



Energy-from-Waste & Its Relationship with Recycling

29 March 2018

World Leader in Energy from Waste (EfW)



- Operates **42 modern EfW facilities** in North America, China and Europe
- Annual capacity to process **20 million tons** of waste
- Generate **9 million megawatt hours**—enough clean energy to **power over 1 million homes**
- Annually **recycle over 550,000 tons of metal** - the equivalent amount of steel that would be used to **build 6 Golden Gate Bridges**
- **3,500 professionals** employed in North America

Covanta Fairfax

- **3,000 Tons Per Day of Municipal Solid Waste**
- **80 MW generated, enough to power 80,000 homes**
- **Key Stats through February 2018**
 - Recycled 568,000 Tons of Ferrous since 1990
Startup – *approximately 2200 tons/month*
 - Recycled 16,000 Tons Non-Ferrous (Starting Dec 2007) – *approximately 350 tons/month*
 - Processed 27 million tons of MSW
 - Avoided 27 million tons of GHG Emissions
- **93 Employees**



Committed to Ongoing Operational and Environmental Excellence

- **Strong Partnership and Collaboration with Fairfax County**

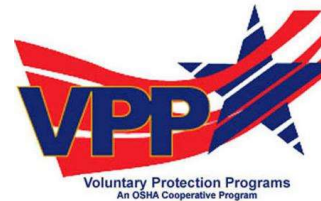
- Since 1990, the Covanta Fairfax Resource Recovery Facility has provided reliable and sustainable waste management service to the County and its residents
- The facility is a key component of the award-winning integrated waste management system of Fairfax County



**E4 – 2011 Extraordinary
Environmental
Enterprise Facility**



**2012 SWANA Waste-to-
Energy Excellence
Award Winner**



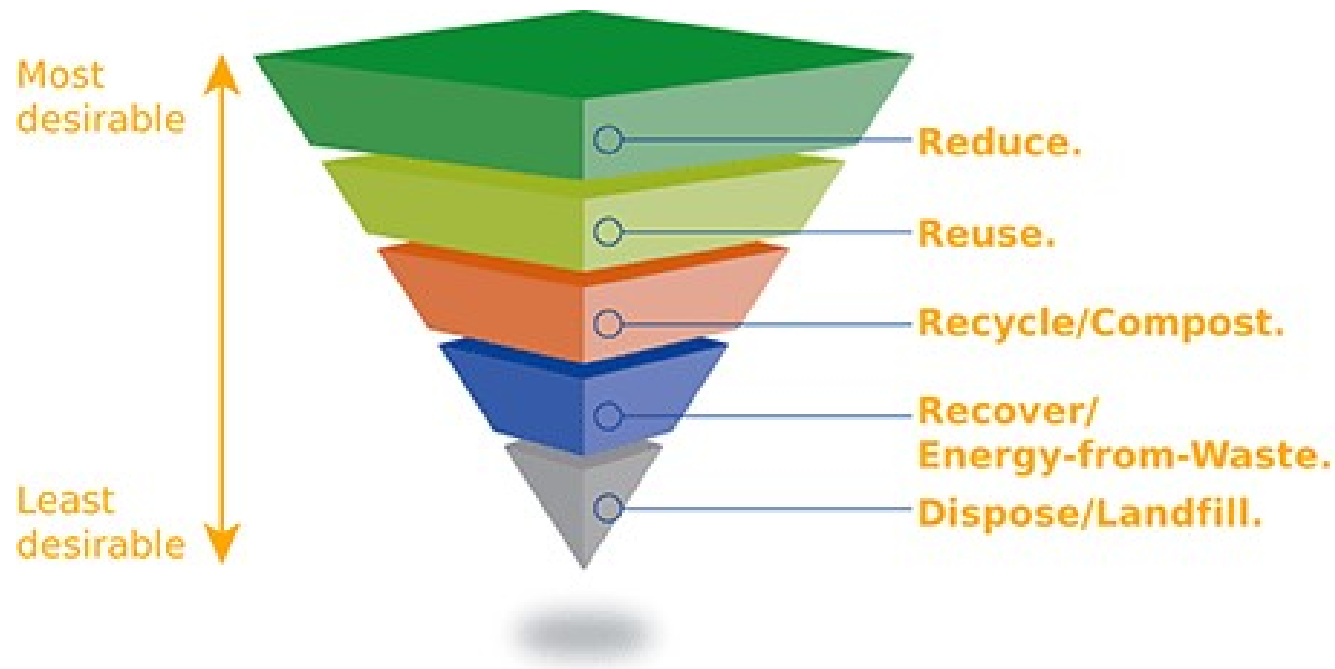
Recertified December 2014

- **Covanta is investing to insure safety excellence and continuing emissions performance that is well below the facility's VADEQ permit limits**

