GiNRE - Technical Background

Extended Facts on Why Garbage is NOT Renewable Energy

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What is landfill gas?

Modern landfills isolate our discards from water and air, and in particular, oxygen. This creates an anaerobic (oxygen-depleted) environment ideal for the proliferation of methanogenic bacteria. As these bacteria break down the organic (biodegradable) materials, the bacteria in turn release methane gas, a greenhouse gas 23 times more powerful than carbon dioxide. Landfills are the number one source of human-derived methane in the U.S., more than livestock emissions and wastewater treatment facilities. Landfills in the U.S. generate more than 25% of the methane produced by landfills worldwide, despite handling the waste disposal for only 5% of the world's population.

Landfill gas also includes hazardous air pollutants and volatile organic compounds, including known carcinogens. According to the U.S. Environmental Protection Agency (EPA), "landfill gas contains carbon dioxide, methane, [volatile organic compounds] VOC, [hazardous air pollutants] HAP, and odorous compounds that can adversely affect public health and the environment...exposure to HAP can cause a variety of health problems such as cancerous illnesses, respiratory irritation, and central nervous system damage." When landfill operators capture landfill gas and either burn it off or use it for energy, human health and environmental concerns from the gas are reduced. For this reason, the EPA mandated gas collection at large landfills beginning in 1996.

Legislative history

The Energy Policy Act of 2005, which extended federal tax credits for renewable energy projects, allocated tax credits of 1 cent per kWh to energy derived from landfill gas and "municipal solid waste (MSW) resources," and included these sources in renewable energy purchasing mandates for the federal government. (Traditional renewable energy sources such as wind, solar, geothermal, and closed-loop biomass received 1.5 cents per kWh.) The Act also provided tax credits for cellulosic ethanol production from MSW and loan guarantees for up to 80% of project costs. Prior to 2004, renewable energy legislation did not include MSW, even though the EPA began requiring landfill gas collection at select sites in 1996. The American Jobs Creation Act of 2004 was the first to label landfill gas and incinerators as sources of renewable energy. Landfill gas is also considered a source of renewable energy in numerous state renewable portfolio standards (RPS), which legislate how much of the state's electricity is to come from renewable sources.

Recycling is more effective at saving energy.

Mining for metals, drilling for fossil fuels, and logging for timber all consume vast amounts of energy and fuel, generate huge amounts of water and air pollution, and emit greenhouse gases. When new products are made from recycled materials instead of using freshly cut trees, raw metals or crude oil, the energy and pollution used to extract and transport these virgin materials is avoided. By recycling 30% of our discards in 2003, U.S. communities saved 1,486 trillion Btu (compared to landfilling/combustion disposal)-an amount equivalent to the consumption of 11.9 billion gallons of gasoline or 256 million

barrels of crude oil.

Manufacturing products with virgin materials also requires vast amounts of energy, most of which is produced from fossil fuels. Manufacturing with recycled products uses less energy, which reduces fossil fuel consumption and greenhouse gas emissions. The chart at right shows the energy savings of manufacturing with recycled vs. virgin materials for several products.

The benefits of recycling extend beyond energy savings. Recycling prevents air and water pollution, reduces acidification and eutrophication (excess nutrients in waterways), and reduces greenhouse gases. These savings have an economic value as well: the pollution reductions from recycling are valued at more than $500 per ton of material recycled!

Crediting landfills and incinerators with the production of "green energy" undermines the potential of recycling in conserving energy. Furthermore, the "green energy" designation creates a social acceptance of waste and detracts from efforts to reduce waste and use resources more efficiently, both more important areas of focus in advancing toward sustainable resource management. Just as reducing energy use is preferable to greener energy production, waste reduction and recycling are preferable to landfilling and incineration. Our recycling efforts already save vast quantities of energy, but communities in the U.S. and around the world are demonstrating we could do much better. It is here we should put our focus and our incentives, not toward 20th century disposal practices.

Composting organics restores our soils and cools our atmosphere.

Food scraps and yard waste are 25% of U.S. discards, and while 60% of yard waste is recycled or composted, only 2% of food waste is recovered. As bacteria break down these organic materials in the oxygen-depleted conditions of a landfill, the bacteria release methane gas, a greenhouse gas 23 times more powerful than carbon dioxide.

More important than their global warming potential, organic materials have the potential to become valuable soil amendments. Composting these materials not only reduces greenhouse gas emissions by avoiding methane emissions, but it also decreases fertilizer and pesticide use, improves soil structure, reduces irrigation needs, decreases the effects of high salinity, increases soil productivity, limits erosion, and helps store carbon in our soils. Long-term soil health and sustainable agriculture are essential to the health of our environment and economy, and we must develop and support organics recovery infrastructure to meet these goals. Renewable energy credits for landfills create an incentive to continue the burying of these valuable organic resources and directly oppose the goals of long-term soil health and sustainable agriculture.

The environmental and social benefits of composting have economic value as well. A 2007 life cycle assessment conducted by Morris and Bagby quantified the environmental benefits of natural lawn and garden care practices compared to conventional approaches. Morris calculated the economic value of pollution reductions from backyard composting and reduced use of synthetic fertilizers and pesticides at $16-$21 per household, not including reduced hazardous waste management costs estimated at $5 per year and potentially more than $40 in irrigation savings. These benefits include reduced greenhouse gas emissions, reduced human and ecological toxicity, and reduced eutrophication (excess nutrients in waterways).

Composting organics and generating landfill gas are not compatible.

