MEMO

DATE: February 7, 2008

TO: Energy and Environment Committee

FROM: Christine Fernandez, Assistant Regional Planner, (213) 236-1923, fernande@scag.ca.gov

SUBJECT: Conversion Technology Report

BACKGROUND:
Conversion technologies (CTs) refer to a wide array of biological, chemical, thermal (excluding incineration/direct combustion) and mechanical technologies capable of converting post-recycled residual solid waste into useful products such as chemicals, electricity, fuel gas, ethanol, biodiesel, and other industrial products. CTs have the potential to complement current waste reduction efforts to decrease waste disposal at landfills.

At the request of SCAG's Solid Waste Task Force, Coby Skye (LADPW) will present the Conversion Technology Evaluation Report – Phase II Assessment that was released in October 2007. The report builds on findings from the 2005 Phase I – Initial Technology Evaluation that identified viable technologies and partnership opportunities for building a CT facility in the Los Angeles County area. LA County is taking steps to facilitate development of a demonstration conversion technology facility in Southern California to obtain real-world data on the impacts and benefits of these technologies. CT facilities are currently being successfully operated throughout Japan and Europe.

FISCAL IMPACT:

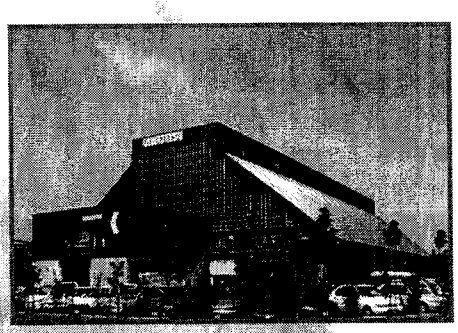
There is no financial impact.

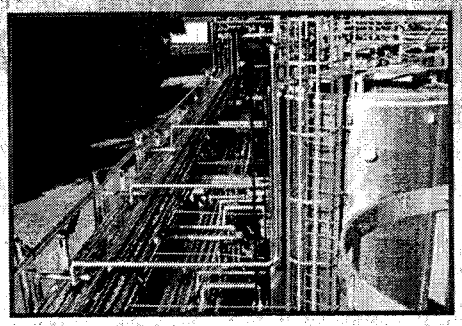
Reviewed by:
Division Manager

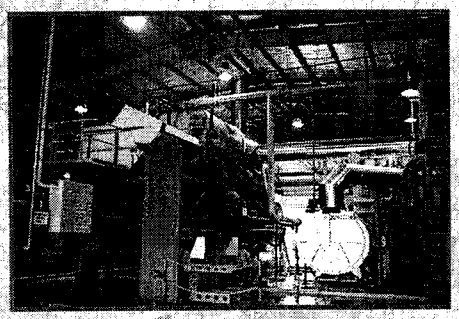
Reviewed by:
Department Director

Reviewed by:
Chief Financial Officer

SOUTHERN CALIFORNIA ASSOCIATION of GOVERNMENTS







Los Angeles County Conversion Technology Evaluation Report

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Phase II – Assessment

Executive Summary

Converting Waste into Renewable Resources

October 2007

ACKNOWLEDGEMENTS

This Phase II Conversion Technology Evaluation Report, developed by the Alternative Technology Advisory Subcommittee of the Los Angeles County Solid Waste Management Committee/Integrated Waste Management Task Force, is the product of tireless efforts by individuals dedicated to improving the quality of life for residents of Los Angeles County and California by advancing the evolution of solid waste management. This pioneering work in evaluating and promoting the development of innovative alternatives to landfills is driving a paradigm shift to resource management and conservation. The Los Angeles County Department of Public Works and the Task Force would like to thank the following individuals for all their contributions of time, effort and professional expertise, without which this Report would not be possible. We also acknowledge the commitment and involvement of the technology suppliers and materials recovery facility owners and operators in providing detailed information and allowing site visits at their respective facilities.

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EXECUTIVE SUMMARY
LOS ANGELES COUNTY
CONVERSION TECHNOLOGY EVALUATION REPORT
PHASE II

October 2007

1.0 OVERVIEW

Background

Conversion technologies refer to a wide array of biological, chemical, thermal (excluding incineration) and mechanical technologies capable of converting post-recycled residual solid waste into useful products and chemicals, green fuels such as hydrogen, natural gas, ethanol and biodiesel, and clean, renewable energy such as electricity. In addition to the production of locally-generated renewable energy and green fuels, the use of conversion technologies in Southern California could effectively enhance recycling and beneficial use of waste, reduce pollution such as greenhouse gas emissions, and reduce dependence on landfilling and imported and domestic fossil fuels.

