COMPOSTING

RESIDENTIAL IMPACT COMPUTED

Have you thought about composting, or is it a practice you attribute to "tree-huggers"? Do you know how much of a difference it makes? At Energy Shrink, we like to put numbers to things. We have composted, calculated the impact, and want to share these findings with you. Let's look at how composting efforts positively impact our community, and if you haven't already, maybe you can convince your household to join in.

Summary: By composting food scraps alone, 4 households could effectively remove a car from the roads. Eight households composting food scraps could offset an average home's electric use per year. Composting food scraps, plus all the remaining organic waste from 1 US household, equates to removing 1.5 cars from the roads or 75% of an average home's energy use per year.

How did we arrive at these figures?

Food is the most obvious thing to compost. The average household produces 450 lbs. (200 kg) of food waste per year.

This estimate is based on a recent US study across three cities that determined that the average household wastes 8.7 lbs. of food per week [1]. This figure is consistent with the roughly 6 lbs. per week that lands in the compost bin from our household consisting of 2 adults and 2 kids. Our compostable waste includes not just food but also paper towels and compostable packaging (biomass). In the US, food scraps make up only about 12% of municipal solid waste (MSW). In all, about 70% of US MSW is made up of biomass and is therefore compostable. See table below [2].

Characterization of US MSW by USEPA [7]

Biomass components	(%)	Petrochemical components	(%)
Paper/board	36.2	Plastics	11.3
Wood	5.8	Rubber, nylon, etc.[a]	3.7
Yard trimmings	12.1		
Food scraps	11.7		
Cotton, wool, leather[a]	3.7		
Total biomass	69.5%	Total man-made	15.0%

[a]Rubber, leather and textiles category of USEPA was assumed to be divided equally between natural and man-made products.

Figure 1. The composition of municipal solid waste (MSW) as presented in the "Methane generation in Landfills" paper [2]

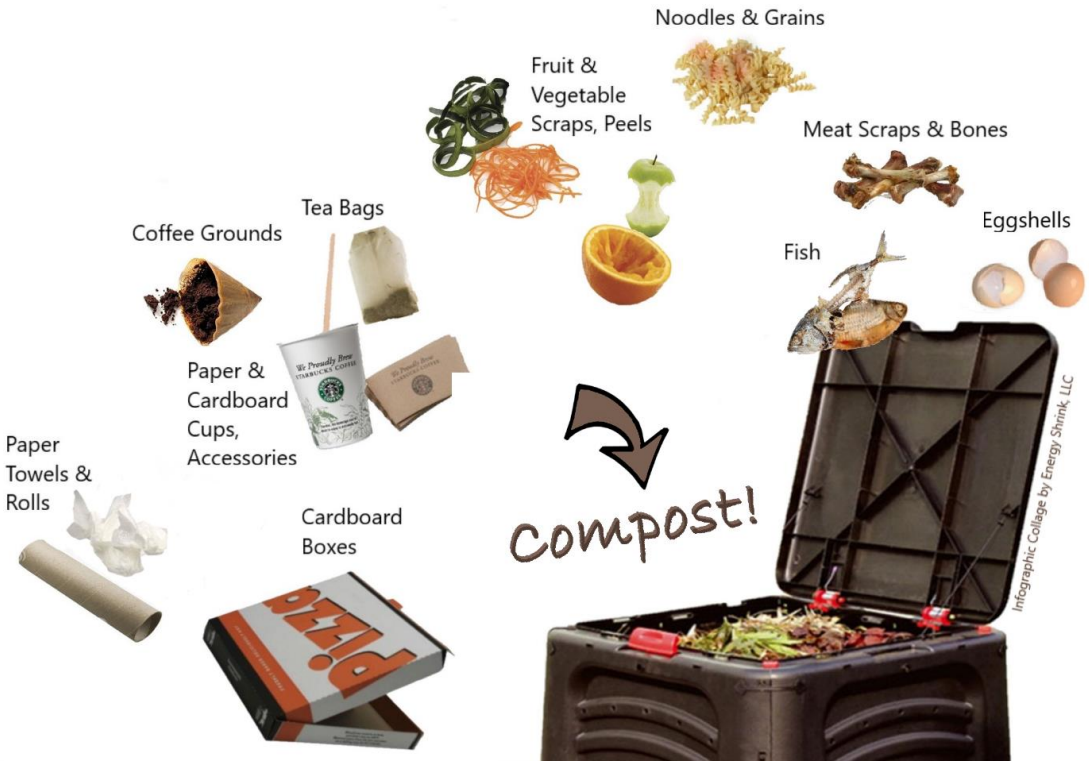

Figure 2. A surprising amount of household waste is compostable

The average US household produces 2 tons of municipal solid waste (MSW) per year.

