How does Trash Incineration compare to Landfilling? Coal?

Environmentalists have long understood that, as bad as landfilling is, trash incineration (and landfilling the toxic ash) is even worse. Energy Justice Network claims that trash incineration is the most expensive and polluting way to manage waste or to make energy. Is this really supported by the evidence?

Incineration is more expensive than landfilling. This has been affirmed by local experiences nearly everywhere in the U.S., and by a 2005 national tipping fee survey by the National Solid Waste Management Association (a waste industry trade association). A 2013 statement by the president of the incinerator industry's trade association, the Energy Recovery Council, also stated in public testimony that it's "not in dispute" that trash incineration "compared to a landfill… is more expensive… almost in every case."[1]

Incineration is the most expensive source of energy. The Energy Information Administration has published two studies that compare the costs of incineration to other energy sources. In each case, trash incineration came out as the most expensive to build ***and*** the most expansive to operate and maintain.[2]

Incineration is more polluting than coal. The average coal power plant in the U.S. was built in 1971. The average trash incinerator was built in 1987, and has additional air pollution control devices. Despite these additional controls, a 2011 report by the Environmental Integrity Project compared two trash incinerators in Maryland with four coal power plants in the state, and found that the incinerators emitted mercury, lead, nitrogen oxides (NOx), carbon monoxide (CO), and carbon dioxide (CO_2) at higher rates than coal. Toxic lead emissions were found to be emitted at a rate six times that of coal.[3] Also in 2011, the New York Department of Environmental Conservation published comments objecting to incineration being considered renewable energy in New York, and comparing the emissions from their 10 trash incinerators to their 8 coal power plants. The state's analysis found that incinerators release mercury, lead, cadmium, CO, NOx and hydrochloric acid at higher rates than coal, though emissions of sulfur dioxide (SO_2) were lower than coal. Shockingly, mercury from incineration was found to be emitted at a rate 14 times that of coal.[4] Energy Justice Network 2014 analysis of U.S. EPA data compared 59 trash incinerators to 383 coal power plants and found that, to make the same amount of energy, trash incineration emits 2.5 times as much CO_2, three times as much NOx and 70% more SO_2 than coal. Using the best available industry-wide EPA data, Energy Justice also found that mercury is emitted by trash incinerators at a rate six times that of coal, and that incinerator release dioxins – the most toxic man-made chemicals known to science – at a rate 28 times that of coal.[5]

Of course, trash incinerators are not meant to be power plants, and even the president of the incinerator industry's trade association has admitted that energy generation is a "secondary function," and that they're primarily designed to manage solid waste. *So how do incinerators compare to landfills?*

Incineration is more polluting than landfills. Incinerators do not avoid landfills. For every 100 tons of trash burned, 30 tons become toxic ash that goes to landfills. The other 70 tons don't turn into energy, but become air pollution. In terms of air pollution, and groundwater impacts, burning waste then burying ash is far worse than direct landfilling, and both are worse than a Zero Waste approach.

In a 2017 life cycle analysis conducted to evaluate Washington, DC's waste options, ten different environmental measures were examined when comparing incineration in Lorton, VA to trucking waste to four southeastern Virginia landfills that were 2-4 times as far from DC. On a majority of the 10 environmental measures evaluated, incineration turned out to be worse than landfilling, even counting the extra emissions from diesel trucks hauling waste further to reach landfills. In fact, emissions from trucking were insignificant compared to those from the waste facilities. Incineration proved to be worse than landfills when it comes to global warming pollution, and pollution from nitrogen oxides, particulate matter, toxic chemical releases, acid gases, and smog. On a 7th measure (eutrophication), they were about tied, and on three of the smallest measures of types of chemical releases, landfills proved to be worse.[6]

Too often, major air pollution and health issues (like asthma and cancer), get swept aside when some look only at global warming pollution, where some studies suggest that landfills are worse than incinerators. In fact, landfills *are* bad for global warming, as they emit large amounts of landfill gas as organics like food scraps and yard waste rapidly degrade. Landfill gas is about half carbon dioxide and half methane. Methane was long thought to be just about 20-some times as bad as CO_2 for the climate, but is now understood to be 34 times as bad over a 100-year time span, and a whopping 86 times as bad over a 20-year horizon, which is more relevant for avoiding global warming tipping points. However, even using the latest science on methane and a 20-year time horizon, the evaluation found that trucking waste four times as far to a landfill is still not as bad for the climate than burning closer to home.

Greenhouse gas comparisons that make incineration out to be better than landfills (or coal) rely on some major flawed assumptions.[7] Nearly half of the CO_2 emissions from trash incineration are "biogenic" in that they come from burning food scraps, yard waste, wood, paper, and other products that were grown, as opposed to petroleum-based plastics that produce the other half. While it's been scientifically debunked repeatedly, some still embrace the "carbon neutrality" argument that counts those emissions as zero because new growing plants suck up the carbon.[8] However, the decision to burn or bury has no impact on whether plants will regrow, and it's not valid to discount nearly half of an incinerator's GHG emissions while counting the GHG emissions from landfills, which are entirely "biogenic" (the plastics in landfills aren't forming GHGs). Another major flaw is subtracting emissions from coal power plants as if any energy generation at an incinerator displaces coal. In fact, because of trash incineration being considered renewable energy in many places, it can be more likely to be displacing emission-free wind power. Energy displacement is too speculative to enter into such life cycle analysis, and if it is used, the full benefits of a zero waste system should be included, whereby recycling and composting save 3-5 times more energy than incineration creates by burning those materials that will need to be recreated with more energy. Subtracting avoided methane emissions from landfills is also a dishonest way to do a comparison between incinerators and landfills.

Burning trash creates new toxic chemicals and makes existing toxins in products more available to leach out when rainwater contacts ash in a landfill. Since it's the toxicity (not volume) of waste that harms health, it's better to send stabilized, unburned trash to a landfill than incinerator ash.

There are three major options for how to manage waste, all of which end in landfilling in some way:

1) Landfill directly
2) Incinerate and landfill toxic ash
3) Zero waste with material recovery and biological treatment prior to stabilized landfilling

Studies comparing landfilling and incineration to zero waste approaches have found – not surprisingly – that avoided production (reduction and reuse), recycling and composting are better for the climate than burning or burying materials,[9] and that the "leftovers" are best handled with a material recovery and biological treatment (MRBT) process before landfilling.[10] Material recovery means mechanically removing extra recyclables that are still discarded. Biological treatment means stabilizing any residual organic material with an anaerobic digestion process so that any gas generation is done in an enclosed system where gases can be easily captured, avoiding having a gassy, stinky landfill. Following the Zero Waste Hierarchy provides the best results.[11]

[1] http://www.energyjustice.net/incineration/expensive-waste
[2] http://www.energyjustice.net/incineration/expensive-energy
[3] http://www.environmentalintegrity.org/documents/FINALWTEINCINERATORREPORT-101111.pdf
[4] http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={DEEA097E-A9A6-4E53-898C-0BC2F4C60CC4} See pp.22 & 25.
[5] http://www.energyjustice.net/incineration/worsethancoal
[6] http://www.energyjustice.net/files/incineration/incineration_vs_landfills_DC.pdf See slides 7-11, 15-17, and 25-37.
[7] http://www.energyjustice.net/incineration/climate
[8] http://www.energyjustice.net/biomass/climate
[9] http://www.eunomia.co.uk/reports-tools/the-potential-contribution-of-waste-management-to-a-low-carbon-economy/
[10] http://www.ecocycle.org/specialreports/leftovers
[11] http://zwia.org/standards/zero-waste-hierarchy/

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