Conversion technologies are successfully used to manage solid waste throughout Europe, Israel, Japan, and other countries in Asia, but are not yet in commercial operation in the United States. While there are and have been pilot demonstrations of conversion technologies in the United States, the absence of larger scale demonstration facilities and commercial facilities in this country is an obstacle to demonstrating the benefits these technologies can offer. In addition to lack of U.S. experience, specific development hurdles for conversion technologies in California may include: cost, especially when compared to the current, relatively inexpensive cost of landfill disposal; the lack of a clear permitting and regulatory pathway; a lack of diversion credit, renewable energy credit, or other incentives for the development of emerging technologies; and misconceptions regarding the performance of these technologies.

For nearly a decade, the County of Los Angeles has been a consistent supporter of conversion technologies for their ability to manage post-recycling residual waste materials in an environmentally preferable manner and their potential to assist jurisdictions in meeting the State's waste diversion mandate. For example, the County has supported legislation and worked with State and local governments and other key stakeholders to advance research and development of conversion technologies.

County Role

Pursuant to AB 939, counties have the added responsibility of preparing and administrating the Countywide Siting Element and the Countywide Integrated Waste Management Summary Plan. The Summary Plan describes the steps that will be taken by local agencies, acting independently and in concert, to achieve the 50 percent waste diversion mandate. The Countywide Siting Element, which was adopted by a majority of the cities in

the County of Los Angeles encompassing a majority of the cities' population, the County Board of Supervisors, and the State, is the current long-term planning document which provides for the County's solid waste disposal needs for the residual waste remaining after undergoing all recycling and other waste diversion efforts. Currently, residents and businesses in Los Angeles County generate over 24 million tons of trash each year, of which approximately 12 million tons, equivalent to over 40,000 tons of trash each day, must be properly disposed.

Meeting the mandates of AB 939 is especially challenging in Los Angeles County. The County of Los Angeles includes 88 cities and 134 unincorporated communities with a combined population in excess of 10 million. The County of Los Angeles has the largest and most complex solid waste management system in the country, with over 140 permitted waste haulers, 28 large transfer stations/material recovery facilities, 11 municipal solid waste landfills, 11 inert waste landfills, 2 waste-to-energy facilities, 43 construction and demolition debris recycling facilities and 350 recyclers. Each year, Los Angeles County residents and businesses generate approximately 24 million tons of materials, with approximately 50% being diverted through source reduction and recycling away from disposal. However, 12 million tons of trash remains each year, equivalent to approximately 40,000 tons which must be safely and properly disposed on a daily basis. This presents a challenge in not only protecting the public health and safety and the environment through effective solid waste management on a daily basis but also continuing to expand waste reduction, resource recovery, and recycling programs and policies.

The Los Angeles County Board of Supervisors is the legislative and executive branch of County government. The Board of Supervisors have been steadfast advocates of alternatives to landfills, and provided the leadership needed to advance the development of these emerging technologies. The Board of Supervisors have designated the Department of Public Works as the lead County agency advising the Board of Supervisors on waste management issues and responsible for the County's compliance with AB 939 mandates. This includes the waste diversion mandate for the unincorporated areas as well as Countywide solid waste planning responsibilities, in concert with the cities and the Task Force.

As part of its continuing efforts to evaluate and promote the development of conversion technologies, the County incorporated into the land use permit for the Puente Hills Landfill a condition requiring the owner/operator of the landfill, the County Sanitation Districts of Los Angeles County, to provide up to $100,000 in funding each year for the remainder of the landfill's lifespan, in order to study conversion technologies, and requires the Sanitation Districts consider funding a pilot conversion technology facility, should a suitable technology be identified. The land use permit approved by the County Board of Supervisors also requested the Los Angeles County Solid Waste Management Committee/Integrated Waste Management Task Force (see description below) form the Alternative Technology Advisory Subcommittee (Subcommittee), a multi-stakeholder group whose mission is to thoroughly evaluate and promote the development of conversion technologies.

Continuing this model, the County adopted a land use permit for the Sunshine Canyon landfill, owned and operated by Browning-Ferris, Industries, which included a condition for

providing $200,000 per year in funding for 10 years. This funding will continue the work of the Subcommittee, the Task Force and the Department of Public Works in implementing the recommendations of this Report and advancing the vision of the Board of Supervisors to some day make landfills obsolete.

To further this goal in the near term, the County of Los Angeles Department of Public Works is collaboratively working with the Task Force and the Subcommittee to facilitate development of a fully operational conversion technology demonstration facility in Southern California. The goal of the County's project is to demonstrate technical, environmental and economic benefits of conversion technologies through design, construction and operation of a facility in Southern California, in order to forge permitting and legislative pathways for conversion technologies and promote development of future projects. This demonstration project is the first implementation resulting from the combined efforts to evaluate the feasibility of conversion technologies in Southern California, including a broad evaluation in Phase I and a more detailed evaluation in Phase II. A brief description of the Phases is included below, with a more detailed explanation in Sections 2 and 3 of this Report.