The average person in the US produces 4.4 lbs. of solid waste daily [3]. For a typical household size of 2.58 persons [4], this equates to roughly 4,150 lbs. (4,143 lbs. to be exact) or 1,880 kg (1.88 Metric tons) of MSW per year, that is, *approximately 2.07 US tons*). Of this, 69.5%, or 2,880 lbs. (1300 kg) is compostable (see Figure 1 above).

Each ton of MSW produces 100 Nm³ of landfill gas [2], equating to about 50 Nm³ of CO_2 and 50 Nm3 of methane per ton of MSW with some other gases in trace amounts [5].

The primary gas that causes global warming is carbon dioxide (CO_2), but it doesn't act alone. In fact, many other gases also cause global warming[1]. Methane gas is one of the biggest culprits. The global warming potential (GWP) of methane is several times that of CO_2 [6] [7]. A 100-year reference period is the industry standard for comparing the GWP of gases, downplaying

[1] For simplicity, the impact of the other gases is measured in Carbon Dioxide Equivalent (CO_2eq). Carbon dioxide equivalent is a measure used to compare the emissions from various greenhouse gases based upon their global warming potential. For example, the global warming potential for methane over 100 years is 21. This means that emissions of one million metric tons of methane is equivalent to emissions of 21 million metric tons of carbon dioxide. (Source: https://stats.oecd.org/glossary/detail.asp?ID=285 , accessed July 27, 2018.)

methane's overall impact by averaging it over 100 years. Methane lingers in the atmosphere for only a decade on average (8-12 years) compared to hundreds of years for CO_2 [1]. Consequently, even though its duration in the atmosphere is shorter than CO_2's, pound for pound, methane's contribution to melting the glaciers is actually much greater [8].

The MSW from each US household produces 0.3 tons of methane and 0.2 tons of CO_2 per year.

As stated above, each US household produces 2 tons of MSW, and every ton of MSW produces 100 Nm^3 of landfill gases. So, 2 tons of solid waste equates to 200 Nm^3 of landfill gases, equivalent to 100 Nm^3 of CO_2 and 100 Nm^3 of methane. Several US landfills report capturing as much as 100 Nm^3 of methane per ton of MSW landfilled in a given year [2]. But the Columbia paper [2] takes a conservative approach and claims half of that impact. We use the same conservative figure in our calculations here. Using the Columbia paper's findings, (p. 1248), each ton of MSW generates 0.15 tons (0.149 to be exact) of methane. So, 2 tons of MSW is responsible for producing roughly 0.3 tons of methane. As for CO_2, with each ton of MSW producing 50 Nm^3 CO_2, 2 tons of annual waste produces 100 Nm^3 or 200 kg of CO_2, or 0.2 tons (1 Nm^3 of CO_2 equals 1.97 kg CO_2.)

By composting food scraps alone, 4 households could effectively remove a car from the roads, and 8 households could offset an average home's electricity use.

Now that we know how much greenhouse gas an average household emits, we can have some fun measuring its impact using the EPA's handy Greenhouse Gas Equivalencies Calculator [https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator, Accessed April 22, 2018]. The results show that in the best-case scenario where every organic scrap is composted, a household's composting could offset nearly the equivalent of its annual emissions from driving or energy use at home. [Emissions from the total compostable waste for a US household equates to 1.5 cars driven per year or 75% of an average home's electric use]. This figure is also equivalent to 181 tree seedlings grown for 10 years! Even if homes were to compost only their food waste (450 lbs. or 200 kg or 0.2 tons per year), that would still account for 15% of the total 2,880 lbs. of the total compostable waste per year.

Figure 3. Have you weighed your food waste lately? 6 lbs. of compostable waste go out from our home in a typical week. (The bucket sitting on the weighing scale weighs 2.25 lbs.)

A residential neighborhood of 530 homes could offset the emissions from 400 homes or nearly 800 cars in the best-case scenario.

In my neighborhood of 530 homes, using the average figures, we can estimate that we produce 159 tons of methane and 106 tons of CO_2 per year. The EPA calculator shows that these emissions are equivalent to 793 passenger vehicles driven for one year, or 400 homes' energy use. The impact with composting food scraps only would be 15% of this amount.

