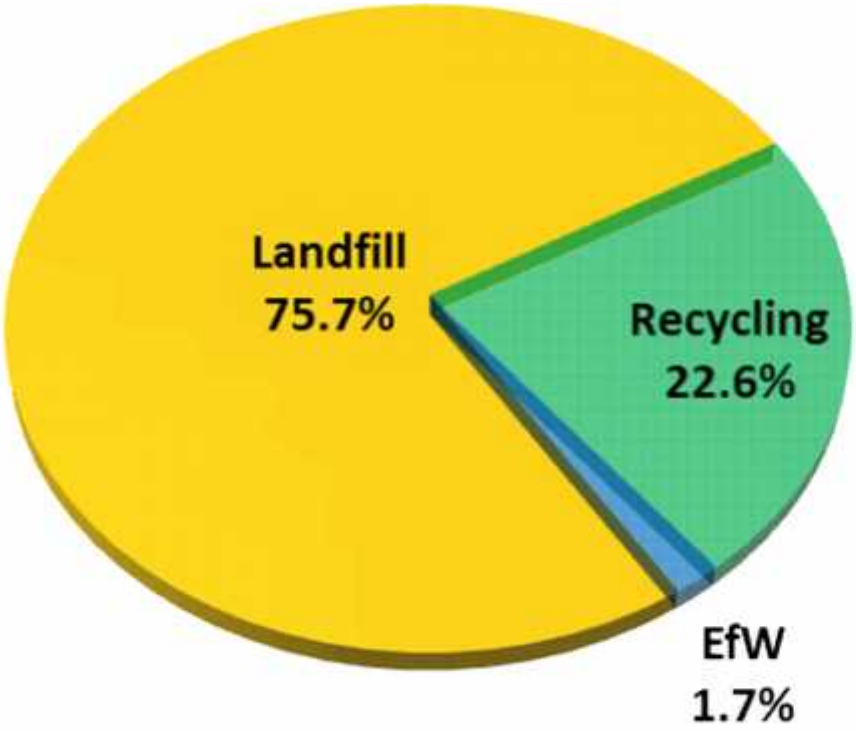
Ontario: Current Picture



Landfilled & exported waste: A missed opportunity

- Additional truck traffic & fuel consumed
- Lost energy potential
- Greater GHG emissions from landfilling
- Lost economic benefit

Source: Statistics Canada (2008) Waste Management Industry Survey: Business and Government Sectors. EfW tonnage based on capacity of Algonquin & Elementa facilities

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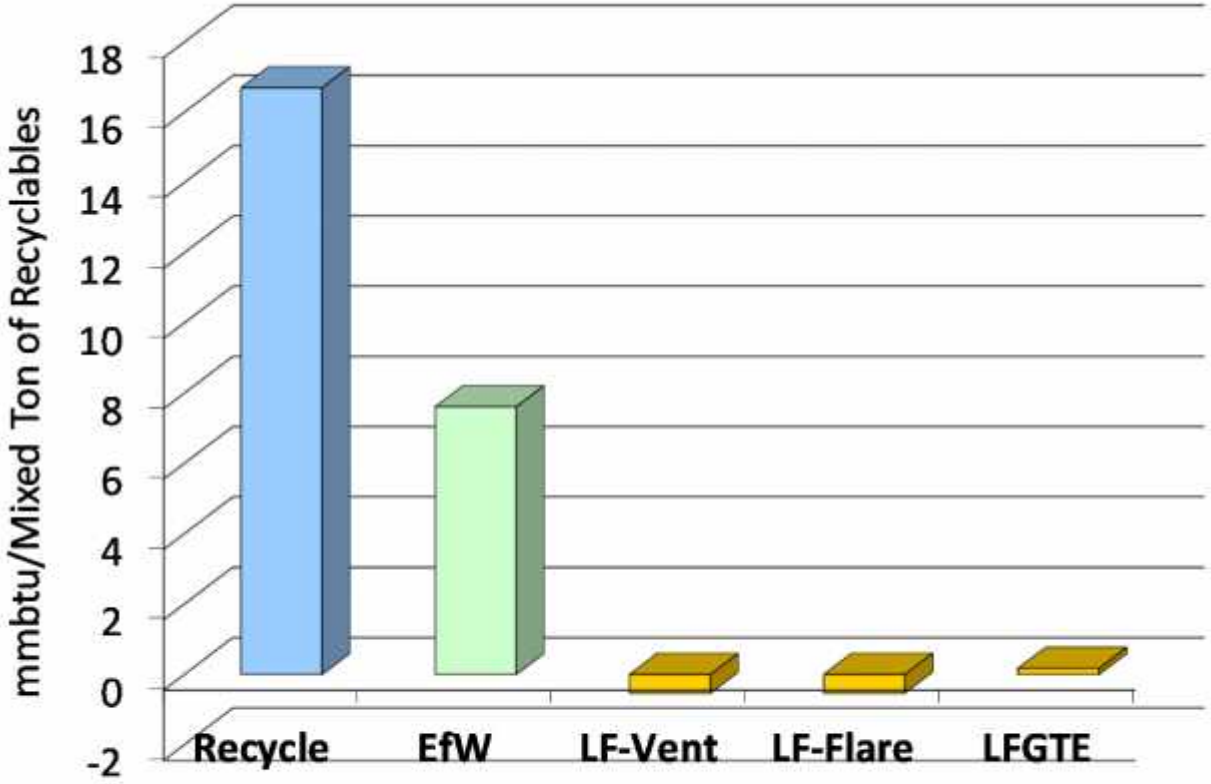
Energy: Waste is a Valuable Resource



Source: U.S. EPA Waste Reduction Model (WARM) Version 9 (October 2008)

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The GHG Value of Recycling

Recycle one ton of:	Reduce GHG emissions (tons CO_2e) by:
Aluminum	9.8 tons
Office Paper	4.4 tons
Newspaper	1.9 tons
Ferrous Metal	2.0 tons
HDPE	1.0 tons