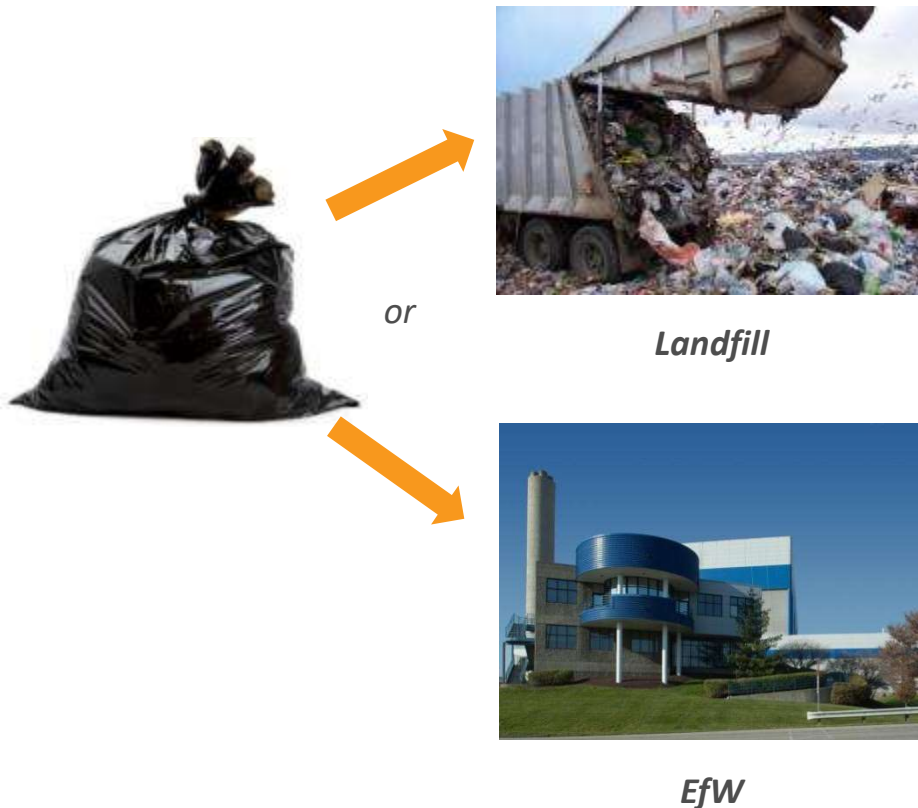
- Nearly \$20 million in enhancements to the Fire Prevention and Suppression Systems (sprinkler, monitors, IR Cameras, roofing etc.)
- Covanta will have invested ~ \$30 MM in new bag houses and other improvements through 2019
- Low NOX technology implementation in 2018-2021

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



Why Energy from Waste?



