

Plasma Arc Technology for Municipal Solid Waste:

A Proven Technology or Incinerator in Disguise?

**Will Florida's Health and Environment
Be Protected?**

Greenaction for Health and Environmental Justice

Global Alliance for Incinerator Alternatives

March 10, 2008

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Greenaction for Health and Environmental Justice and the Global Alliance for Incinerator Alternatives researched and produced this briefing paper as a public service to educate and alert Florida residents to the toxic threat posed by the plasma arc plants proposed in several locations in the state. We encourage community members, government officials and the media to research these issues and to fully scrutinize the claims being made by companies promoting these technologies.

Green Power Systems is proposing to build and operate a plasma arc facility to process 1,000 tons per day of municipal solid waste (garbage) in Tallahassee, Florida. Geoplasma is proposing to build a similar facility for up to 3,000 tons of solid waste per day in St. Lucie County. Both companies claim that the technology is proven, can generate large amounts of “renewable” electricity, and is environmentally friendly. Both companies propose to use “Plasma Gasification Vitrification” technology supplied by Westinghouse Plasma Corporation, a wholly owned subsidiary of Alter NRG.

If built, these facilities would be the very first of their kind in the United States.

Is this a technology you can trust?

As the Green Power Systems and Geoplasma projects would be the very first plasma arc facilities in the United States ever used for the commercial treatment of municipal solid waste (garbage) if they are to be seriously considered, then full and truthful disclosure of their plans, supporting data and a full public review of the project is essential.

Unfortunately, these projects and the claims of the companies involved have not received adequate scrutiny by government agencies. Instead, many government officials and agencies seem to have welcomed these companies despite serious problems with this technology in actual commercial operations, despite misleading claims and despite a lack of truly verifiable independent data from actual operating conditions to back up key claims. An industry that constantly misleads the public about the basic facts of their technologies should not be trusted with the health of our communities.

Tallahassee and St. Lucie County: Guinea Pigs for an Unproven Technology

Green Power Systems and Geoplasma have never built or operated a plasma arc facility. Westinghouse Plasma Corporation and Green Power Systems point to a facility operated by Hitachi Metals in Utashinai, Japan. Comparisons to the Hitachi facility are not warranted, as that facility is much smaller than the proposed facilities in Florida and the waste stream is not the same. According to the Alter NRG website, that Hitachi facility has the capability to process 165-190 tons per day of a mixture of auto shredder residue and some municipal solid waste – and only generates 3.9 megawatts of electricity. In addition, Green Power Systems has not been able to get or provide any test data whatsoever from the Hitachi facility, despite claiming to have inspected that facility.

No Stack? No Emissions? No Way!

Green Power Systems' website claims "The reactor has no need for a stack as there are no emissions from the gasification process."

The above statement by Green Power Systems is not accurate and is seriously misleading.

Greenaction challenged the claim that there would be no stack or emissions after a January 22, 2008 phone conversation with Ingo Krieg, President of Green Power Systems, in which he admitted there would be a 90 or 100-foot stack and that there would be emissions.

After being challenged by Greenaction, on February 10, 2008, Green Power Systems finally admitted that their claim of "no stack" "could be misleading:"

"Our permit application process is out in the sunshine for everyone to see and I have discussed this with my partners and Westinghouse. **During my discussion with Westinghouse, they also made me aware that the process page could be mi(s)leading as you had pointed out. I never liked it, I was not the author of the website and hated when someone would say no stack. It was a clarification that is long overdue.**" (February 10, 2008 email from Ingo Krieg, Green Power Systems to Bradley Angel, Greenaction)

As of March 8, 2008, the Green Power Systems website still contained the statements that the company's President admits he "hated" and "could be misleading."

It should be of great concern that it took a challenge from Greenaction to expose the fact that the claims about "no stack" and "no emissions" were not correct, but it should be an even greater concern that Green Power Systems keeps these claims which they admit "could be misleading" on their website for all to see.

Green Power Systems' website also includes a process flow diagram for their "PGV Process" (Plasma Gasification Vitrification) that completely leaves the stack out. That diagram also refers to "clean gas" when in fact – without a doubt - the synthetic gas ("syngas") would contain toxic chemicals.

Not an Incinerator - or Incinerator in Disguise?