Savings shown are relative to landfilling

Source: USEPA, Waste Reduction Model (WARM version 12)

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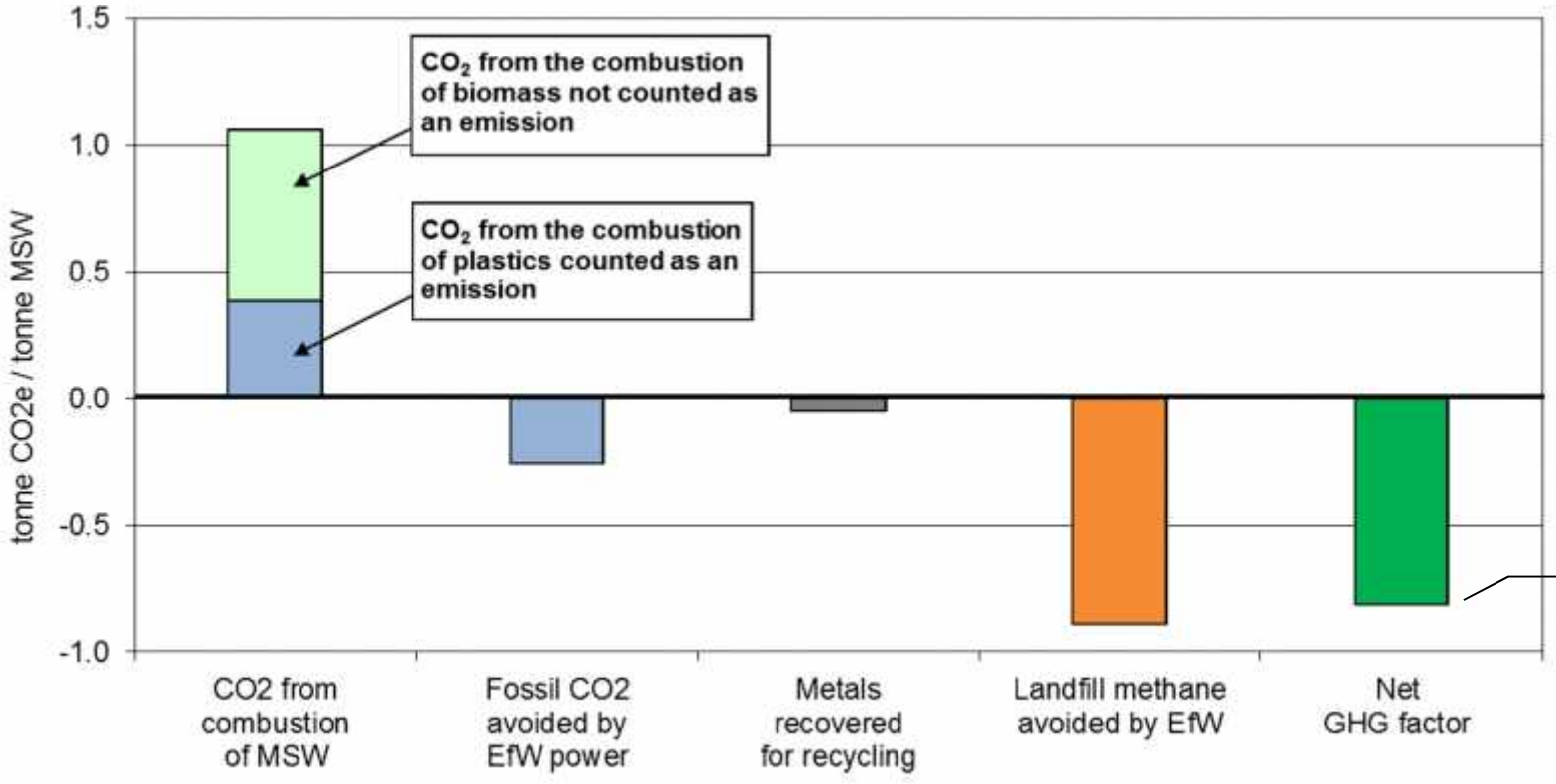
GHG Benefits of EfW – Ontario Case



Net GHG benefit of 0.8 tonne GHG savings / tonne MSW

"... MSW combustors actually reduce the amount of GHGs in the atmosphere compared to landfilling. The savings are estimated to be about 1.0 ton of GHGs saved per ton of MSW combusted."

U.S. EPA, Energy Recovery Webpage , http://www.epa.gov/wastes/nonhaz/municipal/wte/airem.htm#7

