



Los Angeles County

Conversion Technology Demonstration Project

OVERVIEW: Conversion Technology Environmental Fact Sheet

Conversion technologies provide an opportunity to reduce our dependence on landfill disposal while reducing air emissions, including greenhouse gases. These are state-of-the-art processes capable of creating useful products, green fuels, and clean, renewable energy from solid waste. More than 130 commercial facilities operate in Europe and Asia as a safe and clean alternative to traditional waste management practices.

Following a decade of research, the County Los Angeles Department of Public Works has compiled this environmental fact sheet to summarize publicly available data, demonstrating that conversion technologies are a **superior option to traditional solid waste management practices** such as landfilling and waste-to-energy and **more than capable of meeting the most stringent air quality standards.**

Key Findings

Conversion technologies are capable of fully complying with the most stringent air emissions standards

Conversion technologies have been shown in actual operation to reduce dioxin and furan emissions in amounts **dramatically below the already low EPA limits** (see graph 1)

Conversion technologies actually make our air CLEANER

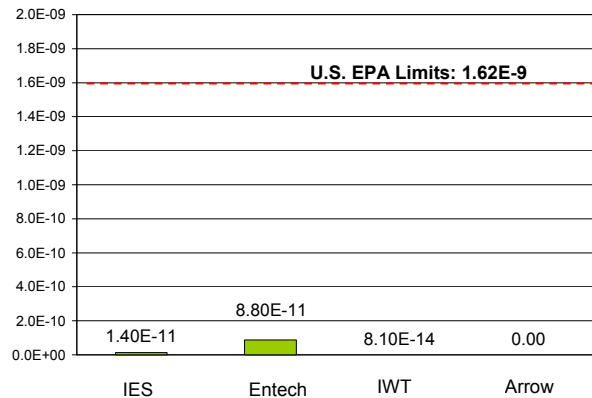
On a net-basis, conversion technologies can actually help **make our air cleaner** (see graph 2) by offsetting higher emissions from other sources, including greenhouse gas (GHG) emissions

Conversion technologies can help us address climate change

Conversion technologies have the potential to **reduce GHG emissions each year by millions of tons of CO₂ equivalent** in California alone

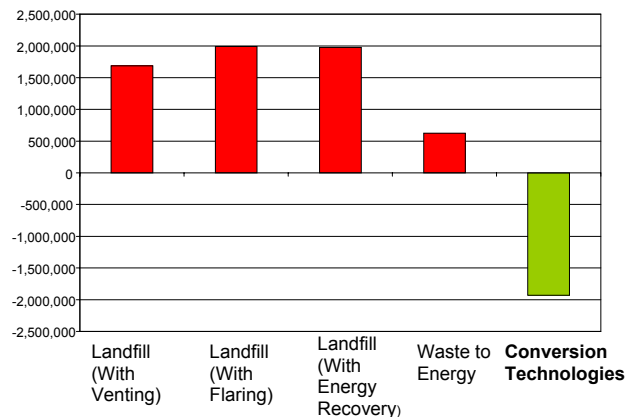
Graph 1

Dioxin/Furan Emissions
Dioxins/Furans per ton MSW processed (lbs)



Graph 2

Annual Nitrogen Oxides Emissions (lbs)
Greater Los Angeles Region – 2010 Projection



Attached is an environmental fact sheet summarizing public data that substantiates these findings. For more information, please visit: www.SoCalConversion.org



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Conversion Technologies: A Clean Solid Waste Alternative

The Los Angeles County Department of Public Works (County) is taking an active role in developing environmentally-sound alternatives to landfilling and waste-to-energy that would convert post-recycled residual solid waste into useful products, green fuels, and clean, renewable energy. These technologies may include biological, thermal, chemical, and mechanical processes; however they do not include waste-to-energy (combustion) as the trash is not actually burned. Public agencies and universities alike have studied air emissions from conversion technologies and concluded that they are capable of operating within regulatory limits. More than 130 commercial facilities, processing a wide variety of wastestreams, operate in Europe and Asia¹ as a safe and clean alternative to traditional waste management practices such as landfilling or waste-to-energy.

