

Mary Nichols, Chair
California Air Resources Board
1001 I Street - P.O. Box 2815
Sacramento, CA 95812

Caroll Mortensen, Director
CalRecycle
1001 I Street - P.O. Box 4025
Sacramento, CA 95812

August 5, 2013

Via Email:

Subject: Comments - Waste Management Sector Plan for the 2013 Scoping Plan Update

Dear Ms. Nichols and Ms. Mortensen:

Thank you for the opportunity to provide comment regarding the Waste Management Sector Plan and supporting white papers (the Plan), as prepared by CalRecycle and the California Air Resources Board (CARB).

It is Sierra Energy's goal to make gasification globally attainable and environmentally sustainable. Since 2004, we have been developing the FastOx gasifier derived from the steel-making blast furnace. This scalable and efficient gasifier can convert nearly any form of waste into renewable energy, thus diverting waste from landfills avoiding the resultant production of greenhouse gas (GHG).

Sierra Energy strongly supports the Plan's commitment to viewing waste as a resource, taking full ownership of the waste generated in California, and maximizing diversion from landfills. We are also encouraged by the Plan's cross-sector approach to actualizing California's GHG reduction and 75% recycling goals. As a champion for integrated solutions to waste diversion, Sierra Energy proposes a formula of 50% recycling, 30% anaerobic digestion, and 20% gasification to achieve zero waste. This method clearly prioritizes recycling measures, promotes a cooperative climate within the waste sector and maximizes the best use of energy found within waste.

Our initial comments regarding the Plan are summarized below, and detailed comments with supporting documentation are provided in the enclosure.

Notably, we were pleased to see acknowledgement of "emerging MSW thermal technologies" such as "gasification and related technologies may offer



221 First Street, Davis, CA 95616
530.759.9827 • 530.759.9872 fax
SierraEnergyCorp.com

advantages” in the areas where traditional mass burn practices have not been successful.

However, as written, the Plan makes little distinction between thermal combustion (mass burn) and thermal non-combustion (no burn) technologies. These are distinctively different technology approaches and processes (see attached enclosures) that would be served well by being clearly segregated and strategized separately in the plan.

Considering the numerous global endorsements of gasification technologies in their ability to considerably reduce GHG emissions, divert waste from landfills, increase recycling rates, increase locally-made renewable energy generation, and create jobs—Sierra Energy encourages CARB and CalRecycle to thoroughly analyze and outline how they can be better utilized in the Plan.

Sierra Energy understands the “regulatory barriers” and “political uncertainty” alluded in the technical papers and suggests that regulatory changes and attention would be best served removing gasification technologies out of the mass-burn legislative umbrella, rectifying scientifically incorrect statutes, and seeking solutions to include gasification as an essential tool to actualizing the State’s goals.

We appreciate the opportunity to comment on the proposed Waste Management Sector Plan. We look forward to working with CARB and CalRecycle staff with any questions, requests for information, and in finding a path forward for realizing the State’s energy, waste, and environmental goals. Please feel free to contact Ms. Rashael Parker, Director of Communications at info@sierraenergycorp.com or 530-759-9827 x510.

Sincerely,

A handwritten signature in black ink, appearing to read 'MH', with a long horizontal stroke extending to the right.

Mike Hart
CEO, Sierra Energy

Enclosures:

1. Specific Comments
2. The Cross-Sector Approach to Zero Waste
3. Distinctions Between Incineration and Gasification Graphic
4. Emissions Table for MSW gasification versus MSW incineration

