

GM's Waste Goals Supporting Zero Emissions

Environmental Stewardship Program Oct Meeting

Glenn Perham

“When you think of Garbage think of Glenn”

Sr. Environmental Engineer

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Agenda

1. Development of Zero Waste Program
2. GM's Zero Waste Program
3. Ownership of Circular Economy
4. Program Wins
5. Lessons Learned
6. Questions maybe Answers



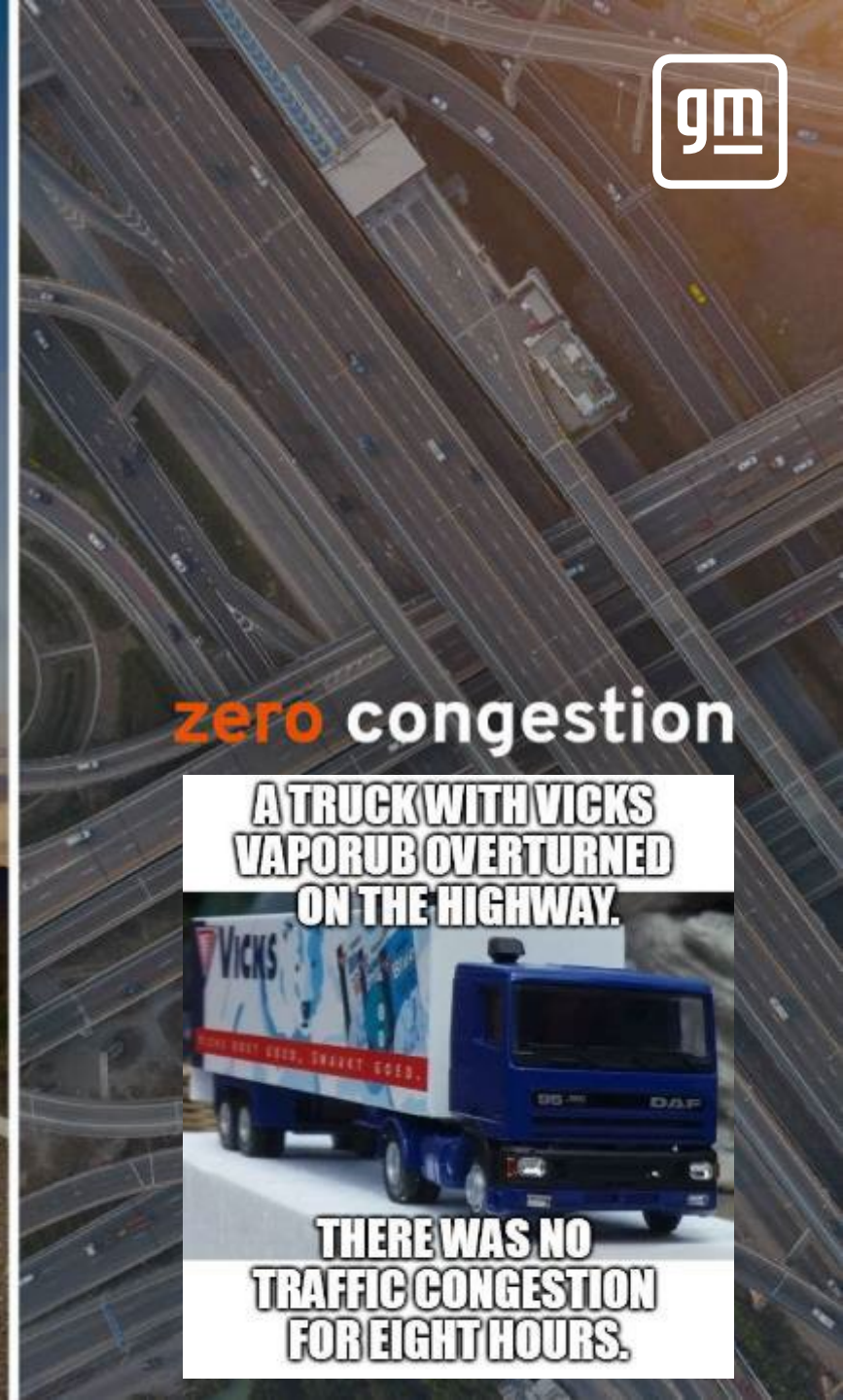
zero crashes

zero emissions

zero congestion

**A TRUCK WITH VICKS
VAPORUB OVERTURNED
ON THE HIGHWAY.**

**THERE WAS NO
TRAFFIC CONGESTION
FOR EIGHT HOURS.**



GM's Zero Waste Program Development



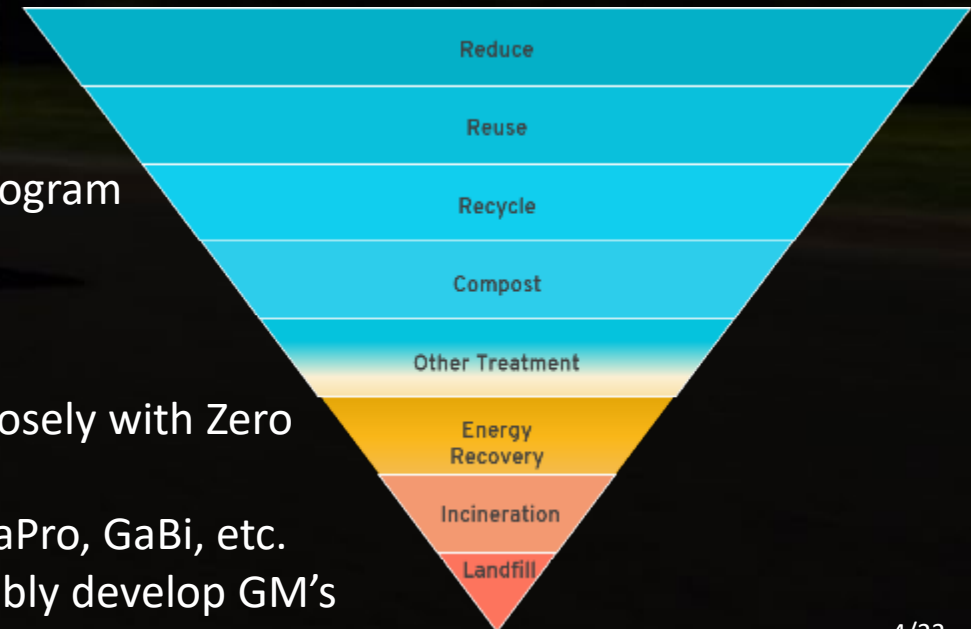
Peer-Reviewed, International Definition of Zero Waste: "The conservation of all resources by means of responsible production, consumption, reuse, and recovery of products, packaging, and materials without burning and with no discharges to land, water, or air that threaten the environment or human health."

Consulted with multiple 3rd Party's Zero Waste Programs to identify best practices.

- Diversion definition
- % Diversion – how to calculate it
- Tier/Rankings system
- Greenwashing – how to validate integrity of program
- Encourage Employee Engagement
- Administrative burden with no impact

Life Cycle Analysis -Possible next steps is to align more closely with Zero Emissions

- Reviewed know platforms such as WARM, SimaPro, GaBi, etc.
- Project with Purdue University Seniors to possibly develop GM's own LCA