Companies promoting plasma arc, gasification and pyrolysis all claim the technology is not an incinerator. While there are differences with traditional incineration technologies, the plasma arc, gasification and pyrolysis processes all involve incineration/combustion as an essential component.

All of these technologies emit dioxins and other harmful pollutants, and are defined as incineration by the U.S. Environmental Protection Agency (U.S. Environmental Protection Agency, Title 40: Protection of Environment, Hazardous Waste Management System: General, subpart B—definitions, 260.10, current as of February 5, 2008).

If you relied on the websites of the companies, their diagrams made public to date and process descriptions, you probably would not realize that these are indeed incinerators disguised as "renewable energy" technologies.

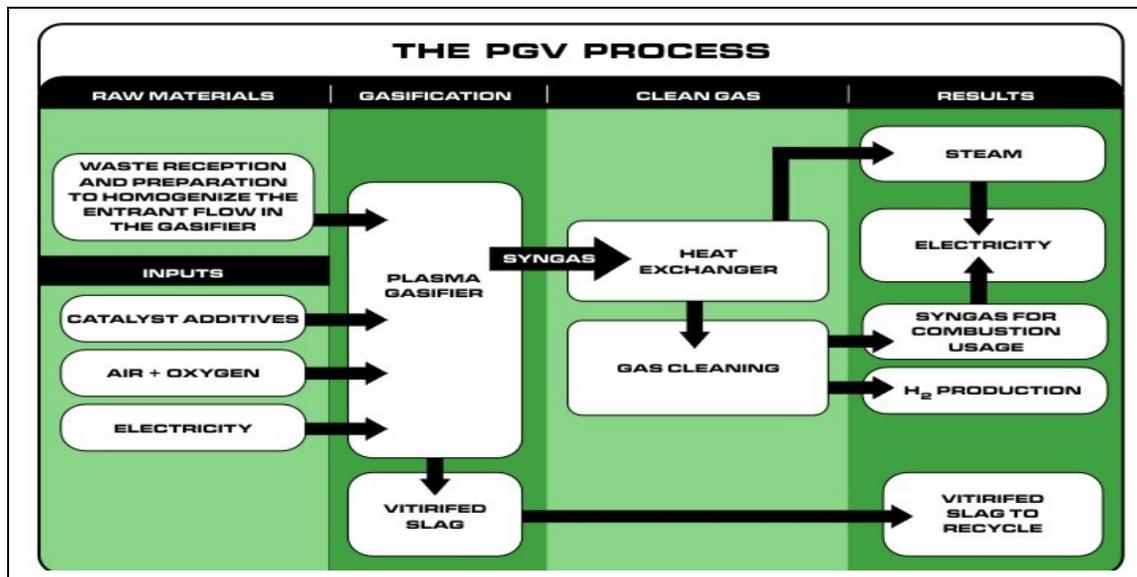
One difference is that while traditional incinerators burn the waste directly, plasma arc heats the waste, creating a synthetic gas ("syngas"). The heating of the waste and the creation of the syngas is the stage where the plasma arc companies often fail to fully describe the process.

Key to the process – the incinerator in disguise process – is the burning of the syngas. Every plasma arc and gasification proposal for waste processing and electricity generation includes combustion.

This combustion process is the incineration that results in emissions of toxic and criteria pollutants into the air. These emissions will include dioxins and furans, highly toxic chemicals linked to a wide range of profound illnesses including cancer, reproductive, developmental and immunological diseases.

You have to read Green Power Systems’ website closely to discover references to the full process being proposed in Tallahassee.

When viewing the diagram of “The PGV Process” on their website, you can see that there is a notation of “SYNGAS FOR COMBUSTION USAGE.” On the “Welcome” page of their website, Green Power Systems admits that a key phase of their proposed process would involve injecting the synthesis gas (“syngas” created by the heating of the garbage) into a “typical combustion turbine” for the production of electricity. According to Ingo Krieg of Green Power Systems, the combustion of the syngas would occur in a boiler. This boiler would be directly connected to the plasma equipment.



The Green Power System’s diagram entitled “The PGV Process” refers to “clean gas.” In fact, this syngas is not clean, but instead would contain toxic chemicals.

Where is the data backing up claims that plasma arc is a safe, environmentally friendly and proven technology?