2013 AB 32 Scoping Plan Update

Draft Waste Management Sector Plan

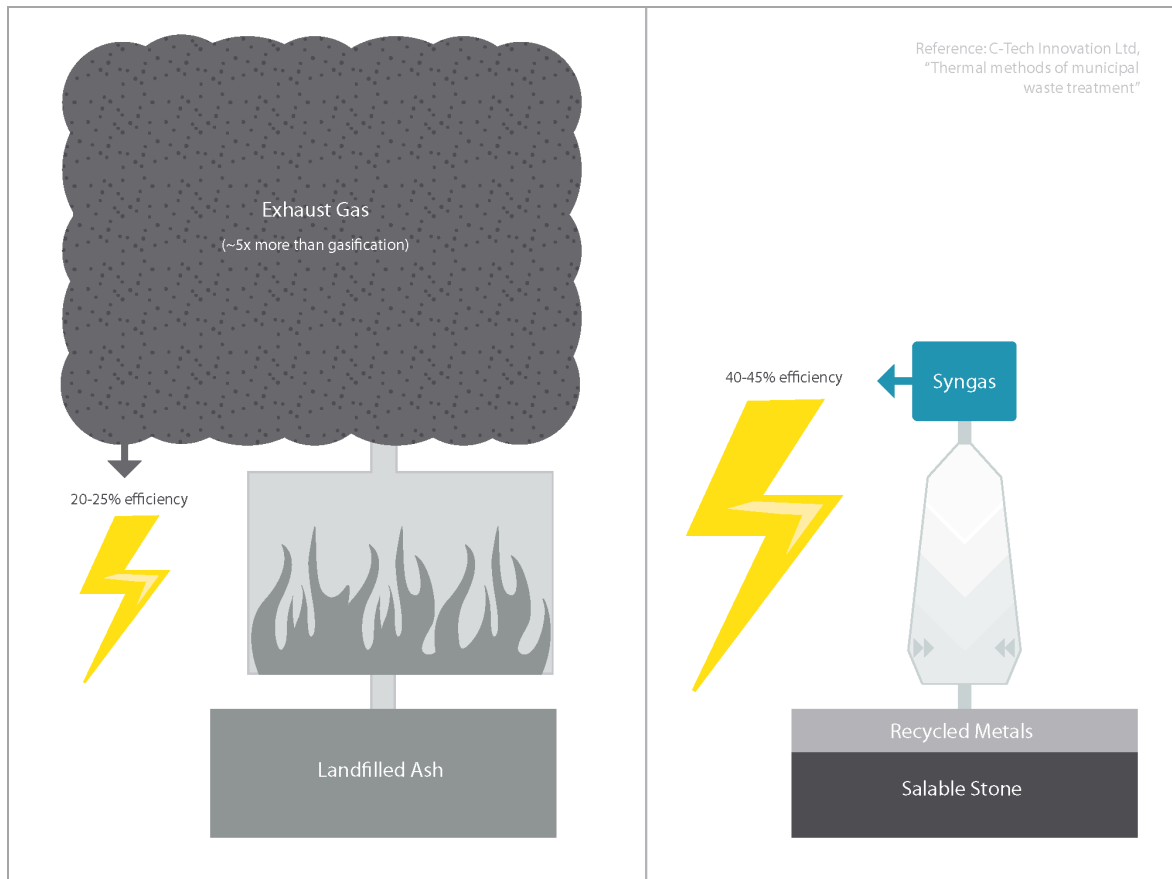
Specific Comments Regarding Plan Overview and Technical Papers

Sierra Energy – August 5, 2013

Clarify and discuss the future of non-burning technologies independently from mass burn

Thermal transformation (combustion, burning) technologies should be made unmistakably distinctive from thermal conversion (non-combustion, no burn, gasification) technologies.

Figure 1 Distinctions Between Incineration and Gasification



Incineration

Incineration is the combustion of waste in an excess of oxygen creating substantial volumes of exhaust gas, five times¹ the volume created by gasification. Due to its

¹ "Thermal methods of municipal waste treatment", 2007

rudimentary and incomplete transformation process, incineration has very low electrical efficiency (nearly half that of natural gas and significantly lower than coal-fired power). Electrical efficiency represents how much of the original energy is actually transported into the grid as electricity. Table 2 (below) shows a clear disparity between incineration and gasification. Figure 1 (above) visually identifies these key differences.