Fairfax County could offset 3.1 million tons of CO_2eq emissions every year by composting the waste from all its households, in the best-case scenario. This equates to emissions from 605,000 cars or 305,000 homes.

Virginia's Fairfax County, where we are based, is comprised of 405,000 households. The compostable waste from these households collectively produces 1.2 million tons of methane (121,500 tons), and 81,000 tons of CO_2. The EPA calculator shows that these emissions are equivalent to 605,793 cars driven for one year or the energy use of 305,481 homes. When composting only the food waste, 15% of this result could be mitigated every year. Our neighboring Falls Church City has initiated a composting program for its residents. Such programs can help a city or county meet its greenhouse emissions goals.

Some Facts:

- Annual emissions at Fairfax County were equivalent to 15 million tons of CO_2eq in 2005 (10% lower in 2017) [11]
- The annual CO_2eq emissions of the entire US are about 7 billion tons. The US has 4% of the global population and emits about 15% of global emissions. [12]

Table 1. Potential impact of composting residential food scraps in the DMV region

Potential impact from composting all residential food scraps in the DMV region					
Region	**Number of Households**	**Tons of Methane**	**Tons of CO_2**	**Emissions from ___ Passenger vehicles driven for one year**	**Emissions from ___ Homes' electricity use for one year**
Fairfax County, Virginia	405,000	18,225	12,150	100,000	70,000
Montgomery County, Maryland	373,346 as of Dec 7, 2018	16,801	11,200	92,000	65,000
Washington D.C.	281,475 as of Dec 7, 2018	12,656	8,437	70,000	49,000

What are the options for composting?

- Local composting programs are readily available, including services that regularly collect food scraps and organic waste from your home. Some of these organizations offer composted fertilizer in return. Locally, Veteran Compost (our current provider) or Compost Crew offer rates averaging $30/month. Falls Church City residents enjoy composting for a low rate of $6/month thanks to a city subsidy and an agreement with Compost Crew (Prices current as of December 2017).
- Some parks, such as the Potomac Overlook Park, offer a composting site in the Community Garden for residents to deposit their organic waste for free, which is then handled by park staff and volunteers. Residents of Arlington, VA, can now drop food scraps off at the Earth Products Recycling Yard where the resultant fertilizer will be used for county projects.
- Some shops, such as Mom's Organic Market in Arlington, offer bins for shoppers to deposit their compostable waste for free. Hint: Trader Joe's now offers compostable vegetable bags, which can be re-used effectively for transporting organic waste from home.
    - The DIY option is also quite basic! You can create a compost pile or pit in your own backyard, where you place scraps and waste in a small area that can be rotated or turned over. Just make sure to add some nitrogen-rich material (i.e. hay, weeds, grass) along with some course plant material (i.e. twigs, corn husks) to increase drainage and aeration.
    - You could even buy a special compost tumbler, a device which automatically or manually rotates compost.

Figure 4. Even a 3-year old can turn this composting bin installed at Haycock Elementary School in McLean, VA.

Frequently Asked Questions

Q: **Doesn't storing food waste make the house smell?**

A: Food scraps smell when left for days. To remedy this, we keep a nicer-looking countertop compost container at the kitchen counter right above our waste bin, which is fitted with a carbon filter. This helps motivate us to separate the food waste to its proper place. Once a day, we transfer the waste into our main compost bucket, that is kept in the garage. We've tested this through the seasons, and have had no issues with odors.

Q. **Why does organic waste produce methane in a landfill, but not in a composting bin or pit? Food is bio-degradable after all, so throwing food scraps and paper products into a landfill should be harmless.**

A: When organic materials break down in a landfill they get buried and rot "anaerobically" (without oxygen) and produce methane and carbon dioxide.

Composting is a slow and natural process in which organic waste (waste derived from living matter) from food and the yard is piled up and allowed to decompose naturally [9] by earthworms, bacteria and other organisms that live in soil. The compost pile needs to be turned frequently, adding oxygen and water to the mix (an "aerobic" process). Over several months, this decomposed material forms 'humus,' a rich, nutrient-dense fertilizer, a great alternative to chemical fertilizers. Synthetic nitrogen used in chemical fertilizers is one of the most significant sources of N2O, a powerful greenhouse gas that is about 310 times more potent than CO_2 [10]. A layer of well-aerated compost on the soil also reduces soil erosion and helps reduce stormwater runoff. Composting also keeps food and yard waste out of the landfill. Clearly, the benefits reach far beyond reducing greenhouse gases.

References:

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