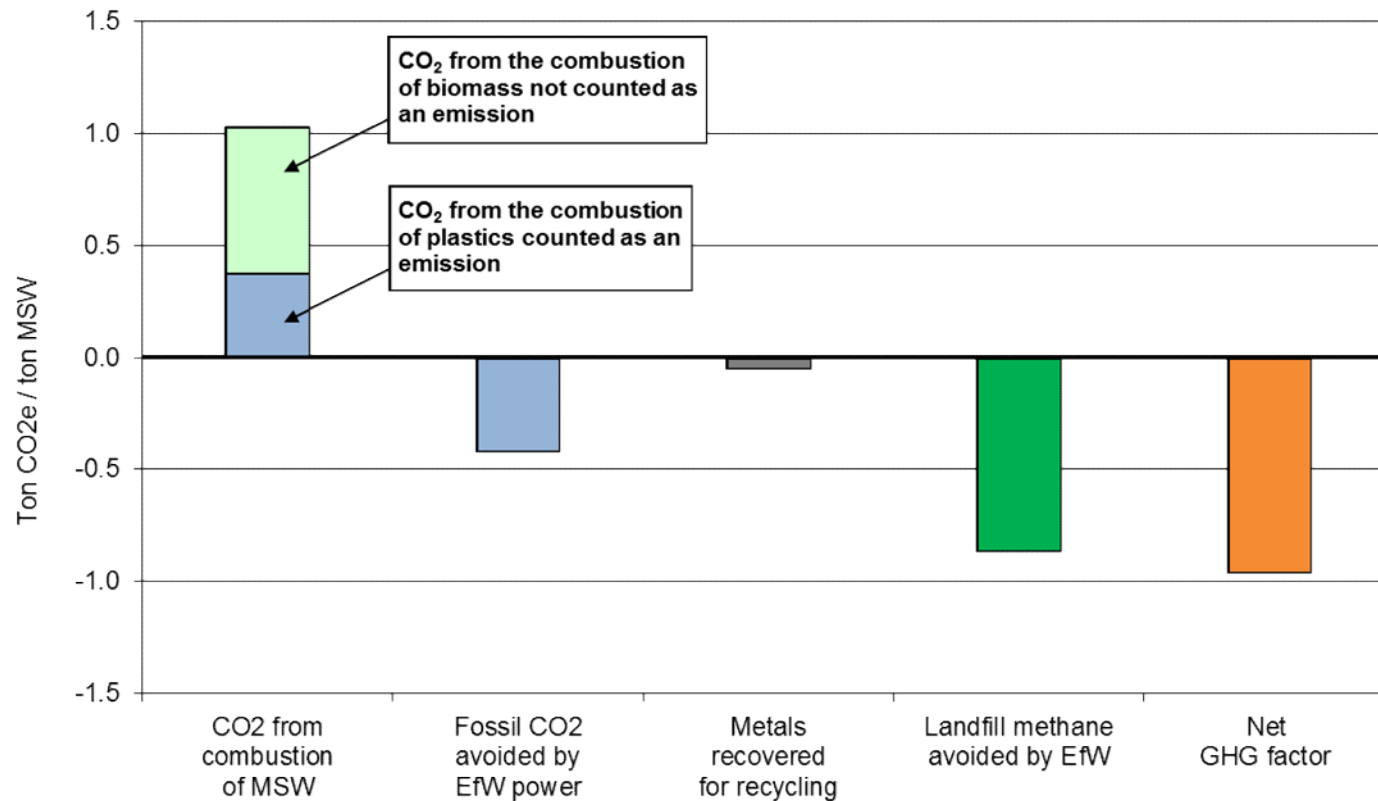
- *Landfills are a major source of man-made methane*
- *Methane is more than 30X more potent than Carbon Dioxide*
- *Leachate generation: ground water contamination*
- *Non sustainable use of land*
- *Energy generation from landfills: **65 kWh per ton of waste***

- *90% reduction of waste in volume*
- *Clean base load power generation*
- *Recovers metals for recycling*
- *Offsets on average one ton of carbon dioxide equivalent for each ton of waste processed*
- *Renewable energy generation from EfW: **550 kWh per ton of waste***