Table 1: Emissions for MSW Thermal Treatments²

	Electrical Efficiency	Moles CO2 per kWh electricity
Gasification + CCGT	45%	17.8
Gasification + CCGT	40%	20.0
Incineration	25%	32.0
Incineration	20%	40.0

Gasification

Gasification, on the other hand, restricts available oxygen and thus does not burn. Therefore, resultant syngas, contains virtually all of the energy in the original feedstock. This efficiency allows syngas to be upgraded to transportation fuels offsetting the use of fossil fuels, another superiority over incineration. The Gasification Technologies Council (at Gasification.org) identifies in detail the certain formation and reformation of toxic dioxins and furans from plastics and other materials as another chief disadvantage of incineration.

A report prepared by CalRecycle predecessor, The California Integrated Waste Management Board states, in comparison to incineration, gasification technologies:

- Produce more energy
- Produce fewer emissions of criteria air pollutants
- Produce lower emissions of CO₂

Further research corroborates with these results showing gasification as having significantly reduced criteria pollutants (see Table 2 on next page).

² "Thermal Methods of Municipal Waste Treatment", C-Tech Innovation Ltd, 2003

Table 2 : Emissions of MSW gasification versus MSW Incineration³

	PM [mg / Nm3]	NOx [mg / Nm3]	CO [mg / Nm3]	SO ₂ [mg / Nm3]	Dioxin/ furans [ng TEQ/ Nm3]	HCl [mg / Nm3]	Cd [mg / Nm3]	Pb [mg / Nm3]	Hg [mg / Nm3]
Gasification (Average)	2.02	55.60	43.44	1.46	0.0239	9.43	0.0006	0.0090	0.0024
Incineration (Average)	13.46	692.75	435.50	72.35	33.25	39.48	0.0007	0.0155	0.0290
% Reduction	-85.0%	-92.0%	-90.0%	-98.0%	-99.9%	-76.1%	-21.4%	-41.7%	-91.7%

Another clear advantage of high-temperature gasification technologies, is the ability to recover and recycle metals as well as producing a non-leaching, vitrified stone that can be up-cycled into construction aggregate and cement. Contrary to incineration which creates 30% volume of ash that is often hazardous in nature.

Expand Gasification Categories

Sierra Energy represents a new hybrid of gasification technologies being developed to directly address the limitations of conventional systems. For instance, our FastOx gasifier injects steam and oxygen in highly-concentrated and rapid rates to break down feedstock at the molecular level (without burning) which is then recovered as an energy-dense syngas. The advantage of our process is the reaction reaches high-temperatures facilitating complete and efficient conversion of waste, boasting the advantages of plasma without the need for segregated waste or capital-intensive electric fields which negatively impact parasitic load and project practicality.

Similar innovative gasification technologies are not well represented within the three categories mentioned in the Thermal Conversion technical paper. The technical paper uses the term “new and emerging”, which would perhaps serve very well as a fourth and more inclusive means of categorization.

Bolster Gasification to Fortify and Support Material Recycling

The technical paper raises the concern “MSW Thermal facilities could lead to increased use of feedstock that could otherwise go to recycling, composting, and/or anaerobic digestion” yet does not mention the comprehensive and overwhelming amount of data that has found the opposite to be true. Conversion facilities not only boost their efficiency by using post-recycled waste, but reports have shown they:

- Have a positive impact on glass, metal, and plastic recycling
- Are not likely to affect the recycling of paper
- Will have no impact on recycling and composting markets

³ See attached table for assumptions and notes

- Source-separated recyclables are not likely to flow to conversion facilities
- No negative impact on existing recycling and compost markets would occur if diversion credits were considered for MSW which would otherwise go to landfill

Implement Non-combustion Conversion and Gasification Technologies to Ensure California’s Success in Reaching Landfill Diversion and GHG Reduction Goals.