Dick Basford, Senior Vice President of Green Power Systems, admits they have no information on emissions and emissions levels, and have no final design of the plant: “The emissions and their levels are yet to be determined since the final design of the plant is not completed” (email from Dick Basford to Doctor Ron Saff, February 6, 2008).

As mentioned above, Green Power Systems has not been able to produce any test data from the Hitachi facility or any facility in the world using plasma arc for large scale commercial solid waste treatment.

Westinghouse Plasma Corporation and Alter NRG:

Green Power Systems and Geoplasma both state they plan to use Westinghouse Plasma Corporation's plasma technology. Both companies point to Westinghouse's allegedly successful experience with plasma technology.

However, a review of Westinghouse Plasma's website (www.westinghouse-plasma.com) and that of their parent company Alter NRG (www.alternrg.com) reveals conflicting and troubling statements, and raises important questions about the effectiveness, reliability and safety of the proposed facilities.

Westinghouse claims their technology heats the solid waste in an "oxygen starved" environment, but there are serious questions about that claim. First of all, municipal solid waste has oxygen in it, so it is already in the chamber being heated by the plasma torch. Westinghouse Plasma's website first claims the process is "oxygen starved" but by reading their material closely you can see they admit this is not the case in several places: for example on one page they claim an oxygen starved environment, then on another page they admit that they might be even feeding oxygen and air into the system, then on the same page they refer to the presence of "controlled amounts of oxygen" --- so which one is it?

Even if there is less oxygen in the plasma chamber than in conventional mass-burn incinerators, this does not prevent the formation of harmful pollutants. As one study that examined the formation of dioxins and furans under pyrolysis conditions concludes, even at oxygen concentrations lower than 2 percent, considerable amounts of highly toxic polychlorinated dioxins and furans were formed. (Weber, R., Sakurai, T., 2001. Formation characteristics of PCDD and PCDF during pyrolysis processes. *Chemosphere* 45: 1111-1117).

Westinghouse's website (their section entitled "Environmental Benefits) admits dioxins and furans (and NOx and Sox) are emitted from their process. They directly contradict this admission of toxic emissions elsewhere on their website where they discuss output from Geoplasma's St. Lucie project (in the section entitled "Projects Under Development") where they write that in addition to energy, "the only other output from the facility will be an inert slag which can be used for aggregate in road construction." They seem to have left out the dioxin and furan emissions, as well as NOx and SOx.

How Westinghouse Plasma Corporation claims their technology can generate energy: What is wrong with this picture? Where's the combustion equipment? Where's the stack?

According to a news story in USA Today ("Florida county plans to vaporize landfill trash," (9/9/06), the plasma arc facility proposed by Geoplasma in St. Lucie County claims it would generate about 120 megawatts of electricity, free from outside electricity. The public is entitled to see the proof of this claim, as we are unaware of any facility similar to that proposed that generates electricity free from outside electricity. Where is the data? Where is the proof? Where is a similar plant that has operated and generated this amount of electricity?

The Hitachi Metals facility in Utashinai, Japan is claimed to only generate 3.9 megawatts, far less than the amounts of energy Green Power Systems, Geoplasma and Westinghouse Plasma say they can generate.

Plasma arc facilities are normally generated in a high-energy electrical discharge or arc, and as such require considerable amounts of electrical energy to operate. It is yet to be proven that a full-scale plasma incineration can generate more electricity from the gas stream generated, than is put into the process to treat the waste.

As one article says, “despite its promise [plasma-arc] has not yet turned trash to gold.” In fact, the plasma arc incinerator in Utashinai Japan, “has struggled to make ends meet since opening in 2002.” The incinerator has been unable to sell electricity, and on average processes only 60 percent of the trash volume that the company expected. Given this track-record, it seems highly unrealistic that the company Geoplasma, which is working to site a plasma-arc incinerator in St. Lucie, Florida, would be able to recoup the 80 percent of the income that they claim they can generate from electricity sales. The article also reports that the plasma-arc incinerator in Utashinai, Japan often suffers from operational problems, and one of the two lines is often down for maintenance. (Cyranoski, David, *One Man’s Trash...*, Nature, Volume 444, November 16, 2006, <http://www.nature.com/nature/journal/v444/n7117/full/444262a.html> - browsed February 27, 2008).