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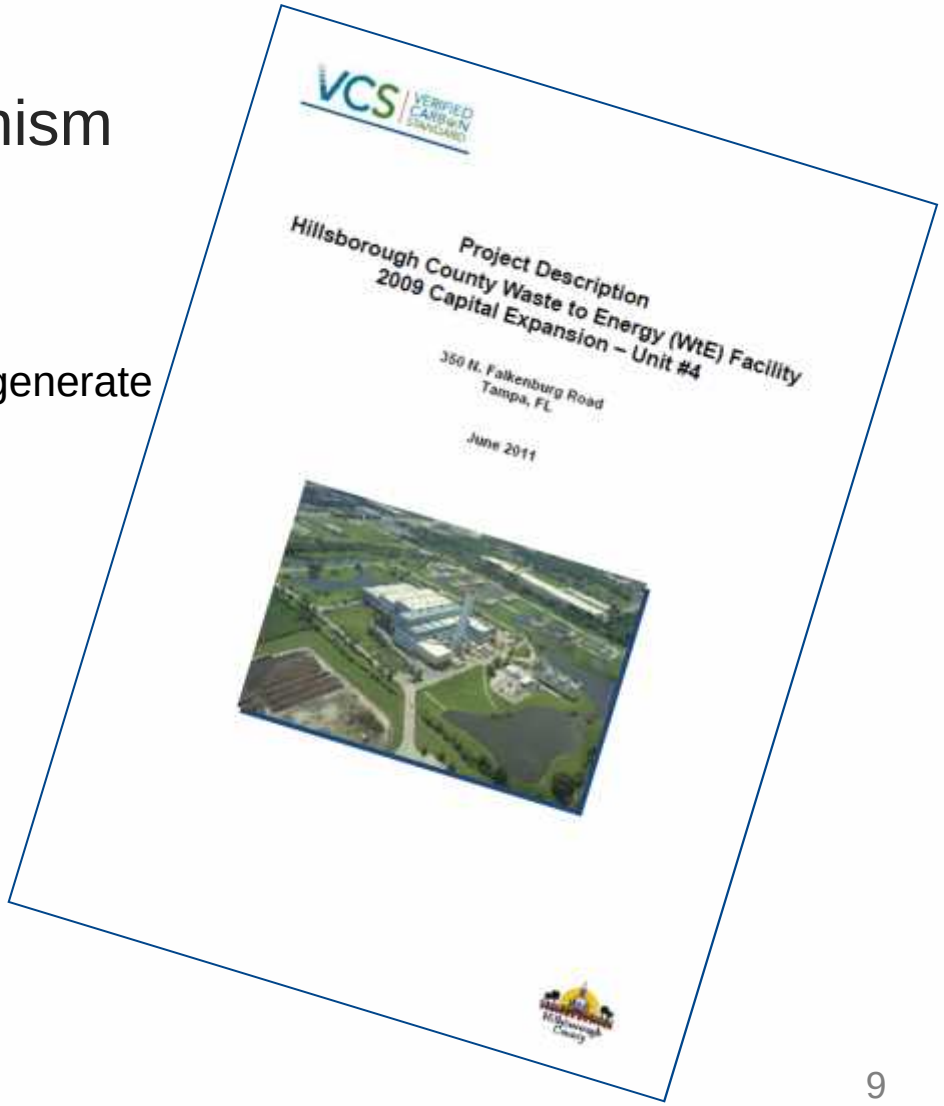
Carbon Offsets

- Clean Development Mechanism
- Voluntary Market (VCS)

  Lee County, FL
  - First EfW facility in North America to generate carbon offset credits
  - Validated & 1st verification - 2009

  Hillsborough County, FL
  - Validated & 1st verification – 2011

  H-Power (Honolulu)
  - Validated – 2014



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International Recognition

- **U.S. EPA Clean Power Plan**
- **European Environment Agency:** "As recycling and incineration with energy recovery are increasingly used, net greenhouse gas emissions from municipal waste management are expected to drop considerably by 2020"
- **IPCC:** WTE recognized as a "key GHG mitigation technology"
- **Rio UN Conference:** "We therefore commit to further reduce, reuse and recycle waste (3Rs), and to increase energy recovery from waste"
- **Davos World Economic Forum:** WTE included in the list of 10 low-carbon energy technologies

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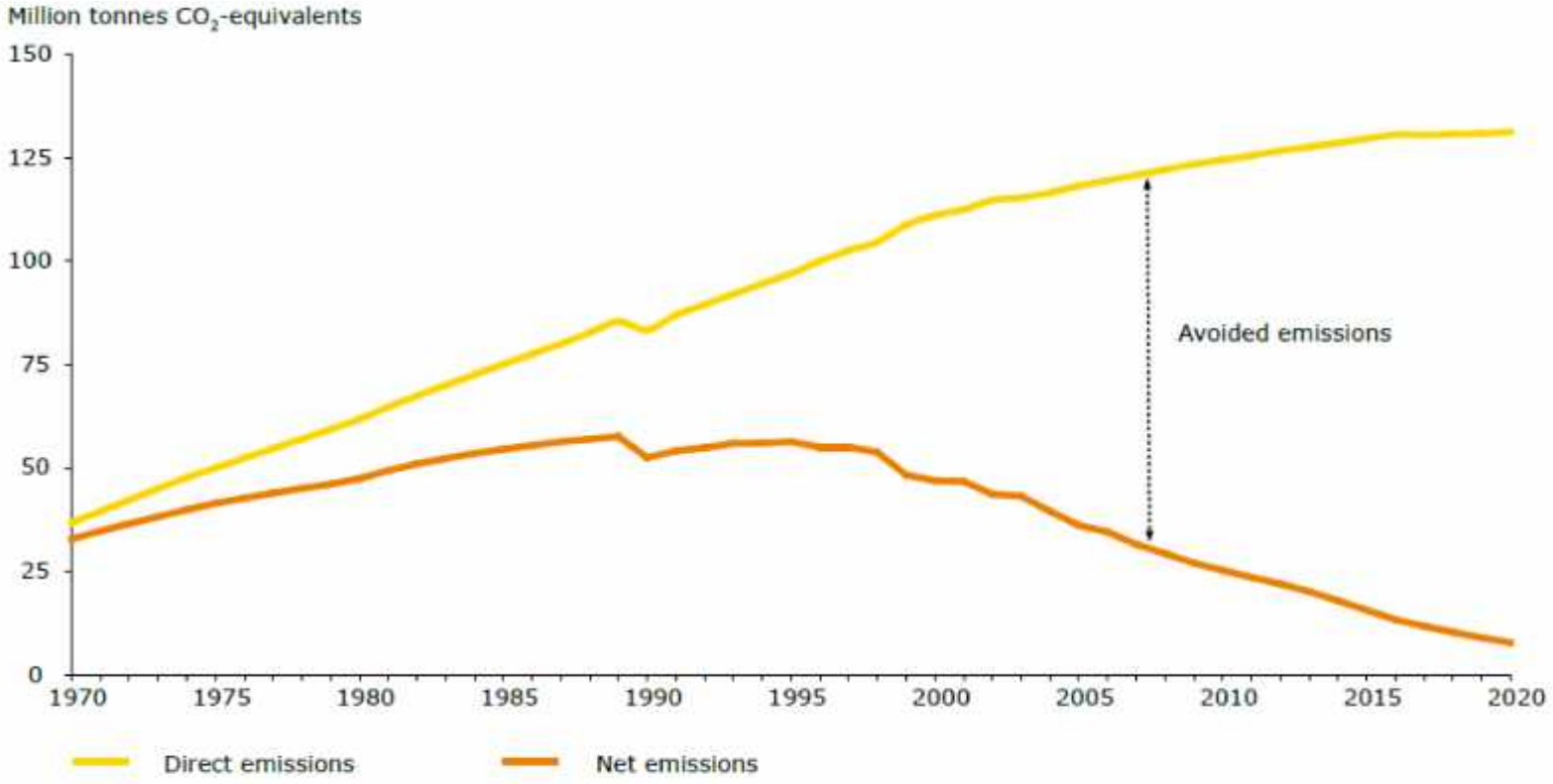
EU: Translating Sustainable Waste Management into GHG Success



Source: ETC/RWM.