The U.S. Environmental Protection Agency’s (EPA) has published extensive data on how non-combustion technologies, such as gasification, are net-carbon negative by:

- offsetting conventional and petroleum based electricity and fuels;
- offsetting the mining of virgin materials through metal recovery; and
- diverting the waste from landfills thus drastically reducing GHG emissions.

As written, the Plan does very little to propose the role that fuel and energy from post-recycled waste can play in actualizing the State’s GHG reduction and AB 341 goals.

The California Integrated Waste Management Board report also concludes that in comparison to landfilling, gasification technologies:

- Produce more energy thus creating less “large life cycle benefits such as less dependence on non-renewable fuels
- Lower emissions of criteria air pollutants
- Lower emissions of CO₂

Considering these and numerous other global endorsements of gasification in its clear and significant advantages over incineration and landfills along with its capacity to lower GHG emissions, divert waste, and produce renewable products—Sierra Energy strongly encourages CARB and CalRecycle to thoroughly analyze and outline how gasification technologies can be utilized in the Plan as an essential tool.

Identify a Path Forward for the Regulatory Structure of Non-Combustion Facilities

The Plan makes several references to the “regulatory barriers” and “political uncertainty” of thermal technologies, yet is unsuccessful at further clarifying, clearly segregating, or identifying solutions for a path forward.

Furthermore, it suggests creating new regulations on MSW Thermal facilities to protect recycling programs that studies have shown would likely not be impacted (and rather enhanced) by non-combustion thermal conversion.

Sierra Energy suggests regulatory changes and attention would be better served removing non-combustion technologies out of the mass-burn legislative umbrella,

rectifying scientifically incorrect statuses, and seeking solutions for the of waste gasification as part of the Plan.

Refocus Implementation Plan and Next Steps to be Goal-Centric and Technology Neutral

A number of the proposed actions mentioned in the implementation plan are focused on composting and anaerobic digestion, however the focus would be better served on projects that can demonstrate a reduction in both GHG emissions and landfill disposal. Keeping these goal focused versus technology focused allows room for new and emerging technologies to participate in the conversation.

Additionally, Sierra Energy recommends outlining plans for better distinction and segregation legislatively between mass burn technologies and new, emerging non-combustion technologies. As well as preparing strategies for how gasification technologies can be implemented and utilized in California and be counted as part of the AB 341–75% diversion rate.

Further Analysis

The “composting and anaerobic digestions” technical paper admits “additional research is needed to better quantify the benefits from avoided landfill emissions and anaerobic digestion” (page 5) and “to better understand the role of composting and anaerobic digestion can play in meeting the GHG and waste reduction goals, the direct and avoided emissions from the use of these technologies need to be analyzed and quantified” (page 9). We concur. Despite the lack of accurate GHG measures, composting is positioned as being preferable to other non-landfill alternatives such as conversion technologies.

Sierra Energy suggests expanding this technology-centric statement to include all waste conversion including thermal non-combustion technologies. We also strongly encourage CARB and CalRecycle to commit to continued research on the lifecycle emissions from recycling, composting, and gasification facilities.

Furthermore, in the evaluation of true lifecycle GHG emissions impacts should be equitable for all waste management options. For example, if avoided methane emissions from landfill disposal are accounted for with composting it should be accounted for with conversion technologies as well.