In late February 2008, officials from the Sacramento (California) Municipal Utilities District publicly questioned claims that Westinghouse Plasma’s technology could generate more electricity than it would use. “It takes a lot of electricity,” Jim Shetler, the Sacramento Municipal Utility District’s assistant general manager for energy supply, said in an interview. “Do you use more electricity in the process than you gain from the gas stream that you use to burn and generate electricity?” (*City Sees Green in Garbage Proposal*, Sacramento Bee, by Terry Hardy and Chris Bowman, February 27, 2008).

Westinghouse Plasma’s website omits any mention of stacks, yet the facilities if built would have a stack to emit pollutants into the air of Florida communities and the environment.

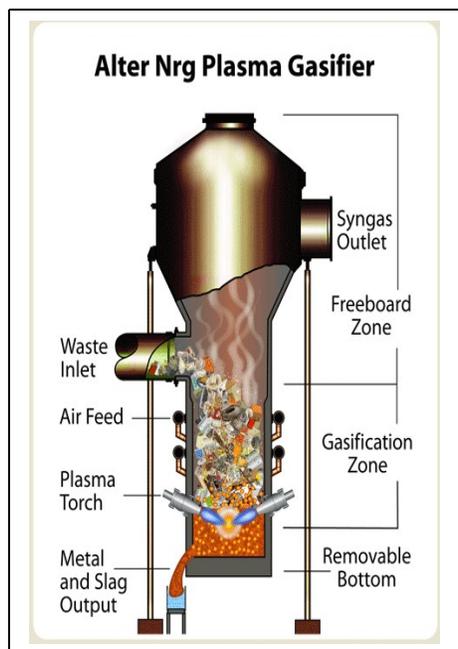
Westinghouse Plasma’s website lacks any description of how the energy would supposedly be generated, nor do they discuss how much energy would be required to be imported for the facility to operate.

WHERE IS THE STACK?

WHERE IS THE COMBUSTION EQUIPMENT?

A major concern is the fact that all the technology diagrams on Westinghouse Plasma’s website omit any drawing or picture showing the equipment that would be used to generate the electricity.

One diagram, entitled the Alter Nrg Plasma Gasifier, shows a “Syngas Outlet” but it is not attached to anything. In actual operation, this would be attached to piping that takes the syngas to the combustion/incineration device (an industrial boiler or internal combustion engine) and then to a stack that would emit dioxin and other pollutants into the air.



Even the Plasma Technology's Manufacturer Warns Not to Rely on Their Information

Debunking the assurances that this technology is proven and reliable, one only needs to read the repeated disclaimers in Alter NRG's website and documents. These disclaimers would be funny if not so serious. Persistent claims that their technology is proven are followed by fine print disclaimers saying these are only "forward-looking statements." Their disclaimer admits that actual results might differ from what is claimed:

"The projections, estimates and beliefs contained in such forward-looking information necessarily involve known and unknown risks, uncertainties and other factors which may cause Alter Nrg's actual results, performance or achievements in future periods to differ materially from any estimates or projections of future results, performance or achievements expressed or implied by such forward-looking information. The risks, uncertainties and other factors, which could influence actual results, are described in other documents previously filed with regulatory authorities. Accordingly. . . .Alter Nrg undertakes no obligation to publish revised forward-looking information to reflect unanticipated events or circumstances" (Alter NRG website, Legal Disclaimer, <http://www.alternrg.com/common/disclaimer.html>).

Should the protection of the health and environment of Florida rely on a company and technology that repeatedly disclaims responsibility for their information and performance of the technology?

The poor track record of plasma arc facilities in the U.S.:

There has never been a commercial facility in the U.S. using plasma arc technology for municipal solid waste. But there have been two commercial plasma arc facilities processing other wastes, and both have had serious problems.

Allied Technology Group operated a commercial plasma arc facility for mixed radioactive and hazardous wastes in Richland, Washington, and the facility closed due to operational problems with the plasma arc equipment as well as financial problems. The Hawaii Medical Vitrification facility run by Asian Pacific Environmental Technologies near Honolulu has also had serious operational problems as well as serious permit violations. For example, the Hawaii Medical Vitrification facility was closed for approximately eight months due to refractory damage in the kiln of the plasma arc equipment.