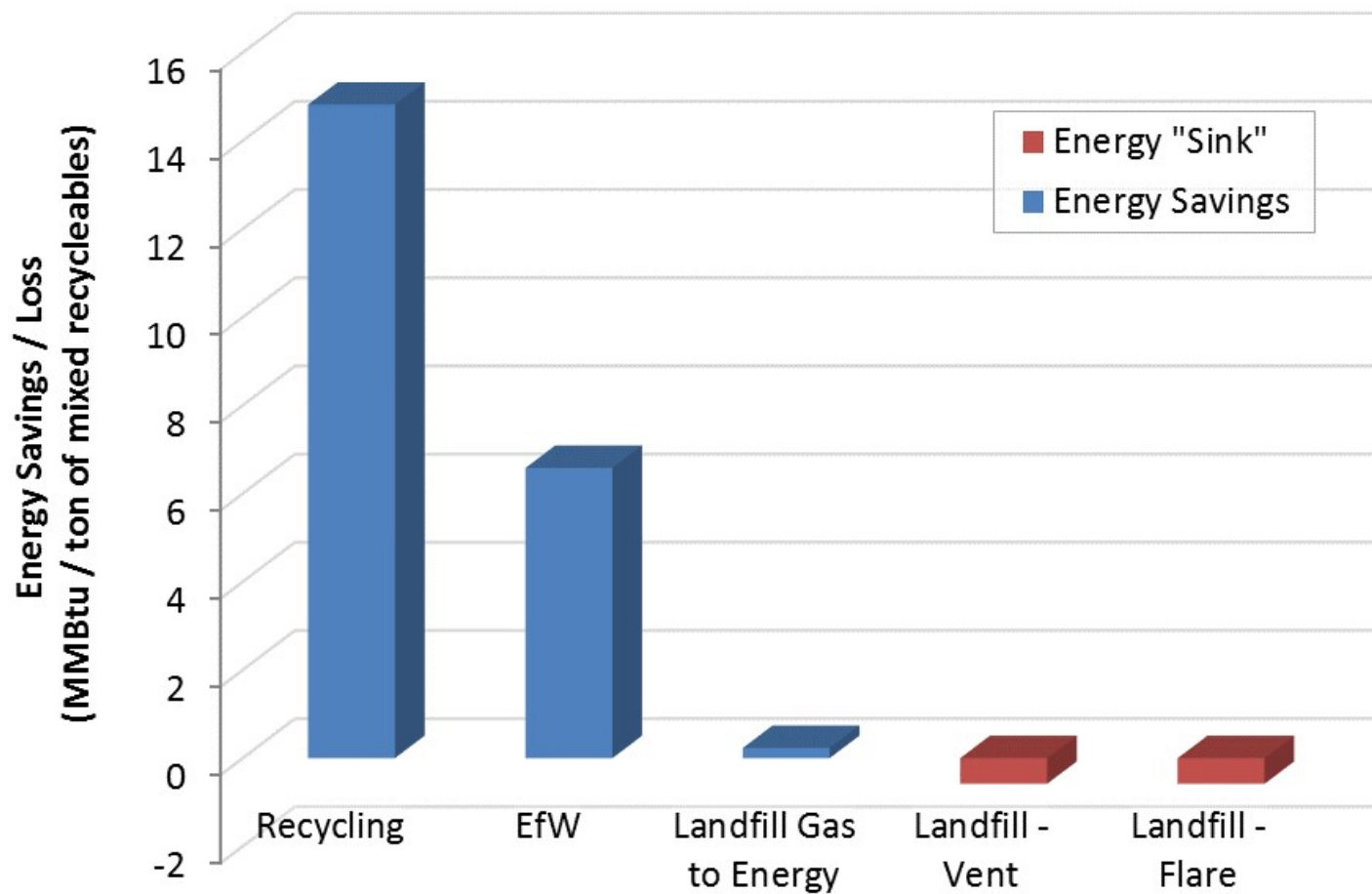
GHG Benefits of Energy from Waste

“... 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>



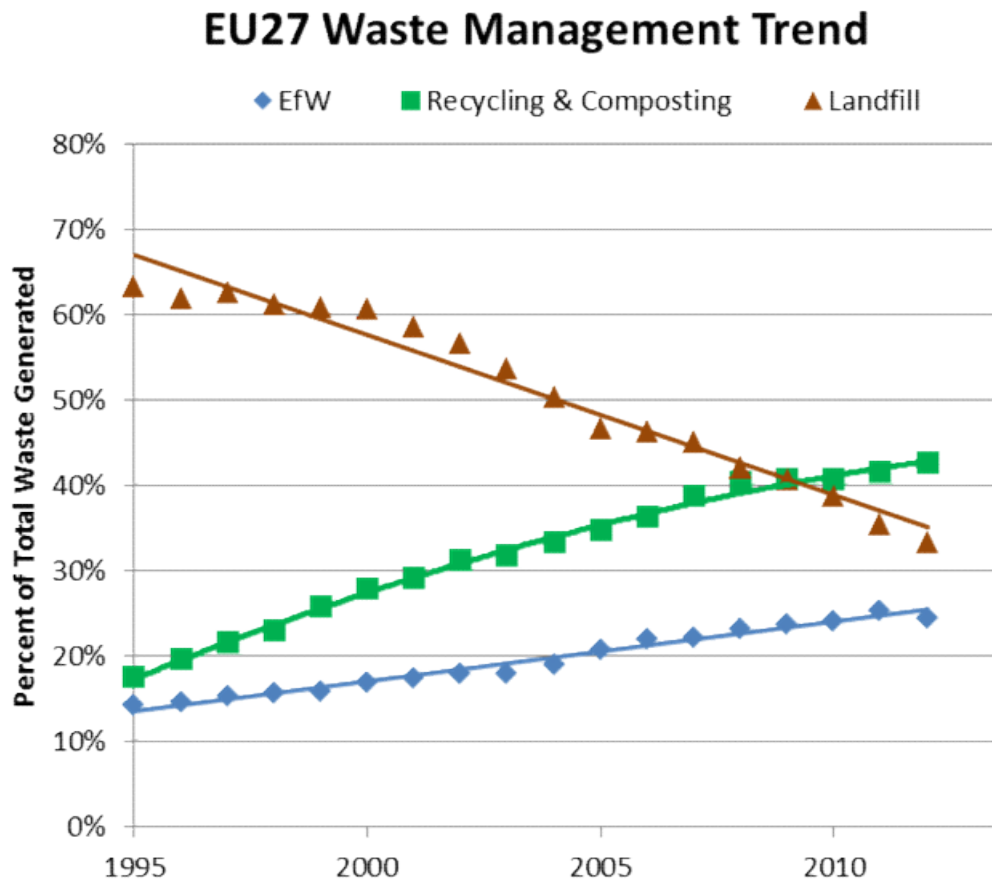
Energy Recovery Comparison of Waste Management Options



Source: U.S. EPA (2016) Waste Reduction Model, Version 14

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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.”
- In the U.S., many Covanta communities recycle well over 50%.

Recycling & EfW together can drive large benefits

	Business as Usual*		Sustainability Scenario
Recycling	28.9%	➔	65%
EfW	7.6%		25%
Landfill	63.5%		10%