The Cross-Sector Approach to Zero Waste



50%



Recycled Materials

30%

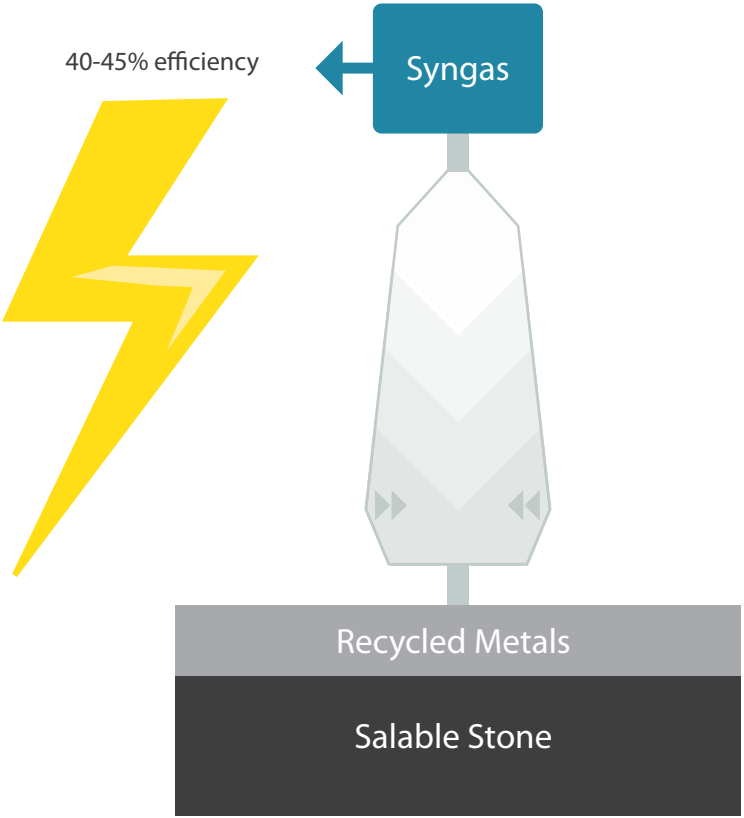
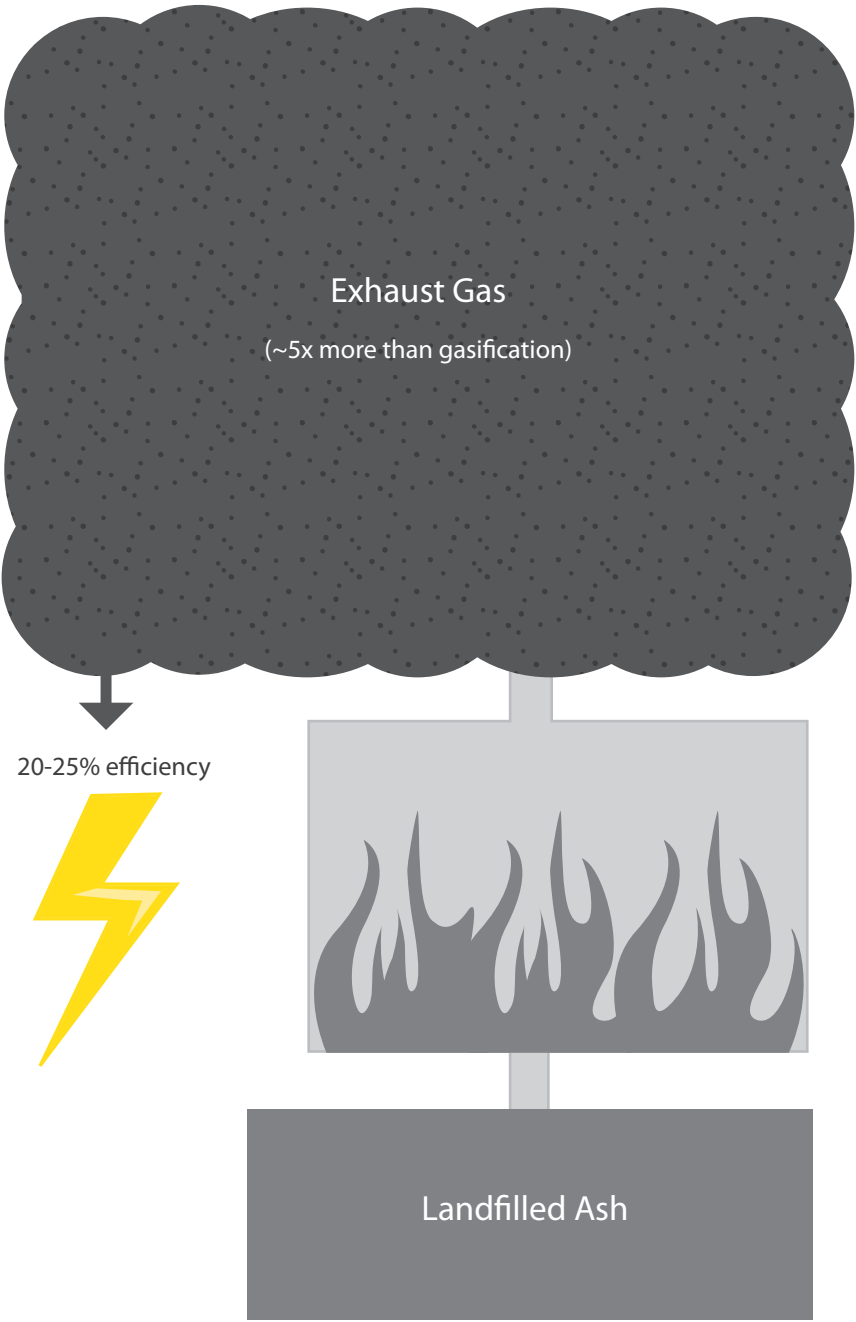