Sample Conversion Technologies From Around the World



Germany



Malaysia



Japan



Southern California

Independent, Peer-Reviewed Studies

Extensive studies have recently been completed by trusted California authorities. For example, a 2006 peer-reviewed study conducted by the University of California, Riverside, on behalf of the California Integrated Waste Management Board, analyzed third-party emissions data from three thermal technology facilities:

- **International Environmental Solutions** - Operates a pyrolysis facility in Romoland, California that utilizes solid waste
- **BRI Energy** - Operates a gasification facility in Fayetteville, Arkansas that was tested with solid waste from California
- **Integrated Environmental Technologies** - Operates a gasification process in Richland, Washington and other parts of the world that utilizes medical waste among other feedstocks

Additionally, Los Angeles County has been evaluating conversion technologies for more than a decade. After review of over 100 technology companies from around the world, the County is considering four technology companies to develop one or more demonstration facilities in Southern California. All four companies

participating in the process have demonstrated the ability to divert at least 87 percent of waste away from disposal, and in some cases 100 percent of the waste. The technology companies being considered by the County are the following:

- **Arrow Ecology and Engineering (Arrow)** - Operates anaerobic digestion facilities in Israel and Australia that process solid waste
- **Entech** – Operates a gasification facilities in Poland, England and Malaysia that process various forms of waste including solid waste, medical waste, and mixed plastics
- **International Environmental Solutions (IES)** - Operates a pyrolysis facility in Romoland, California that utilizes solid waste
- **Interstate Waste Technologies (IWT)** - Operates gasification/pyrolysis facilities in Japan that process various forms of solid waste

The 2006 UC Riverside study, the County’s conversion technology reports, and other key reports can be found online at www.SoCalConversion.org.

Conversion Technologies Meet Environmental Regulations

Since local regulations for conversion processes have not yet been established, UC Riverside researchers compared emissions data to similar known limits, including U.S. EPA limits for starved air solid waste combustors and German thermal conversion regulatory limits. **All three conversion facilities studied were, or will likely be, below these regulatory limits (see below).**

Air Emissions Comparison of Regulations and Three Thermal Technologies²

REGULATORY LIMITS	Particulate Matter	Nitrogen Oxides	Cadmium	Lead	Mercury
US EPA Limits	18.0	220	0.01500	0.15000	0.01500
German Limits	14.0	281	0.04200	0.70000	0.04200
ACTUAL FACILITY EMISSIONS³					
International Environmental Solutions	3.9	275 ⁴	0.000150	0.00028	0.00056
BRI Energy	2.0	10	0.005000	0.02000	0.00010
Integrated Environmental Technologies	<3.3	162	0.000027	0.01100	0.00067

(All limits normalized to mg/N-m³ at 7% O₂)

Los Angeles County also analyzed dioxin/furan data from the four conversion processes currently under consideration in our process. Our research and review of emissions test results reveals that these conversion technologies should have no issues complying with U.S. EPA regulations. In fact, these conversion technologies have been shown in actual operation to produce dioxins and furans in amounts **dramatically lower than the already low U.S. EPA limits**, far less than many commonplace and natural activities such as a wood burning fireplace, and well within safe guidelines (see below).

Air Emissions Comparison of Dioxin/Furan Regulation⁵

REGULATORY LIMITS	Dioxin/Furan
US EPA Limits (for new sources)	0.000000001617131 (1.62 x10 ⁻⁹)
ACTUAL FACILITY EMISSIONS ⁶	
International Environment Solutions	0.000000000014174 (1.42 x10 ⁻¹¹)
Entech Environmental	0.000000000087715 (8.77 x10 ⁻¹¹)
Interstate Waste Technologies	0.000000000000081 (8.10 x10 ⁻¹⁴)
Arrow Ecology and Engineering	This biological process does not produce dioxins or furans

(All limits normalized to lbs dioxins/furans per ton municipal solid waste)⁷

It's important to note that any conversion technology facility constructed in the South Coast Air Quality Management District (SCAQMD) will be subject to even more stringent permitting conditions than the limits above. SCAQMD is the air pollution control agency for Orange County and the urban portions of Los Angeles, Riverside, and San Bernardino counties. Because this region does not meet the Clean Air Act standard for healthy air, it is identified as a "non-attainment" area, requiring a "New Source Review"⁸ for all new and modified sources in the area. Any facility or process that still produces emissions after the best available controls are implemented (above a very low threshold level) are required to offset those emissions in excess of the emissions generated, typically at a ratio of 1.2 to 1. After an extensive vetting process, the County is confident that the four technology companies under consideration by the County (i.e. Arrow, Entech, IES, and IWT) will operate within all regulatory guidelines.