European Environment Agency

New Focus on Methane Reduction

Scientific community calls for separate regulation

"...short- and medium-lived sources (black carbon, tropospheric ozone, and methane) must be regulated separately and dynamically"

Jackson, S., Parallel Pursuit of Near-Term and Long-Term Climate Mitigation
Science (2009) **326:** 526-527

"The case for developing parallel policy initiatives for near- and short-term climate mitigation is compelling."

Weaver, A., Toward the Second Commitment Period of the Kyoto Protocol
Science (2011) **332**: 795-796

Climate and Clean Air Coalition

- Announced by U.S. Sec. of State Clinton in 2012
- Focus on black carbon, HFCs, and methane

White House Methane Strategy – March 2014

Focus on Landfills, Natural Gas & Oil Production & Distribution, Coal Mines, and Agriculture

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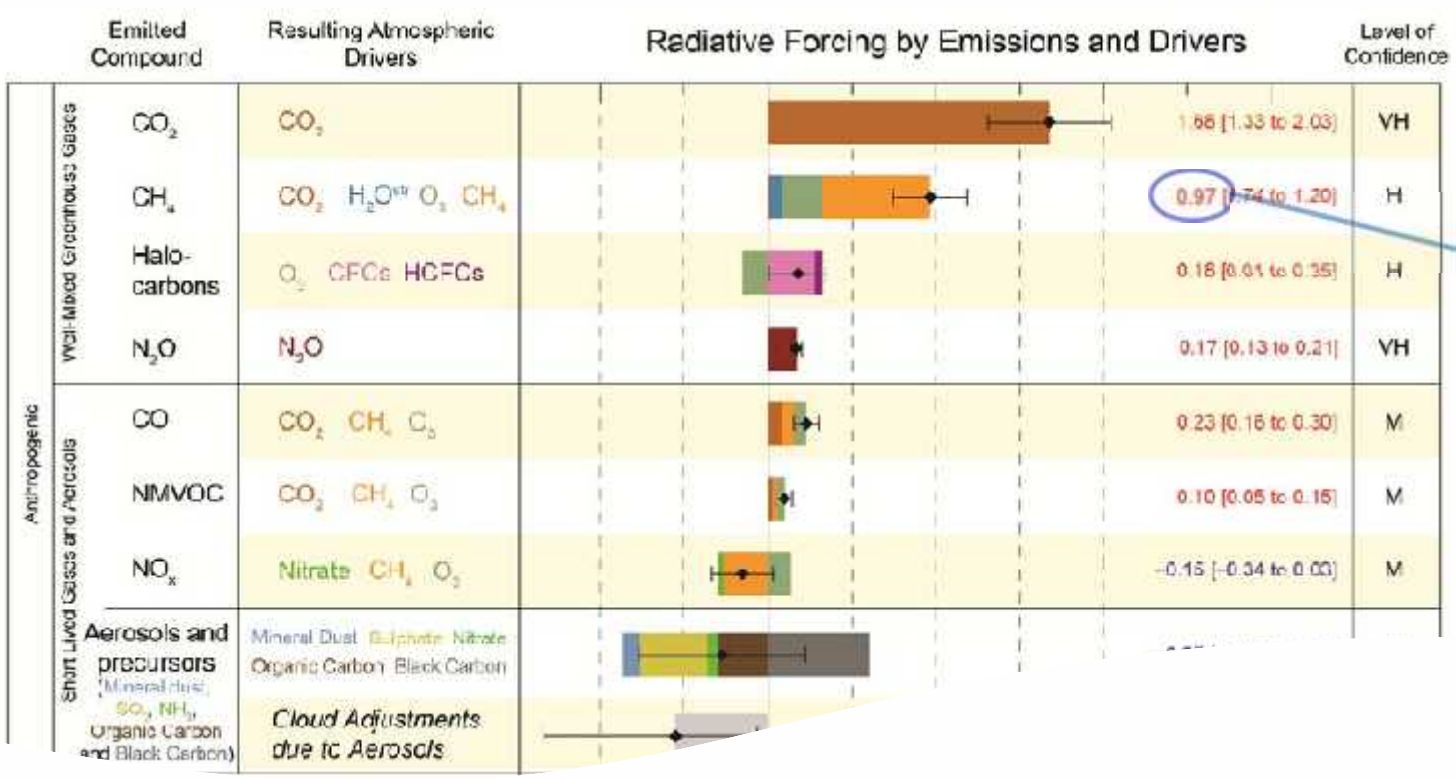
Why? Methane bigger contributor than previously thought:

2013 versus 2007 IPCC reports



2013 Report
CH_4 Radiative Forcing (RF) from Methane
= 0.97 W/m²

58% of CO_2's contribution

42% of total net RF

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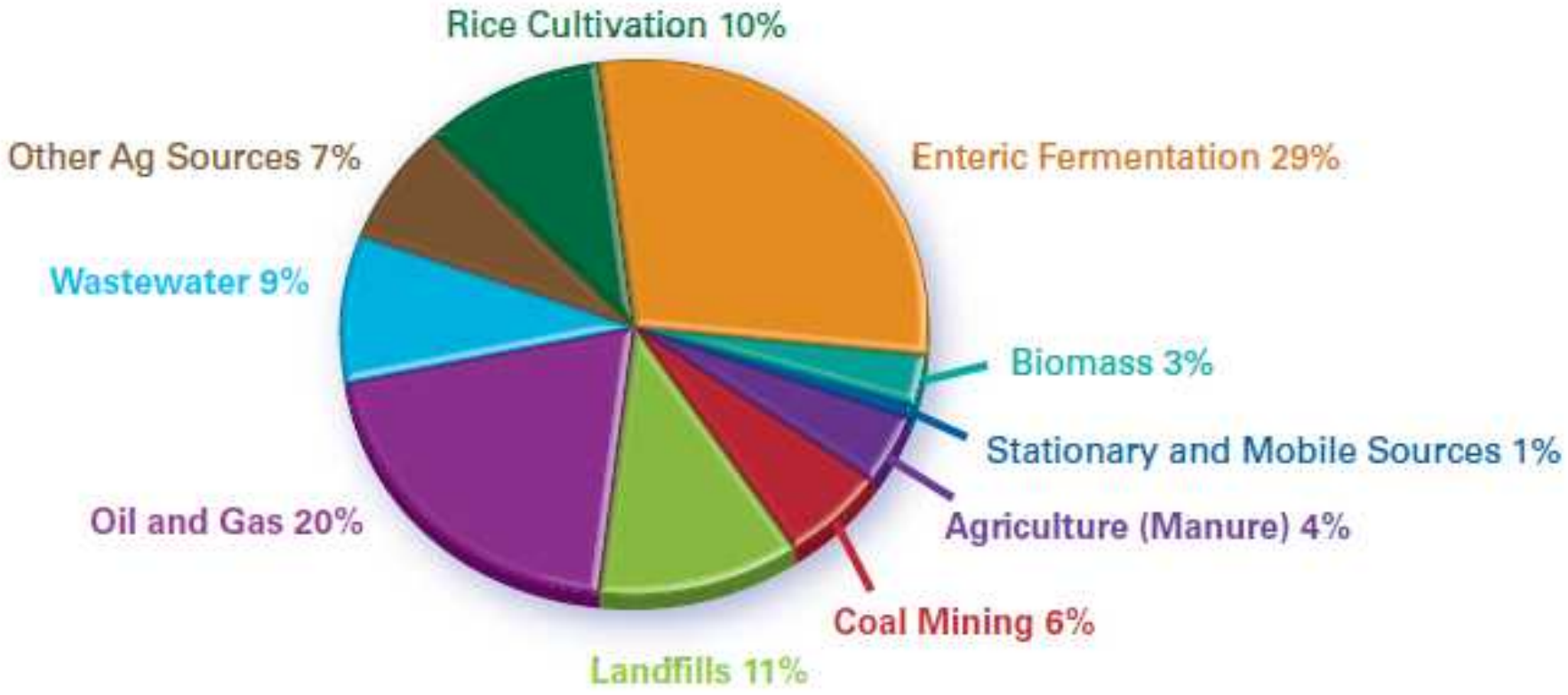
Increasing Trend in Methane GWP

Source	Year	GWP	Time Horizon (years)
IPCC 2nd Assessment	1995	21	100
IPCC 3rd Assessment	2001	23	100
IPCC 4th Assessment	2007	25	100
Shindell *et al.*	2009	34	100
IPCC 5th Assessment	2013	**28 / 34**	100

IPCC 5th Assessment	2013	**84 / 86**	20

Many still refer to the 17-year old GWP of 21

Figure 1: Estimated Global Anthropogenic Methane Emissions by Source, 2010



USEPA's Global Anthropogenic Emissions of Non-CO2 Greenhouse Gases

(EPA Report 430-R06-003)

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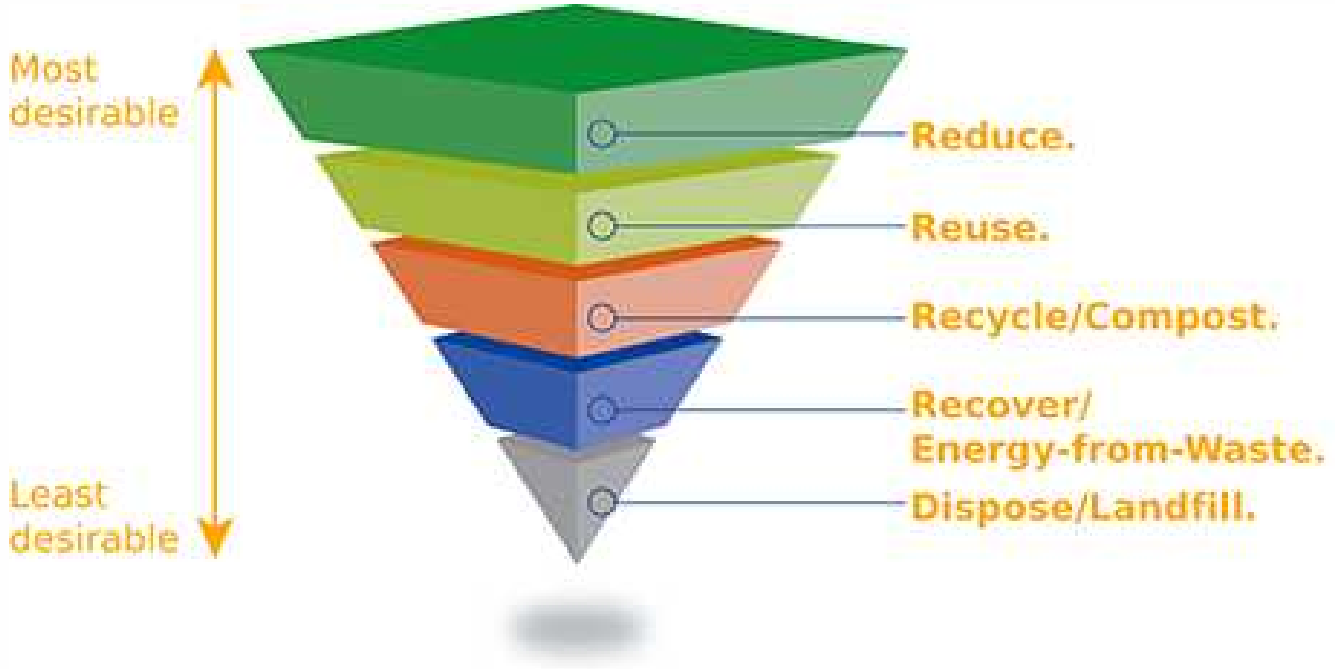
Solid Waste Management Hierarchy

The European Union and the U.S. EPA have both concluded that following the waste management hierarchy generally maximizes energy savings and minimizes greenhouse gas emissions.