Both the Allied Technology Group and the Hawaii Medical Vitrification facilities used Integrated Environmental Technologies' (IET) "Plasma Enhanced Melter" equipment. IET and their related company InEnTec claimed on their website that these two facilities were successful commercial operations using their technology, but the facts show that there were severe problems with the plasma arc equipment at both facilities. InEnTec/IET had also claimed that their technology was "pollution free" and "closed loop." Once challenged, IET President Jeffrey Surma testified truthfully under oath that his company's claims that these two facilities were "already successfully operating," "pollution free" and "closed loop" were not correct.

Florida Department of Environmental Protection White Paper on Plasma Arc:

The Florida Department of Environmental Protection, Solid Waste Section prepared a White Paper on the use of plasma arc technology for the treatment of municipal solid waste. The Florida DEP comments include:

“There is considerable uncertainty about the quality of the “syngas” to be produced by this technology when processing MSW. While the high temperatures can destroy organics, some undesirable compounds, like dioxins and furans, can reform at temperature ranges between 450 and 850 degrees F if chlorine is present.High temperatures can also increase the concentrations of volatile metals in the syngas.”

“There is considerable uncertainty about the quality of the “slag” to be produced by this technology when processing MSW. There is very little leaching data on this material for MSW.One leaching...test...suggests arsenic and cadmium may leach above the groundwater standards. This may adversely impact the beneficial use of this material.”

“The economics of this technology are not well known.”

Risks to Public Safety and Health Consequences for Florida Communities:

Dioxin is the common name for 75 toxic chemicals that are unwanted by-products of manufacturing and combustion processes when chlorine and carbon-containing materials are combined. Garbage and medical incinerators have been identified as the largest sources of dioxins in the United States Environmental Protection Agency’s reassessment report on dioxin in 1994/2004. According to the EPA, dioxin travels long distances in the atmosphere and is found on plants, in water, soil, grazing animals and humans. Dioxin particles are stored in fatty tissue and will accumulate to create “build-up” when low-level exposure is continual.

In 1997, the International Agency for Research on Cancer concluded that dioxin is a human carcinogen. Non-Hodgkin’s lymphoma and cancers of the liver, lung, stomach, soft and connective tissue have been associated with dioxin. Even at very low exposure, at levels of parts per trillion, dioxin causes immune system damage, hormone disruption, and reproductive and development effects. Some newer emission control devices have been effective in decreasing recorded dioxin air emissions from incinerators, but there is no safe level of additional exposure to dioxins. This is because the average daily dioxin intake for is already 200 times higher (Americans (*America's Choice Children's Health or Corporate Profit The American People's Dioxin Report Technical Support Document* November 1999 Center for Health, Environment and Justice Falls Church, VA, Schecter, A. (1999) Personal communication. Available online at <http://www.chej.org/BESAFE/report.html>) than what the EPA defines as a safe dose for adults (U.S. Environmental Protection Agency (USEPA) EPA (1994a) Health Assessment Document for 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD) and Related Compounds, Volume III of III, USEPA, Office of Research and Development, EPA/600/BP-92/001c, External Review Draft, Washington, D.C.).

Those most at risk of receiving the highest concentrations are babies (Tangri, Neil, *A Dying Technology*, 2003, p. 13). Studies also show elevated levels of dioxin in the blood of people living near municipal solid waste incinerators when compared to the general population (Ends Europe Daily *Study reignites French incinerator health row*, Found at <http://www.endseuropedaily.com/articles/index.cfm?action=article&ref=22174&searchtext=incinerator%2Bcancer&searchtype=All> (browsed on February 8, 2008); P. Elliott and others, "Cancer incidence near municipal solid waste incinerators in Great Britain," *BRITISH JOURNAL OF CANCER* Vol. 73 (1996), pgs. 702-710; Leem et al., 2006. Risk Factors Affecting Blood PCDDs and PCDFs in Residents Living near an Industrial Incinerator in Korea. *Arch. Environ. Contam. Toxicol.* 51:478–484.

Is garbage a "renewable resource?"

Today's "waste-to-energy" incinerator companies falsely claim that they can safely, cost-effectively and sustainably turn materials such as household trash, tires, medical waste, biomass and hazardous waste into "renewable" electricity and fuels like ethanol and bio-diesel.

Far from being sources of renewable energy, incinerators and landfills emit harmful pollutants into the air, soil and water, waste more energy than they generate, and contribute to climate change.