- Economic Benefits**

\$130B in direct economic activity

350,000 new permanent jobs

- GHG Savings**

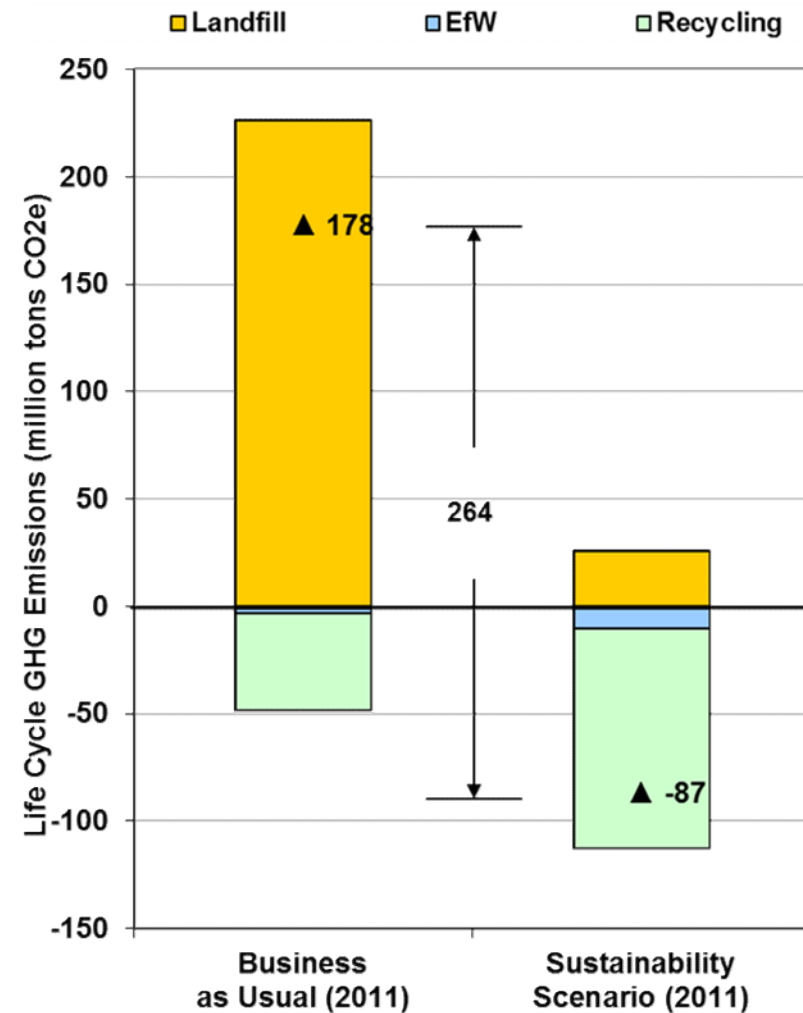
264 million tons CO₂e

≈ closing 63 coal-fired power plants

- Energy Savings**

2.2 Quadrillion BTU primary energy

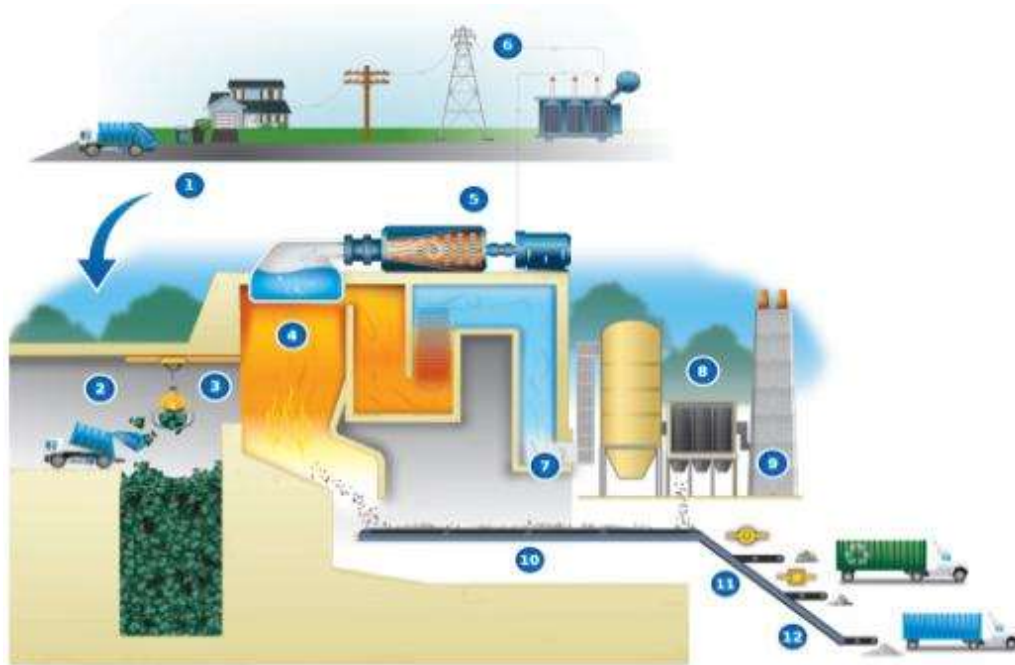
≈ equivalent to the U.S. energy from solar & wind combined



Energy-from-Waste Process

After reducing, reusing and recycling, residual waste is used to produce clean renewable energy at Covanta's EfW facilities.

<https://www.youtube.com/watch?v=-KmTbHInScw&t=102s>



How We Do It:

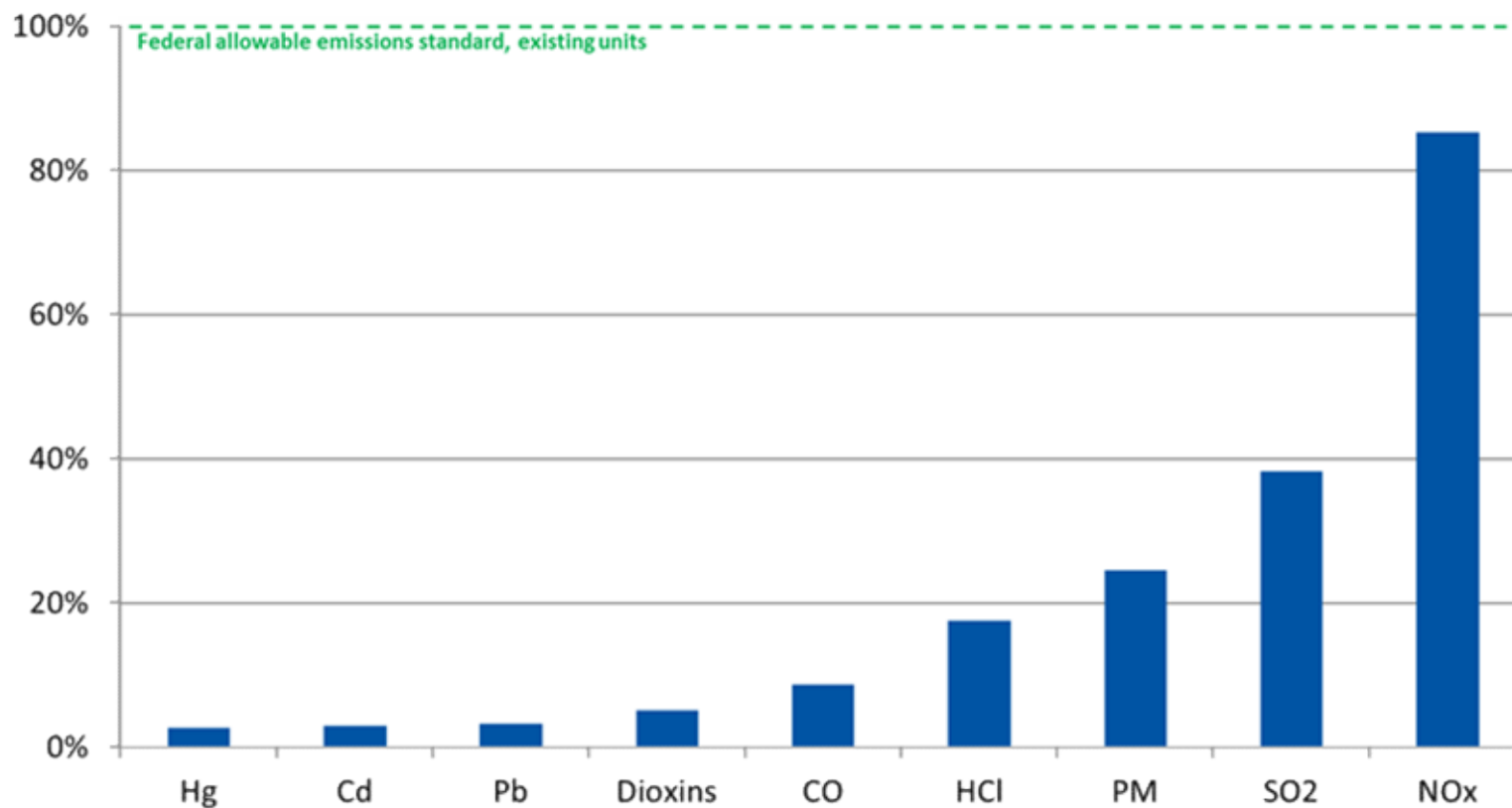
1. Post-recycled waste is picked up
2. Delivery to EfW Bunker
3. Transferred to Combustion Chamber
4. Clean Combustion Process Boils H₂O
5. Steam is used to generate electricity
6. Electricity is distributed to local grid
7. State-of-the art air pollution control equipment cool and scrubs gases
8. Baghouse captures particulate emissions
9. Emissions are continuously monitored
10. Ash residue is collected
11. Metals are recovered for recycling
12. Residual material is beneficially reused or disposed of in landfill