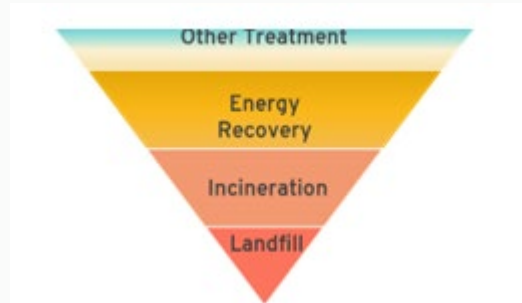


GM's Zero Waste Program



GM's goal as a corporation is to divert 90% of operational waste by 2025

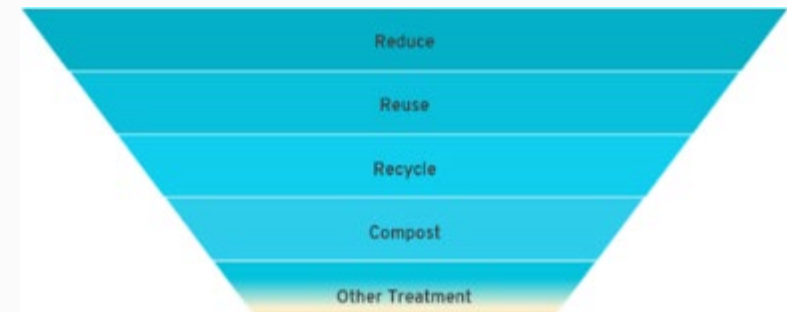
Why Energy Recovery is not a diverted waste



Shortcomings of LFF Programs (and Energy Recovery)

1. Doesn't support GM's vision of Zero Emissions
2. Facility were relying to heavily on Energy Recovery technology.
Doesn't support improvement in waste hierarchy
3. Doesn't support Circular Economy
4. No Requirements for Employee Engagement
5. Cost savings opportunity

Diverted Waste Streams



1. 90% by weight must fall into these categories

3rd party Validation process to prevent greenwashing
easier domestically

2. Leadership Commitment

Env Goals incorporated into GMS

3. Employee Engagement

Participation in ZW Treasure Hunts

4. Innovation

Working to phase out non recyclable plastics
or replace with recyclable plastics



GM's Waste Diversion Formula

Presented during the 2nd World Conference on Waste Management

<https://tiikmpublishing.com/data/conferences/doi/wcwm/26510251.2021.1101.pdf>

- m_{ndw} = mass of non-diverted waste (Includes wastes managed by disposition in a landfill and thermal processing facilities)
- m_{endw} = mass of exempt non-diverted waste (Includes wastes generated in non-operational activities, such as construction, demolition, or remediation projects)
- $m_{baseline\ waste}$ = mass of waste in the baseline period
- m_{te} = Total mass of exempt waste in the baseline period

$$DR_{new} = \left(1 - \frac{\sum m_{ndw} - \sum m_{endw}}{\sum m_{baseline\ waste} - \sum m_{te}} \right) \times 100\%$$

Most common method to calculate diversion rates is to divide the total amount diverted by the total count of waste generated and multiply by 100. This method is limited and not accurate when calculating the diversion rate in the long term. The solution is to use the concept of a baseline, similarly to what the Greenhouse Gas Protocol uses.



New Diversion Calculation was needed

Case 1 - Third-party methodology

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6
1	TRASH	TRASH	TRASH			
2	TRASH	TRASH	TRASH	TRASH		
3	CARDBOARD	CARDBOARD	CARDBOARD	TRASH	TRASH	
4	PLASTIC	PLASTIC	PLASTIC	PLASTIC	TRASH	TRASH
5	PLASTIC	PLASTIC	PLASTIC	PLASTIC	PLASTIC	TRASH
Third Party (No baseline)	60.0%	60.0%	60.0%	50.0%	33.3%	0.0%

Total amount changes affecting the diversion rate. Same quantity goes to landfill but diversion rate changes.

Case 3: GM's methodology

	YEAR 1 - Baseline	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6
1	TRASH	TRASH	TRASH			
2	TRASH	TRASH	TRASH	TRASH		
3	CARDBOARD	CARDBOARD	CARDBOARD	TRASH	TRASH	
4	PLASTIC	PLASTIC	PLASTIC	PLASTIC	TRASH	
5	PLASTIC	PLASTIC	PLASTIC	PLASTIC	PLASTIC	TRASH
New Method	60%	60%	60%	60%	60%	80%

A reduction of the amount that goes to landfill shows higher diversion rate as expected.