Conversion Technologies Are By Far The Most Energy-Efficient Waste Management Practices, And Can Reduce Net Air Emissions

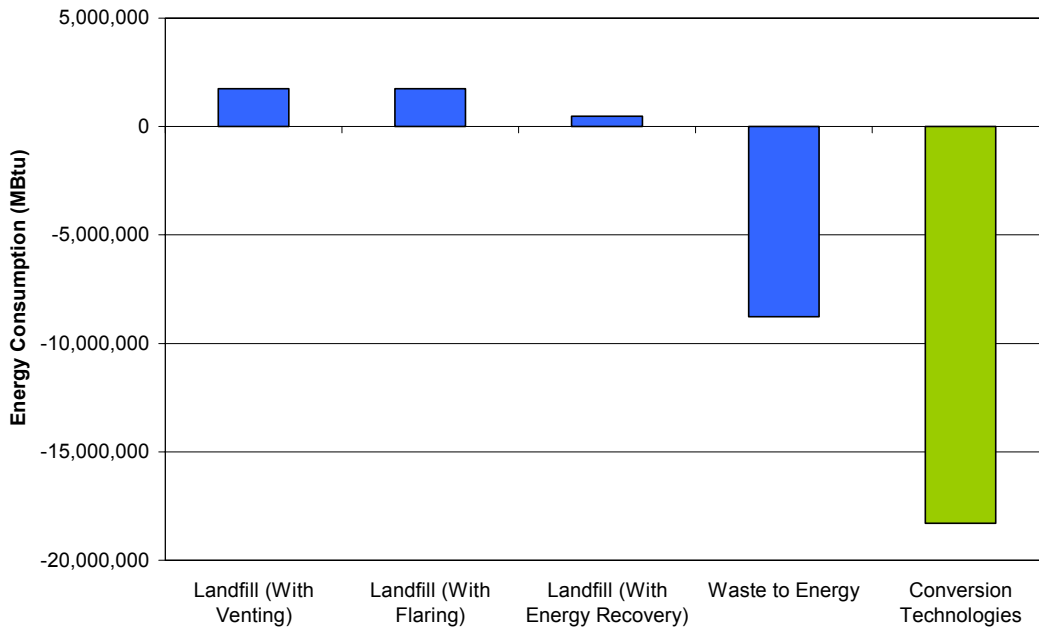
In the 2007 Staff Report to the Board entitled *New and Emerging Conversion Technologies*⁹, the California Integrated Waste Management Board (CIWMB) developed several hypothetical waste management scenarios for a projected amount of waste generated in the year 2010. As noted in the CIWMB report, energy is an important factor when conducting a lifecycle analysis of a waste management scenario because air and water emissions are often a result of energy production. The report found that "as compared to the alternative management scenarios, the conversion technology scenario ranges from two times lower in net energy consumption when compared to the waste-to-energy scenario, to 11 times lower than the landfill without energy recovery scenarios¹⁰".

The CIWMB report attributes these conversion technology savings are to:

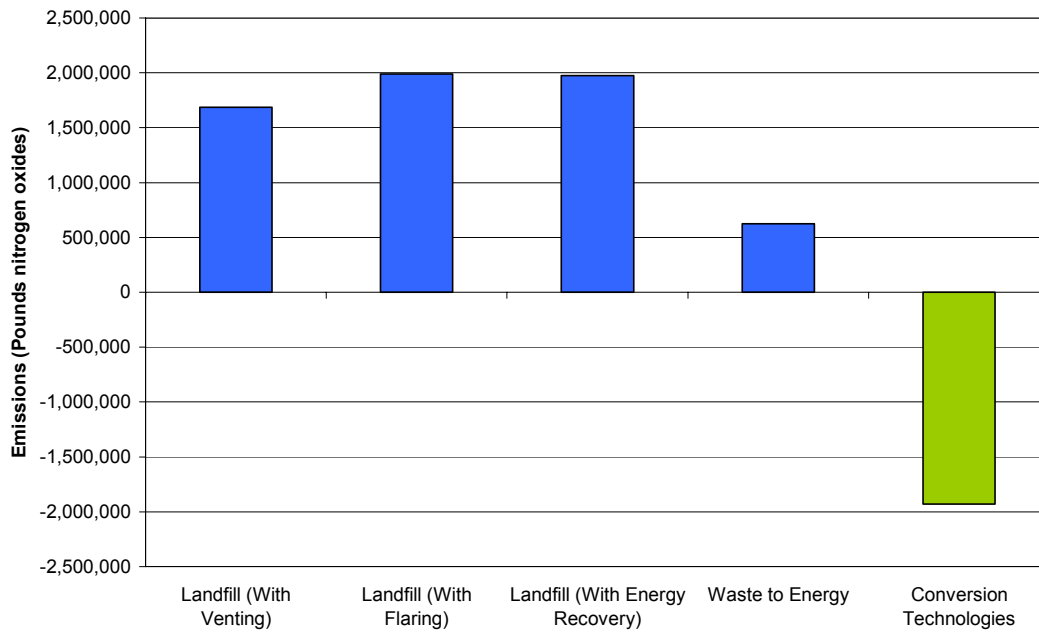
- 1) electricity production which offsets electricity produced by the utility sector;
- 2) biofuels production which offsets fuel production from fossil fuel sources; and
- 3) recyclable and reusable materials that are recovered, which offset the production of these products from virgin resources.

The CIWMB developed the following graphs, which compare emissions from landfills, waste-to-energy, and conversion technologies. The research indicates the **conversion technologies have the lowest net criteria air pollutant levels and GHG emissions**, and can actually help **make our air cleaner** by offsetting higher emissions from other sources:

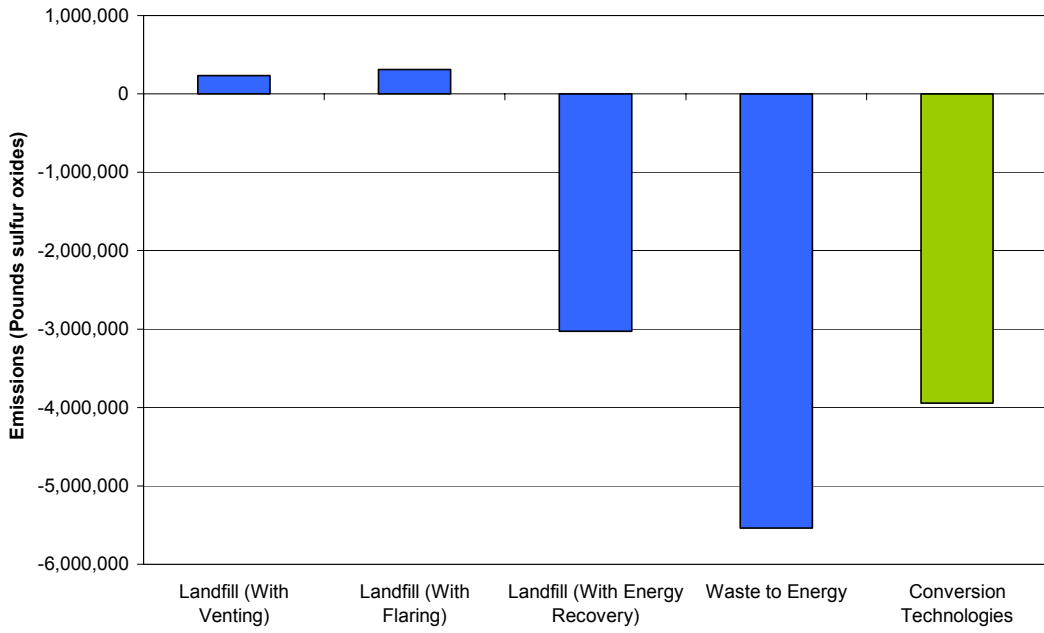
**Annual Net Energy Consumption - Greater Los Angeles Region
2010**