Air Emission Monitoring and Control

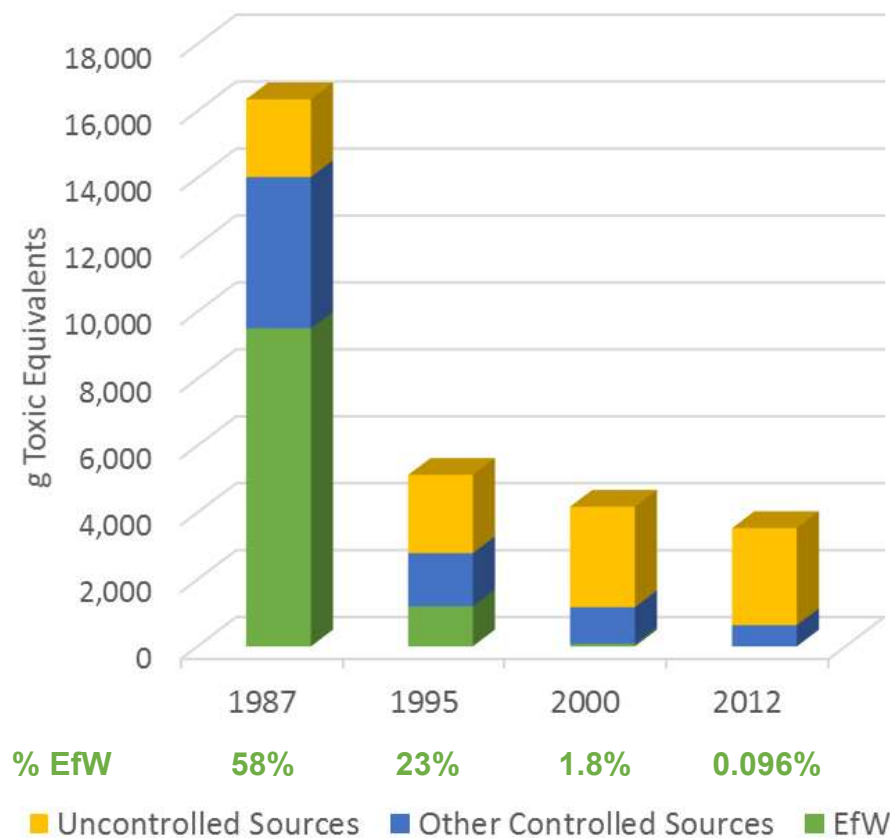
- **Emissions control is a multi-step processes**
 - Good combustion control to maintain carbon monoxide (CO) and furnace temperature conditions
 - Ammonia addition to control nitrogen oxides (NOX) through selective non-catalytic reduction (SNCR)
 - Scrubber Operation
 - Lime addition to reduce acid gases such as hydrogen chloride (HCl) and sulfur dioxide (SO₂)
 - Carbon to control mercury (Hg) and dioxins
 - Fabric Filter Bag House
 - Filters gases to capture particulate matter
- **Emissions are continuously monitored (CO, NO_x, SO₂, and opacity)**
 - Community access to daily results at <https://www.covanta.com/fairfax>
 - Other compounds through annual stack testing by a 3rd party vendor

Covanta Fairfax – Recent Emissions Performance

**Covanta Fairfax 2014-2016 EfW Emissions
compared to federal standards**



U.S. EfW Dioxin Emissions: Lower than Ever



Source	g TEQ / yr
1 Landfill fires	1,300
2 Forest & brush fires	837
3 Backyard burning	385
4 Agricultural burning	131
5 Diesel fuel combustion	118
6 Wood combustion	92
7 Vehicle fires	86
8 Coal combustion	85
9 Land clearing debris burning	72
10 Ferrous smelting	64
⋮	
26 Waste-to-energy	3

Plastics and Energy from Waste

- Plastics are best recycled rather than burned for maximum energy recovery and to minimize GHG emissions.
- Although plastics can contain a higher energy content than typical municipal solid waste, this higher energy content will effectively reduce the quantity of MSW that can be processed – shifting more MSW to landfill disposal.
- MSW is heterogeneous and will include plastics. Plastics can be combusted burned as part of the normal mix of municipal waste – however large dedicated loads can present operational challenges.
- Combustion of plastics does recover resources for productive use and can destroy certain plastic additives (e.g. flame retardants, plasticizers) to prevent release into the environment.

Summary

- Reducing, Reusing and Recycling maximizes energy savings and minimizes greenhouse gas emissions.
- Energy from Waste (EfW) plays key role in the waste hierarchy as a disposal strategy after Recycling.
- EfW is Clean, Sustainable with significant GHG benefits vs landfill.
- Air pollution control equipment installed at modern EfW facilities is effective at controlling emissions to well within established permit limits.
- Recycling and Energy from Waste can co-exist and grow together.
- Covanta encourages recycling for a sustainable future.



COVANTA
Powering Today. Protecting Tomorrow.

Thank You