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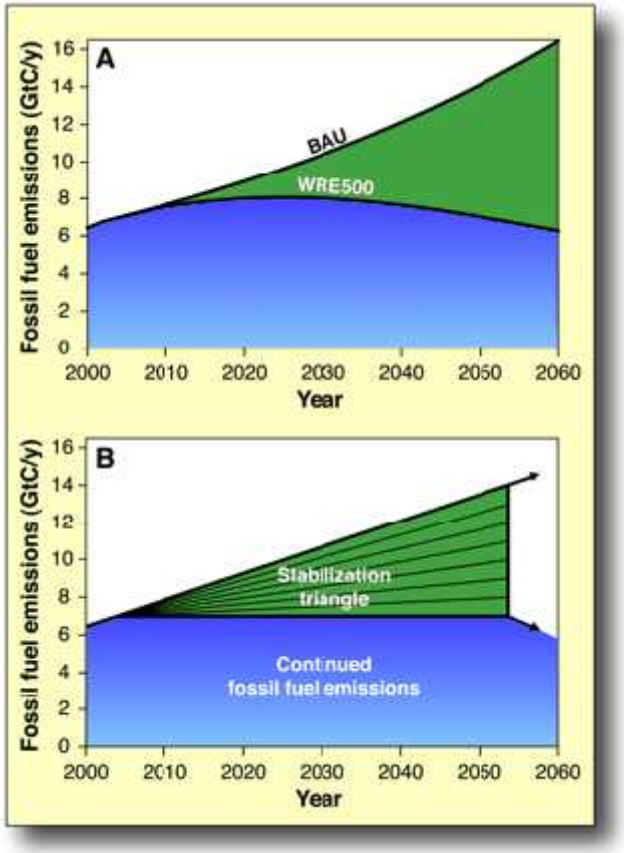
Putting the Benefits into Perspective

- 2004 *Science* article by Drs. Pacala and Socolow (Princeton University) introduced the concept of the stabilization triangle
- 7 gigaton of carbon per year (7 GtC/yr) reduction needed by 2054 versus BAU
- Subdivided into 7 manageable wedges of 1 GtC/yr each
- Seven wedges together would *stabilize* world-wide greenhouse gas *emissions* at today's emission rate



S. Pacala et al., Science 305, 968 -972 (2004)

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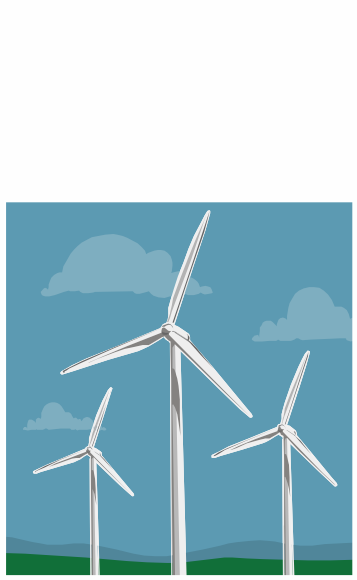
So, What If We All Followed the Hierarchy?

The Waste "Wedge"

The billion metric tonnes of carbon avoided is the equivalent of:

- Closing 1000 large coal-fired power plants
- Building 2 million 1MW wind machines
- Doubling our nuclear power plant capacity



Bahor, B., M. Van Brunt, J. Stovall, K. Blue, 2009, Integrated waste management as a climate stabilization wedge, *Waste Management & Research* 2009: 27: 839-849

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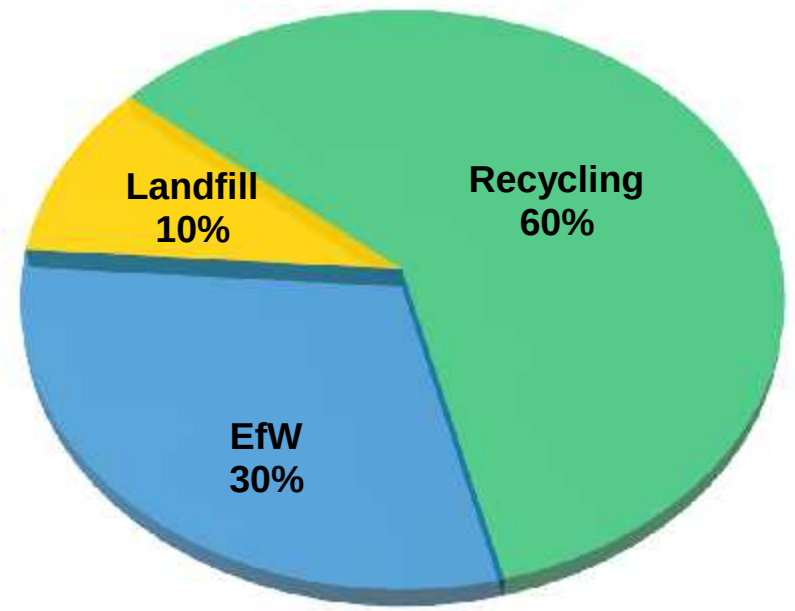
Ontario: The Potential

How much GHGs and energy could we save if:

- We achieved recycling goal of 60%?
- Increased EfW to 30%?
- And only landfilled 10%?