A community committed to source separating organics for composting will greatly reduce or eliminate its landfill's generation of methane over the future life of the landfill. Landfills depend upon organic materials to generate the methane, and then convert the methane into energy, so no methane simply means no energy. Future landfill gas projects and gas volumes are therefore threatened by the removal of organic material from the landfill, and a landfill invested in gas recovery retains a financial interest in maintaining the status quo of landfilling biodegradable materials. Relying upon landfills for "renewable energy" stands in direct opposition to the recovery of organics for composting, which is recognized

universally as a higher use of resources on the waste hierarchy.

Organic materials in the landfill threaten groundwater.

Organic materials in the landfill also lead to the production of leachate. The liquids produced from the biodegradation of these organic materials seep through the landfill and, along the way, collect toxic chemicals and heavy metals from the contents of the landfill. This leachate migrates to the bottom of the landfill and eventually leak through the liner, potentially contaminating local groundwater. By removing organics from the landfill, a community can minimize the production and migration of leachate, therefore protecting its groundwater and potentially saving itself tens of millions of dollars in groundwater remediation and hazardous waste cleanup.

Communities around the world are removing organics from landfills.

Around the world, communities and countries are recognizing the inevitable harm caused by landfilling and are committing to reducing this harm by removing organic materials from the landfill and reducing waste. In the U.S., more than 23 states and numerous communities have banned the landfilling of yard waste. Some of these laws have been in effect for more than 15 years. More recently, cities such as Seattle are pushing beyond yard waste collections by also mandating the collection of food waste. In Canada, mandatory source separation of organics in Nova Scotia and Prince Edward Island has pushed both provinces to the forefront of resource management with recovery rates near 50% and 65%, respectively. Throughout the European Union, countries are required to reduce the landfilling of biodegradable waste by 65% within 15 years under the Landfill Directive. The goal of the directive is to "prevent or reduce as far as possible negative effects on the environment, in particular the pollution of surface water, groundwater, soil and air, and on the global environment, including the greenhouse effect, as well as any resulting risk to human health, from landfilling of waste, during the whole lifecycle of the landfill." At the leading edge of landfill regulations, Germany recently outlawed the landfilling of all untreated mixed waste, meaning all "leftover waste" (after recycling and composting) passes through mechanical, biological or thermal treatment to maximize recovery and to minimize the risks of landfilling.

In committing to sustainability and the protection of environmental and human health, these countries and communities are removing organics from the landfill, not adopting energy policies dependent upon or creating incentives for the continued landfilling of organics. Policies that reward energy from waste stand in direct opposition to safer and more sustainable resource management, and are a step backward from cutting-edge policies to recover organic discards.

Methane emissions could be largely understated.

The contribution of landfill gas to climate change may be dangerously understated. The incredible heterogeneity of municipal waste and the wide variety of geographic conditions at landfills across the country are the primary factors preventing the use of a default calculation model for landfill gas production. However, it is the collection efficiency of landfill gas systems that may be the greatest source of discrepancy. The U.S. EPA assumes 75% gas collection efficiency but measured efficiencies have been reported as low as 9 percent. The 2006 Intergovernmental Panel on Climate Change (IPCC) report on greenhouse gas inventories suggests a default estimate of recovery efficiency of 20 percent. The IPCC cites studies measuring collection efficiencies ranging from 9-90 percent, representative of the many uncertainties involving modeling gas generation and collection efficiency. In general, closed sites with thicker and less permeable covers will demonstrate higher collection efficiencies while sites that are still open or with temporary, sandy covers will operate at the bottom end of the scale.

The landfill industry itself attests methane emissions are not accurately tabulated: "Waste Management has determined that it is infeasible to make reliable measurements of methane emissions at the 243 landfills it operates...and the extraordinary diversity among landfills has made it impossible to develop a useful, broadly-applicable model of fugitive emissions."

Incineration is a waste of energy and a dangerous source of pollution.

Burning our discards releases harmful pollutants into the air, recovers only a fraction of the energy used during the products' life cycle, and perpetuates the cycle of destroying natural resources to make new products. Incinerators produce dioxins, heavy metals such as mercury and lead, particulate matter, and hundreds of other byproducts, only a handful of which have been identified or studied. When air pollution controls are installed to capture these hazardous substances, the materials are just transferred from the air emissions to the fly ash and the scrubber residues, simply moving the hazardous waste problem from one medium to another without addressing the pollution generation.

In 2006 life cycle assessments conducted by the EPA on incineration and recycling, recycling was shown to provide greater net energy and greenhouse reductions than incineration across a wide range of materials, including aluminum cans, steel cans, glass, corrugated cardboard, magazines/third class mail, newspaper, office paper, phonebooks, textbooks, dimensional lumber, and medium-density fiberboard. Furthermore, the combustion of HDPE, LDPE and PET plastics in waste incinerators was shown to be a net contributor to greenhouse gas emissions. (Even though plastics have a high energy content, their carbon content is considered anthropogenic, or derived from human activities, and results in net greenhouse gas emissions.) A 2006 report by Eunomia Research and Consulting (UK) found greenhouse gas emissions from incinerators were actually higher than those from conventional gas-fired power plants.

Because incineration destroys materials, more resources must be continually extracted and manufactured to provide new materials. While incineration may replace power produced from fossil fuels, it also burns the fossil fuels embodied in the discarded products-fuel used to grow or extract, manufacture, transport, and consume these products. Furthermore, the non-biodegradable portion of the waste stream is primarily derived from fossil fuels, a non-renewable energy source, so burning these materials cannot be considered "green energy." Subsidizing incineration as "green energy" will only ensure more materials are sent to incinerators for destruction, contrary to the goals of sustainable resource management.

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