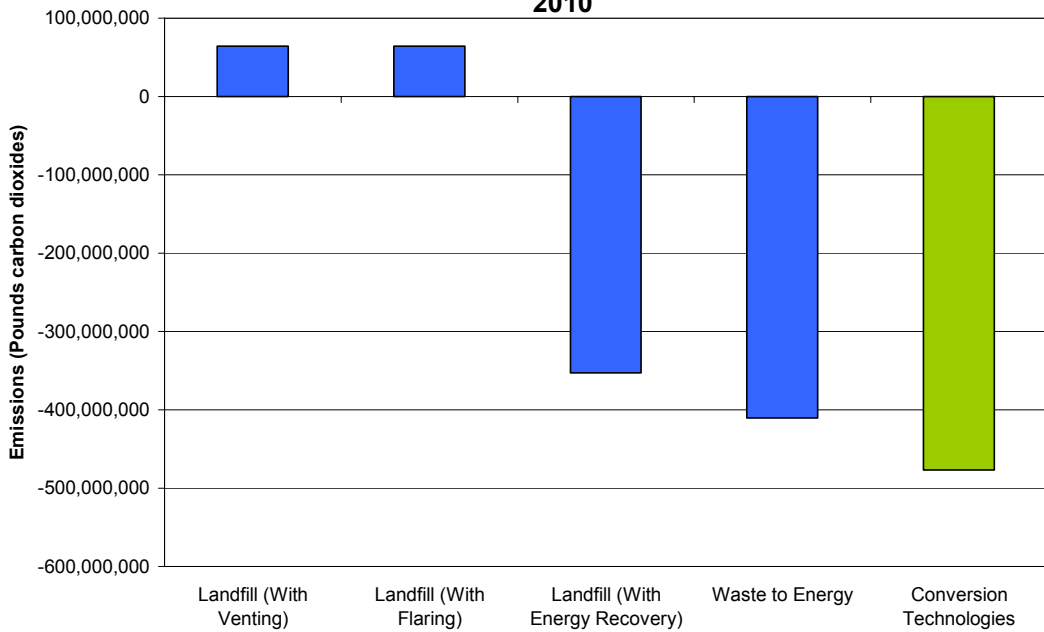
**Annual Nitrogen Oxides Emissions - Greater Los Angeles Region
2010**



**Annual Sulfur Oxides Emissions - Greater Los Angeles Region
2010**



**Annual Carbon Dioxide (from Fossil Fuels) Emissions - Greater Los Angeles Region
2010**



Conversion Technologies Are An Integral Climate Change Solution

In February 2008, the California Air Resources Board’s Economic and Technology Advancement Advisory Committee (ETAAC) released a report noting that *by conservative estimates*, conversion technologies have the potential to **reduce** annual GHG emissions by approximately **five million metric tons of CO₂ equivalent in California**.¹¹

In fact, the potential GHG reduction of conversion technologies may be significantly greater, since conversion technologies have a simultaneous triple benefit to the environment: 1) reduction of transportation emissions resulting from long distance shipping of waste; 2) prevention of methane and other emissions from waste that would otherwise be landfilled; and 3) displacement of the use of fossil fuels from the energy (fuel and electricity) produced by conversion technologies. The ETAAC report only estimated reductions from this third benefit.

Conversion Technologies vs. Current Energy Production Practices

According to the U.S. Department of Energy and the California Energy Commission, approximately half of the electricity used in the United States and about one-sixth of California’s electricity is generated by coal combustion¹². Coal has the highest carbon intensity among fossil fuels, resulting in coal-fired plants having the highest output rate of carbon dioxide per kilowatt hour¹³. Emissions from coal combustion for electricity constitute 32 percent of total U.S. carbon dioxide emissions¹⁴. For comparison purposes, the following table illustrates the difference in emissions between a typical coal plant and a theoretical IES pyrolytic facility operating in Southern California. In all categories, the IES facility emits fewer pollutants including 67 percent less CO₂ than the coal plant.