Case 2: GM's methodology

	YEAR 1 - Baseline	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6
1	TRASH	TRASH	TRASH			
2	TRASH	TRASH	TRASH	TRASH		
3	CARDBOARD	CARDBOARD	CARDBOARD	TRASH	TRASH	
4	PLASTIC	PLASTIC	PLASTIC	PLASTIC	TRASH	TRASH
5	PLASTIC	PLASTIC	PLASTIC	PLASTIC	PLASTIC	TRASH
New Method	60%	60%	60%	60%	60%	60%

A fixed baseline solves the issue. Same quantity that goes to landfill yields same diversion rate

Case 4: GM's methodology

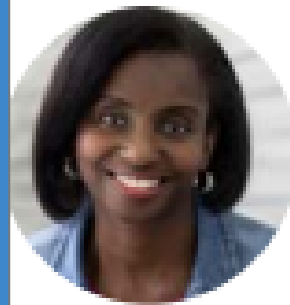
	YEAR 1 - Baseline	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6
1	TRASH	TRASH	TRASH			TRASH
2	TRASH	TRASH	TRASH	TRASH	TRASH	TRASH
3	CARDBOARD	CARDBOARD	CARDBOARD	TRASH	TRASH	TRASH
4	PLASTIC	PLASTIC	PLASTIC	PLASTIC	TRASH	TRASH
5	PLASTIC	PLASTIC	PLASTIC	PLASTIC	PLASTIC	TRASH
New Method	60%	60%	60%	60%	40%	0%

An increase of the amount that goes to landfill shows lower diversion rate as expected.

GM Circular Economy



Share Ownership in Circular Economy



“We believe that **collaboration is critical** when focusing on circularity. We are piloting new packaging types and materials to minimize waste, and evaluating tools that measure how much material we reuse, recycle and remanufacture.”

Reeshemah Howard
Emerging ESG Sustainability Strategies Manager

Without Collaboration



Upstream Collaboration Timing is Critical



Plastic shipping aid initiative

- Upstream – Get materials you can recycle
 - Employees that set specs for parts
 - Process to purchase only recyclable plastic
 - Cost savings/neutral opportunity
 - Employees that ensure quality
 - Is it really needed or can it be reused
 - Employees that are budget holders
 - Gain financial support by sharing downstream costs for trans, disposal, labor, etc.
 - Ergo Employees

Timing

- Over communicate Sustainability Goals
- Gain support by injecting sustainability metrics during design phase

Downstream Collaboration

Know your vendors capabilities



Collect



Sort



Wash



Grind



Identification of
regrind



Extruding +
compounding

Taking Ownership of Circular Economy

- New product for vehicle
- New Caps / Plugs
- Filler for asphalt



Zero Waste Program Indiana Site Wins

1. Wastewater Treatment Sludge
 - A. Reduced - unknown
Slug load plan to reduce treatment chemicals (solids to process)
 - B. Recycled – 472 tons
Used as a constituent replacing raw materials in cement
2. Reusable Absorbent Program: 6 months to divert 28.3 tons
3. Approx \$60,000 revenue for headlights
4. Wood recycled estimated to divert 100 tons annually
5. 237 tons of mixed auto plastic parts

2022 Diversion Rate of 91.8%

Lessons Learned

**I definitely learned my lesson about speeding today and it will never happen again.
I didn't get pulled over or anything, I just showed up to work 20 minutes early.**

3rd party certifiers

Cost Approx \$10,000 /site

Need years of good data for baseline.

Used 3 years to account for anomalies in waste generation

Savings from Landfill Free programs can be reallocated to fund projects that support circular economy





Questions?