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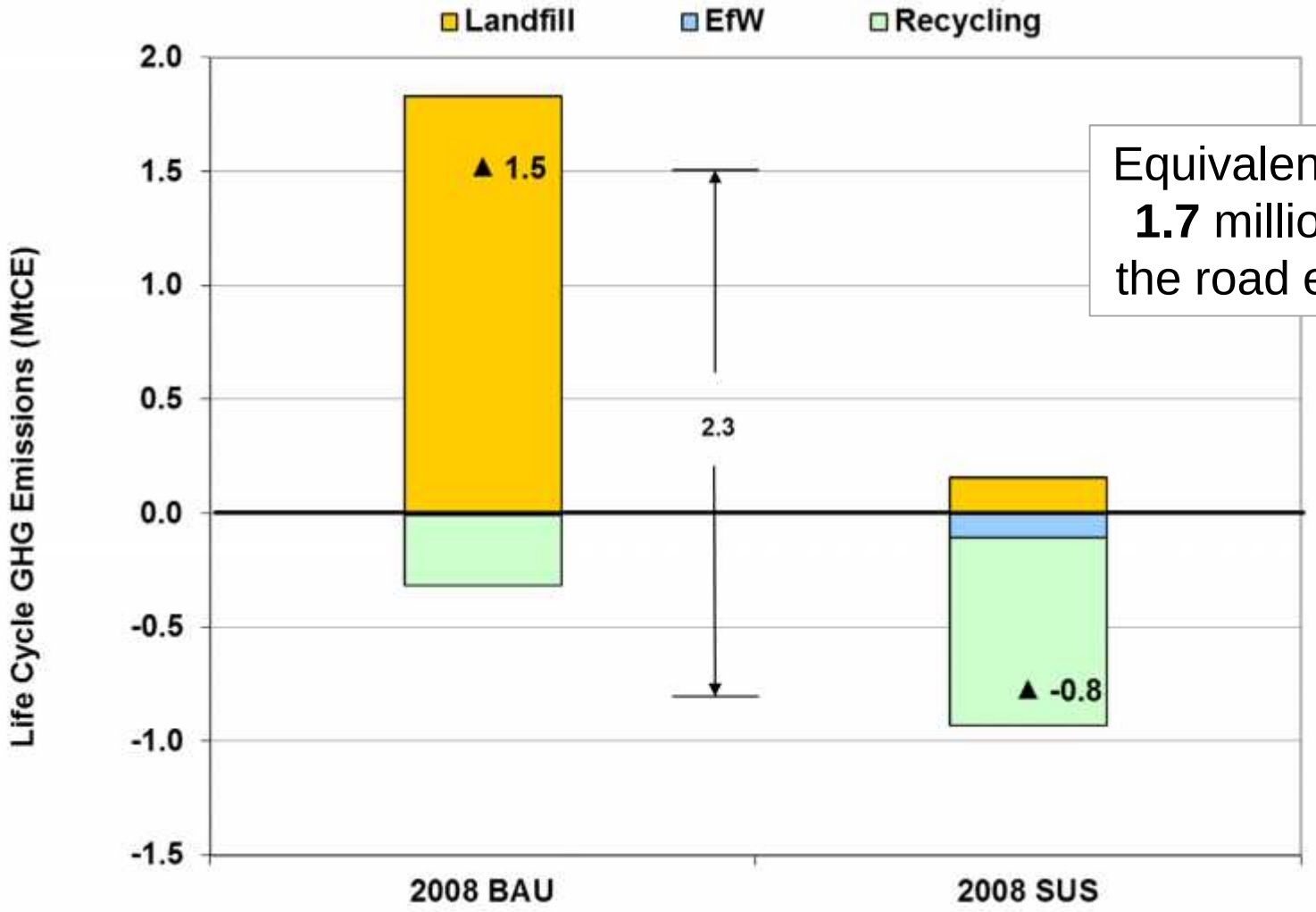
Ontario "Wedge"



Equivalent to pulling **1.7** million cars off the road every year.