Air Emissions Comparison of Equivalent-Sized Coal and Conversion Technology Facilities

POLLUTANT	10 MW COAL PLANT ¹⁵	10 MW IES CONVERSION TECHNOLOGY FACILITY ¹⁶
Sulfur Dioxide	400,000	230
Nitrogen Oxide	408,000	76,755
Carbon Dioxide	148,000,000	49,033,364
Small Particles	20,000	1,701
Hydrocarbons	8,800	1,555
Carbon Monoxide	28,800	0.00
Arsenic	4.50	0.03
Lead	2.28	0.01
Cadmium	0.08	0.01
Mercury	3.69	0.09

(All pollutants measured in pounds/year)

Conclusion

Managing our waste through the best available conversion technologies rather than relying on current disposal options can lead to a net reduction in air emissions. These technologies have been used successfully in other parts of the world. Any new facilities developed would be required to comply with the most stringent air emissions controls and standards in the U.S., and are capable of doing so. Conversion technologies have the potential to provide real benefits to our ability to address the energy, solid waste and climate change crises. For more information and to download copies of key reports, please visit: www.SoCalConversion.org

A Project of Los Angeles County Department of Public Works



“Communities where residents live and work in a safe, clean and sustainable environment”

¹ California Integrated Waste Management Board, *Staff Report to the Board: New and Emerging Conversion Technologies*, 2007 pg 10

² Adapted from University of CA, Riverside “Evaluation of Environmental Impacts of Thermochemical Conversion Technologies Using Municipal Solid Waste Feedstocks: Final Summary Report”, 2006

³ Significant figures are provided for ease of comparison; however, the actual measurements may not be accurate to this level of detail.

⁴ IES utilized selective non-catalytic reduction (SNCR) for controlling nitrogen oxide emissions. Typically SNCR control efficiency ranges from 10 - 40%. This control technology was utilized in source testing due to engineering and manufacturing time schedules. Additionally SNCR lowered the nitrogen oxide emissions below SCAQMD permit limit for 24/7 operation. Although the use of SNCR brought these emissions during source testing into compliance, future IES facilities are being designed to use selective catalytic reduction (SCR) for nitrogen oxide control. This technology is proven to reduce nitrogen oxide emissions from 65 - 90%. It is anticipated that the use of SCR will bring the nitrogen oxide emissions well within the EPA limit.

⁵ Adapted from *Los Angeles County Conversion Technology Evaluation Report - Phase II Assessment*, prepared for Los Angeles County Department of Public Works by Alternative Resources, Inc, 2007

⁶ Significant figures are provided for ease of comparison; however, the actual measurements may not be accurate to this level of detail.

⁷ Dioxin and furan emissions listed herein are evaluated on a basis known as ITEQ (International Toxic Equivalents), which accounts for the relative toxicity of the individual compounds. In the United States, dioxin and furan emissions are often reported on a total mass basis, which does not account for the toxicity of the individual compounds. U.S. EPA published an equivalency between total mass and toxic equivalents, specifically for traditional waste-to-energy technology, in 60 FR 65396. The total mass statistics available in the United States were converted to ITEQ. For comparison, traditional waste-to-energy facilities in California, on average, generate 0.00000000540838 (5.41x 10⁻¹⁰) Lbs Dioxins/Furans per ton MSW processed, also well below the U.S. EPA limit for new sources.

⁸ South Coast Air Quality Management District: “New Source Review” <http://www.aqmd.gov/prdas/NSR/index.html>

⁹ California Integrated Waste Management Board, *Staff Report to the Board: New and Emerging Conversion Technologies*, 2007, pp 60-64

¹⁰ *Ibid*, pg 60

¹¹ Economic and Technology Advancement Advisory Committee, “*Technologies and Policies to Consider for Reducing Greenhouse Gas Emissions in California*”, 2008

¹² Energy Information Administration (EIA) <http://www.eia.doe.gov/fuelectric.html>

¹³ US Dept. of Energy, *Carbon Dioxide Emissions from the Generation of Electric Power in the United States*, 2000

¹⁴ Energy Information Administration (EIA) Annual energy outlook And EIA 2007 Emission of greenhouse gases in the U.S., 2008

¹⁵ Union of Concerned Scientists, “*How Coal Works*” (values prorated from a 500 MW coal plant), <http://www.ucsusa.org>, 2008

¹⁶ International Environmental Solutions (IES), 2006 Air Kinetics Report, values prorated from testing of 13.36 tpd MSW