Pursuant to Chapter 3.67 of the Los Angeles County Code and AB 939, the Task Force is responsible for coordinating the development of all major solid waste planning documents prepared for the County of Los Angeles and its 88 cities. Consistent with these responsibilities, and to ensure a coordinated and cost-effective and environmentally-sound solid waste management system in Los Angeles County, the Task Force also addresses issues impacting the system on a Countywide basis. The Task Force membership includes representatives of the League of California Cities-Los Angeles County Division, the County of Los Angeles Board of Supervisors, the City of Los Angeles, the waste management industry, environmental groups, the public, and a number of other governmental agencies.

In 2004, as requested by the County, the Task Force established the Alternative Technology Advisory Subcommittee to evaluate and promote the development of conversion technologies. The Subcommittee's membership includes municipal officials, regulators, consultants, industry, environmental and community representatives, all experts in the field of conversion technologies and solid waste management.

Phase I – Initial Technology Evaluation

Beginning in 2004, the County contracted with URS Corporation to conduct a preliminary evaluation of a range of conversion technologies and technology suppliers, and initiated efforts to identify material recovery facilities (MRFs) and transfer stations (TSs) in Southern California that could potentially host a conversion technology facility. A scope beyond just Los Angeles County was considered important as stakeholders in the Subcommittee extended beyond Los Angeles County, and the implications of this effort will have many regional impacts.

In August 2005, the Task Force adopted the Subcommittee's *Conversion Technology Evaluation Report*. As more fully described in Section 2 of this report, Phase I resulted in identification of a preliminary short list of technology suppliers and MRF/TS sites, along with development of a long-term strategy for implementation of a conversion technology

demonstration facility at one of these sites. The Department of Public Works and the Subcommittee intentionally pursued integrating a conversion technology facility at a MRF/TS site in order to further divert post-recycling residual waste from landfilling and take advantage of a number of beneficial synergies from co-locating a conversion facility at a MRF.

Phase II – Facilitation Efforts for Demonstration Facility

In July 2006, the County contracted with Alternative Resources, Inc. (ARI) to further advance its efforts to facilitate development of a conversion technology demonstration facility (Phase II). The ARI team included multi-disciplined expertise, including Clements Environmental Corporation, Facility Builders and Erectors, Holland & Knight, and UltraSystems Environmental. Key Phase II services provided by the ARI team included:

- an independent evaluation and verification of the qualifications of selected technology suppliers and the capabilities of their conversion technologies;
- an independent evaluation of candidate MRF/TS sites, to determine suitability for installation, integration and operation of one of the technologies;
- a review of permitting pathways;
- identification of funding opportunities and financing means;
- identification of potential County incentives (i.e., supporting benefits) to encourage facility development amongst potential project sponsors; and
- negotiation activities to assist these parties in developing project teams and a demonstration project.

This report describes progress to date on Phase II of the County's project to facilitate development of a conversion technology demonstration facility in Southern California, and represents a culmination of approximately one year of work conducted by the County and Subcommittee in conjunction with the ARI team.

Phase III – Long-Term Development of Conversion Technologies

As described previously, Los Angeles County residents and businesses generate approximately 24 million tons of materials, with approximately 50% being diverted through source reduction and recycling away from disposal. This results in over 12 million tons of trash left for disposal every year, a number that is expected to continue to grow, despite waste reduction and recycling programs, due to continued population and economic growth in the region. With the certainty that in-County landfill capacity will run out in the long term, and will be substantially diminished in the short term, the County of Los Angeles recognizes the imperative to develop technically, economically and environmentally feasible alternatives to landfills within Los Angeles County.

The goal of the County's demonstration project (Phase II) is to forge permitting and legislative pathways for conversion technologies and promote development of future projects. Building on the experiences gained after the successful development of one or more demonstration projects in Phase II, the next logical step is a focus on development of commercial scale facilities using proven technologies within Los Angeles County. To facilitate this goal, future, Phase III activities may include the following:

- Re-evaluating the marketplace of conversion technologies to consider new and emerging developments and continue to pursue development of the most technically and environmentally effective technologies, focusing on the identification of potential sites within Los Angeles County, including key potential sites identified in Phase II;

- Developing partnerships with local cities within Los Angeles County interested in the development of conversion technology facilities within or adjacent to their borders; and

- Facilitating development of commercial-scale conversion technology facilities designed to manage Los Angeles County's waste stream.