Organic Waste

20%



Divert Remainder From Landfill



<< July 29 2013 -- Emissions for MSW gasification versus MSW incineration

	PM [mg / Nm3]	NOx [mg / Nm3]	CO [mg / Nm3]	SO2 [mg / Nm3]	Dioxin + furans [ng TEQ / Nm3]	HCl [mg / Nm3]	Cd [mg / Nm3]	Pb [mg / Nm3]	Hg [mg / Nm3]
Thermostelect *	0.84	21.76	2.95	0.16	0.0007-0.0011		0.0010	0.0130	0.0018
Alter NRG **	4.21	124.64	83.92	2.76	Not detected	13.61			< 0.0014
Zegen ***	< 1	< 20.4			< 0.07	< 5.25	< 0.0001	< 0.005	< 0.0040
Incineration ****	16 - 27	374 - 697	435.50	68.4 - 76.3	13 - 30	52.5 - 60.9			0.028 - 0.080
SEMASS #3 Incineration *****	7.04	< 850			< 30	12.39	0.0010	0.0250	0.0034
SEMASS #1 Incineration *****	3.79	< 850			< 60	32.13	0.0004	0.0059	0.0047
US EPA Limits *****	18.40	219.80	89.20	61.20	30 - 60	29.10	0.0153	0.1533	0.0613
Gasification (Average)	2.02	55.60	43.44	1.46	0.0239	9.43	0.0006	0.0090	0.0024
Incineration (Average)	13.46	692.75	435.50	72.35	33.25	39.48	0.0007	0.0155	0.0290
% Reduction	-85.0%	-92.0%	-90.0%	-98.0%	-99.9%	-76.1%	-21.4%	-41.7%	-91.7%

Notes:

- PM = Particulate matter, TOC = total organic carbon, VOC = volatile organic carbon, Cd = Cadmium, Pb = Lead, Hg = Mercury, ND = not detected, Unless otherwise stated, all emissions values are corrected to 11%vol. O2 on a dry basis.
- The values presented for Zegen, SEMASS #1 and #3 are corrected for 7% vol. O2 on a dry basis.
- * Most comparable technology to FastOx -- Data provided by Thermostelect licensee Interstate Waste Technologies, Inc. Malvern, PA.
- ** Comparable to FastOx -- Data provided by ENSR AECOM report on Alter NRG
- *** Zegen commercial facility estimates
- **** Recently permitted incineration facilities in the USA (200 - 800 tpd MSW), from ENSR AECOM report on Alter NRG
- ***** Operating data from the Seamass MSW mass-burn facility located in Massachusetts.
- ***** US EPA section 111(d) emissions guidelines