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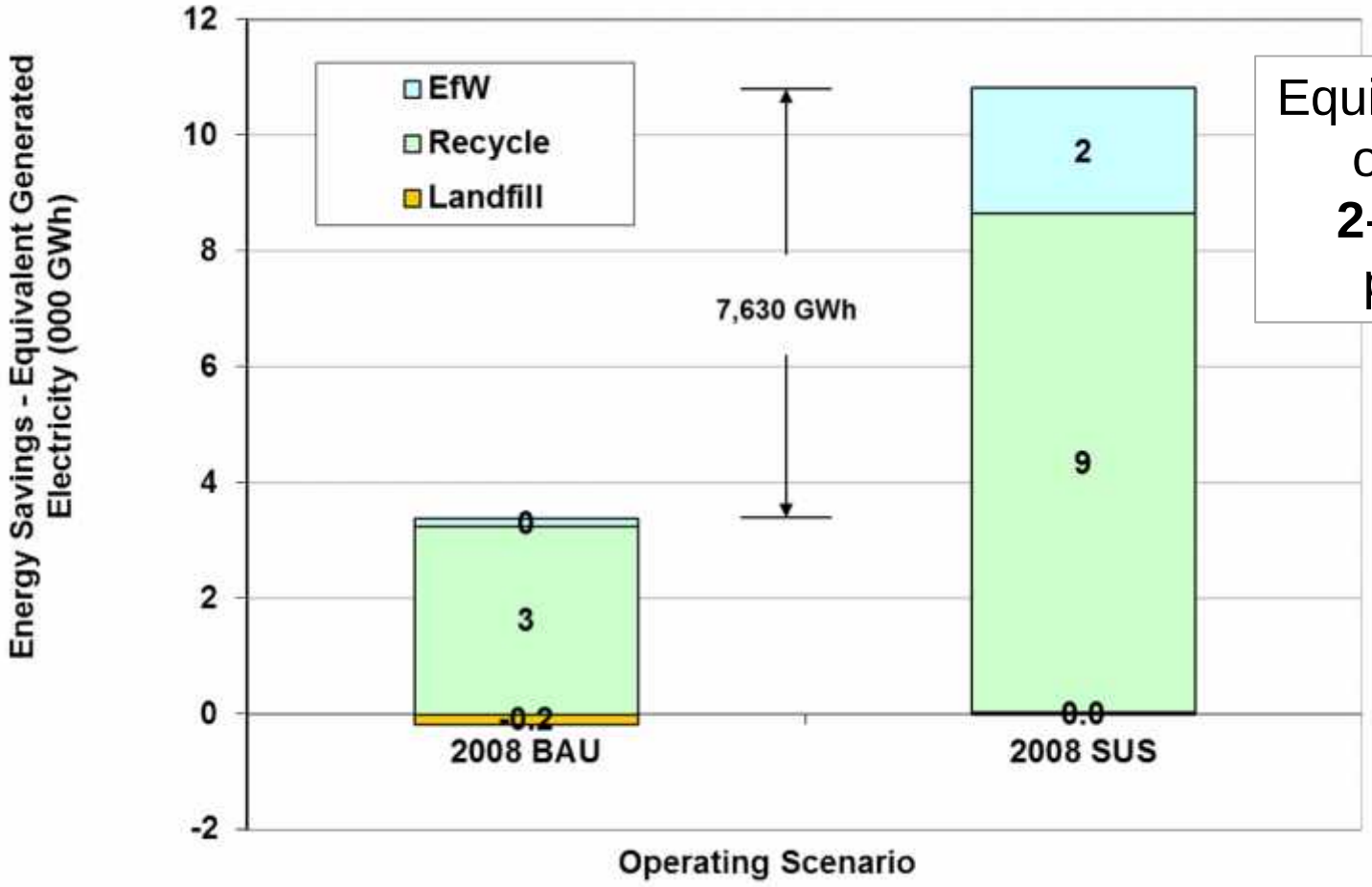
Ontario "Wedge": Energy Savings



Equivalent to annual output of over **2**-500 MW coal power plants

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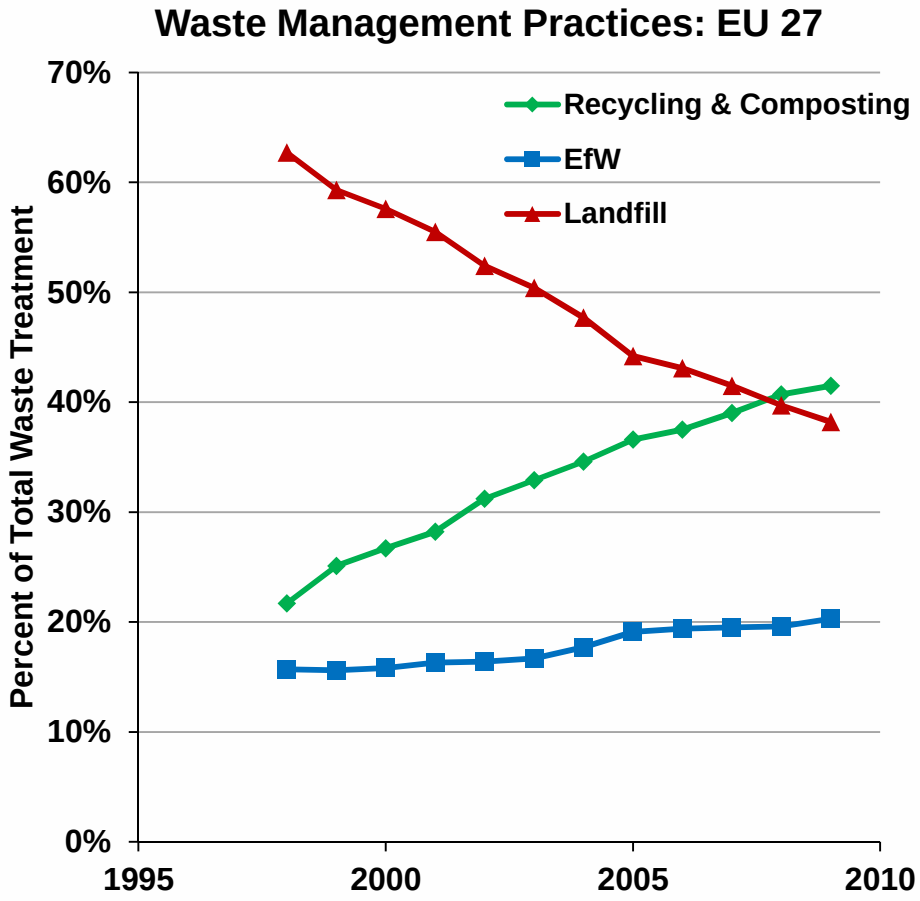
EfW: Compatible With Recycling



- In the EU, recycling and Energy Recovery have grown together because of policies that minimize landfills.
- The European Environment Agency says "there is no evidence to support" the argument that "incineration of waste with energy recovery hinders the development of recycling."

http://www.eea.europa.eu/publications/state_of_environment_report_2007_1/chapter6.pdf

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Policy Tools: How Do We Get There?

- **Learn from the EU Success**
- **Beyond the 3 R's: Embrace the Full Waste Hierarchy**
  - Energy Recovery
- **Discourage Landfilling: The Least Preferable Practice**
  - Landfill levies
  - Biodegradable waste bans
- **Preferential electricity rates / Feed in Tariff**
  - WTE should be eligible
  - LFGTE, a less preferable process, is currently in
- **Accurate carbon / carbon offset policy**

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Summary

- Ontario's current waste management represents a missed energy, GHG mitigation, and economic opportunity
- Ontario can achieve significant energy savings and GHG emissions reductions through implementation of the full waste hierarchy (4Rs)
- Ontario can learn through the experience of the EU
- Durham and York have blazed a path – others may follow

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THANK YOU

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