More than two thirds of the materials we use in the United States are still burned or buried, despite the fact that we have the technical capacity to cost-effectively recycle, reuse or compost the vast majority of what we waste. For every item that is incinerated or landfilled, a new one must be created from raw resources rather than reused materials. This requires a constant flow of resources to be pulled out of the earth, processed in factories, shipped around the world, and burned or buried in our communities. The impact of this wasteful cycle reaches far beyond local disposal projects, causing greenhouse gas emissions, wasted energy and pollution thousands of miles away.

Telling Facts Include:

- The U.S. Environmental Protection Agency's 2006 report Solid Waste Management and Greenhouse Gases shows that it is far better for the climate to recycle, rather than incinerate or landfill discarded materials. For example, the report shows that incinerating a ton of mixed plastic rather than recycling it causes more than six times as many greenhouse gas emissions.
- According to research published by Friends of the Earth in 2006, getting energy from incinerating waste produces 33 percent more greenhouse gas emissions than burning coal in power stations.
- Recycling materials saves 50 percent more energy than incinerating those same materials generates. For example, recycling mixed paper saves more than ten times more energy than what can be generated and offset by incinerating it.
- Studies show elevated levels of dioxin -a known carcinogen -in the blood of people living near municipal solid waste incinerators when compared to the general population.
- Incinerators oblige communities to waste valuable resources and taxpayer dollars for decades to come. For example, by the end of the contract in 2009, Detroit taxpayers will have paid over \$1 billion to build and operate the incinerator. Detroit could have saved over \$55 million in just one year if it had never built the incinerator.
- Pyrolysis, plasma and gasification incinerators may even have a larger climate footprint than conventional mass burn incinerators. These incinerators treat waste in a chamber that requires large inputs of additional fuels and/or electricity to operate. This requires the combustion of greenhouse gas intensive fossil fuels such as natural gas and coal.

Incinerators negatively impact public health and the environment, and gobble up public taxpayer money meant for real renewable energy, waste reduction and climate solutions. Strengthening community health and stopping climate change requires that we strengthen waste reduction, source

separation, reuse, recycling and composting as a means to reduce greenhouse gas emissions and energy use. It also requires that we stop subsidizing waste incineration as a renewable source of energy.

For decades, everyone has been encouraged to do the 3 R's: Reduce, Reuse and Recycle. But today, some companies are saying we should all stop worrying about creating so much garbage because we are now told it is a "renewable" energy source.

Not only is garbage not a renewable source, but an expensive plasma arc facility will require the generation of vast amounts of garbage forever – endangering real recycling and renewable energy programs. We need to support the sun and wind, not garbage, as renewable resources.

Zero Waste: A Healthy and Sustainable Solution for our solid waste problem

Despite several existing models in U.S. cities that prove otherwise, disposal of valuable natural resources in incinerators and landfills is all too often considered inevitable. Alternatively, we can choose to invest in community-based solutions such as waste-reduction, reuse, recycling, and composting as a vehicle for environmental, job and economic renewal.

What is Zero Waste? Zero Waste means investing in the workforce, infrastructure and local strategies needed to reduce what we trash in incinerators and landfills to zero by a given year. It means stopping even another dime of taxpayer money from subsidizing waste projects that contaminate environments and the people who live there. It means investing public money in innovative waste reduction, reuse and recycling programs, and requiring that products are made and handled in ways that are healthy for people and the planet.

Cities around the world including Buenos Aires, Canberra, Oakland, Nova Scotia, Seattle and others have already passed groundbreaking zero waste measures. These cities are already working towards Zero Waste by building state-of-art recycling and composting parks, implementing innovative collection systems, requiring products to be made in ways that are safe for people in the planet, and creating locally-based green-collar jobs. These cities have developed plans to invest in sound economic development and jobs that will benefit their residents, rather than pouring money into harmful waste disposal projects. They have specific and achievable plans to reduce waste disposal levels to zero by a given year.

Leading the way, San Francisco and Oakland are on track to reuse 75 percent of discarded materials by the year 2010, and 100 percent by the year 2020. Already, 63 percent of San Francisco's discarded materials are reused, recycled, or composted, and the city has passed groundbreaking laws to shift the unjust and unsustainable ways in which products are made. Stopping polluting incinerators in communities and achieving critical greenhouse gas emission reductions depends on Zero Waste gaining increased support from decision-makers at the local, regional and federal level.

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