

WASTE-TO-ENERGY

WHAT TO DO ABOUT OUR TRASH: MICRO LESSON PART 1

Start: What happens to the trash in our garbage bin?

Students usually answer this question by saying that it goes to the dump, but ask them for more. Such as:

- ⇒ What happens when it gets there?"
- ⇒ You can go further and ask, "What happens to your trash over time in a landfill?"

Information to add

- ◇ Leachate- liquid waste that pools at the bottom of landfills, can leak into the ground and ground water if the landfill is not properly lined.
- ◇ Landfills are the 3rd largest source of Methane emissions in US (14% of total) 1
- ◇ 20 years until max CO₂ and CH₄ production is reached, keeps producing these emissions for several more decades at a declining rate. 2
- ◇ Waste materials biodegrade in large mounds for centuries or longer
- ◇ Materials are not reused

Links on Local Recycling



Infographics about trash & recycling in Hillsborough County



Quick Reference of what the Recycle in Hillsborough County

Next: Ask students what might be a better solution

- ◆ Recycling is usually a top answer. Followed by some recommendations about creating less trash, composting, and using more biodegradable materials.
- ◆ These are good answers, but you can then ask them, 'Why do we not choose these options with all of our waste?'
- ⇒ The answer is Cost.
- * You can demonstrate this by asking why we don't recycle diapers.
- * What would it take to separate the bio-waste from the PET plastic, from the fill from the other absorbing compounds?
 - Would your students want that job?
- * It is difficult and more expensive, and the recycled materials will cost much more to recycle than to make them from new materials. So recycled diapers would cost more than diapers made from new materials. What would most consumers choose for their babies or the elderly?
- * How do you recycle greasy cardboard food containers or compounded plastics?
- * Some things are just difficult or expensive to recycle or compost.
- * Most of our recycled plastics only get recycled once, into a non-recyclable product. 3
- * Tell them that you have to pay to have your trash removed and recycled, if the cost of waste removal increases, what do you think some people would start to do more?
- * In Hillsborough County, it costs \$102-131 per year for a single family home, which is a very low rate. 4
 - How much more would you be willing to pay to have your trash taken away and recycled?
 - How much would the general public pay?

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WHAT TO DO ABOUT OUR TRASH: MICRO LESSON PART 2

BRING IT TOGETHER

Ask them if they know what we actually do with our trash.

You can tell them that we are talking about Waste-To-Energy (WTE), and NOT burning your trash in the back yard (which is bad for the environment, your health, and is also illegal)⁵

- **Yes, burning our trash does sound bad, but let us take a deeper look at it.**

- ⇒ Trash is something that we want to get rid of.
- ⇒ Leaving trash in landfills creates many problems for the local area, taking up a space and producing emissions and leachate that harms the environment.

- **How does WTE help solve this? Waste-To-Energy has many important advantages over Landfills.**

- ⇒ **Space Saver:** By employing a Waste-To-Energy program, we reduce the volume and weight of our trash by 90% and 75%, respectively, by turning it into ash. ⁶
- ⇒ **Power Generator:** WTE turn the waste into electricity. The fires that burn the waste are used to create the steam that powers a turbine to make electricity (~550 kilowatt hours (kWh) of energy per ton of waste). ⁷
- ⇒ **Emissions Reducer:** Waste-To-Energy reduces the amount of greenhouse gasses emitted from trash.
 - WTE nearly eliminates the amount of Methane (CH₄, a powerful greenhouse gas) released into the atmosphere.
 - By using scrubbers and air cleaning methods, the emissions created from Waste-To-Energy are cleaner than almost any other type of combustible energy production. ⁸
 - WTE even has lower CO₂ emissions than all other combustible energy fuels. ⁹
 - Modern WTE emits less greenhouse gasses, per ton, than leaving this waste in a landfill. ¹⁰
- ⇒ **Secondary Recycler:** the ash that is left over from incineration, can be mined for recyclable metals (both ferrous *i.e. Steel, iron* and even non-ferrous *i.e. Aluminum*) and the ash can also be used for certain ceramic, cement, and other construction aggregates. ¹¹
- ⇒ **Not Perfect:** WTE does create emissions. Primarily CO₂, but does do so at lower rates than landfills, Coal, and Petroleum energy production. Natural Gas can have lower CO₂ emission per Kilowatt, but the production of Natural Gas is one of the largest emitters of Methane (so is Petroleum) ¹². Also, WTE is an emitter or Carbon Monoxide (CO), Nitrogen Oxides (NO_x), Sulphur Dioxide (SO₂) , Dioxins, and particulate matter with heavy metals in them. While this is clearly not desirable, it is important to know that the rates of these emissions are considerable lower than those of other fuels that we burn for energy, (with the exception of Natural Gas). Furthermore, the rates of these emissions are low and getting lower with the use of Maximum Achievable Control Technology (MACT) that cleans the emissions and captures large amounts of these pollutants before the leave the WTE plant. ¹³

Conclusion

- ◆ The point to this lesson is to get students thinking about opportunity costs.
- ◆ While WTE may not be an absolutely perfect solution to achieve an fully sustainable economy, we need to think of it in terms of what is the next best option. For example, if perfect is not a viable option, what is a better option than WTE?
- ◆ To extend this lesson have your students prioritize the best options for what we should do with our waste the does not meet the criteria for our municipal recycling and composting. Have them consider the sustainability, the environmental impact, and cost of each of the options (Landfill, Waste-To-Energy, and any other recycling ideas that they may come up with)

For the links to the numbered in text citations, and other useful and interesting charts and reports, including the ratios of what is incinerated in the WTE process, follow this link.

LINK HERE

Links and References for

Waste-To-Energy: WHAT TO DO ABOUT OUR TRASH: MICRO-LESSION

What do we burn? (2017 USA) ¹⁴

34 million tons of Municipal Solid Waste (MSW) were combusted with energy recovery.

22% Food Waste.

16% Rubber, leather and textiles

16% Various Plastics

13% paper and paperboard

The other materials accounted for less than 10%

1. <https://www.epa.gov/lmop/basic-information-about-landfill-gas>
2. <https://www.epa.gov/lmop/basic-information-about-landfill-gas>
3. <https://www.maine.gov/dep/waste/recycle/whatrecyclablesbecome.html#1plastic>
<https://www.wwf.org.au/news/blogs/17-cool-products-made-from-recycled-plastics#gs.x6y3g5>
... and many more.
4. <https://www.hillsboroughcounty.org/en/residents/property-owners-and-renters/trash-and-recycling/trash-and-recycling-fees>
5. <https://archive.epa.gov/epawaste/nonhaz/municipal/web/html/health.html>
6. <http://css.umich.edu/factsheets/municipal-solid-waste-factsheet>
7. <https://www.epa.gov/smm/energy-recovery-combustion-municipal-solid-waste-msw>
8. <https://archive.epa.gov/epawaste/nonhaz/municipal/web/html/airem.html>

Fuel	CO₂ (pounds per megawatt hour)
MSW	1016
Coal	2249
Oil	1672
Natural Gas	1135

9. from:
<https://archive.epa.gov/epawaste/nonhaz/municipal/web/html/airem.html>
10. https://www.epa.gov/sites/production/files/2017-02/documents/2017_complete_report.pdf
11. <https://www.fhwa.dot.gov/publications/research/infrastructure/pavements/97148/033.cfm>
12. https://www.epa.gov/sites/production/files/2017-02/documents/2017_complete_report.pdf
13. <https://archive.epa.gov/epawaste/nonhaz/municipal/web/html/airem.html>
14. <https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/national-overview-facts-and-figures-materials>