These activities can occur concurrently with the continued development of the Phase II demonstration projects.

Public Outreach

In January 2007, the County initiated efforts to develop and implement a public outreach and education plan for development of conversion technologies in Southern California. These public outreach efforts have been occurring integrally with the evaluations described in this report. This report is not intended to address the details of the public outreach plan. However, the findings presented herein are intended to be shared through the public outreach program, to facilitate the development of a conversion technology demonstration facility.

The County's Role as a Project Facilitator

The County is promoting the development of a conversion technology demonstration facility by serving as a project facilitator. In this role, the County is effectively using its resources to promote project development in a variety of ways. In the work completed in Phase I and Phase II, the County has utilized the expertise of Department of Public Works staff, the Subcommittee, and its consulting teams to disseminate a wide range of information regarding conversion technologies, potential host locations, and project development activities. Overall, the County is providing a framework to bring technology suppliers and MRF/TS site owners and operators together for development of a project.

As the County continues to support and promote conversion technologies and works to achieve development of a demonstration facility in Southern California, its role of facilitator is likely to evolve. Each technology supplier and MRF/TS site owner/operator may have

different needs and priorities for facilitation of project development. As a facilitator, the County can consider discrete actions along with invested public and private partners, such as County Sanitation Districts Board of Directors and BFI, it can take and specific incentives it can offer to promote project development. There are a wide range of potential opportunities for County facilitation and support of a conversion technology demonstration facility. Some of these are essential support activities, such as providing for public waste supply agreements or for public "backing" of private waste supply agreements for the term of financing. Others are support activities that would facilitate project development, such as developing and sharing technology and site information, and promoting beneficial use of products. These potential opportunities for County support of a conversion technology demonstration facility are further addressed in this report.

2.0 SCOPE AND METHODOLOGY OF PHASE II STUDY

Phase II activities began in July 2006, and progressed steadily through the development of this report. The scope of Phase II work has consisted of implementation of key activities identified in the Phase I strategic action plan, including: verification and evaluation of technology supplier qualifications and technology capabilities; evaluation of candidate MRF/TS sites and verification of their ability and willingness to partner with a technology supplier; and other activities aimed at promoting and facilitating development of a conversion technology demonstration facility. The scope and methodology of the Phase II study is summarized below.

Selection of Participating Technology Suppliers

Technology suppliers were selected to participate in Phase II based on:

(1) The results of the Phase I evaluation and ranking;

(2) Consideration of new and relevant information regarding technology performance and development, including ancillary capabilities of technology suppliers (e.g., integrating combined heat and power or alternative fuels in project development activities); and

(3) The ability and willingness of the technology supplier to participate in Phase II, recognizing the substantial commitment to supply detailed information that would be required on their part. In addition to having the ability and willingness to partner with one of the candidate MRF/TS sites, the minimum commitment required of the technology suppliers included disclosure of technical, environmental and cost information for the technology, disclosure of technical and financial resources of the technology supplier, and identification of an operating reference facility.

Thirty-two technology suppliers were considered for participation in Phase II, including: the six technology suppliers previously short listed in Phase I; the eight technology suppliers that passed the screening criteria and were evaluated in Phase I, but at the time were not recommended for further evaluation; and eighteen additional technology suppliers that were not evaluated in the Phase I study, but had subsequently contacted Los Angeles County and expressed an interest in the County's conversion technology demonstration project. The eighteen additional technology suppliers were evaluated using the minimum criteria established for the Phase I screening and applied to the other technologies, with a more stringent requirement for diversion potential.

Ultimately, nine technology suppliers were selected for participation in Phase II, including the six that were recommended in Phase I and three additional technology suppliers that were evaluated in Phase I but not recommended at the time (Arrow Ecology and Engineering, Ebara Corporation, and International Environmental Solutions).

After selection of the participating technology suppliers, a Request for Information (RFI) was issued to the nine selected participants. During the RFI response period, four of the nine selected technology suppliers chose to withdraw from the process for a variety of reasons on their part. The Phase II process proceeded with a final list of five technology suppliers. The suppliers and proposed projects are listed alphabetically in Table 1.

Table 1. Technology Suppliers Participating in Phase II and Proposed Projects

Technology Supplier	Technology Type	Proposed Capacity	Major Products
Arrow Ecology and Engineering (Arrow)	Anaerobic Digestion	300 tpd	Biogas (Electricity) Digestate (Compost) Recyclables
Changing World Technologies (CWT)	Thermal Depolymerization	200 tpd	Renewable Diesel Carbon Fuel Metals
International Environmental Solutions (IES)	Pyrolysis	242.5 tpd @ 58.9% moisture 125 tpd@ 20% moisture	Syngas (Electricity)
Interstate Waste Technologies (IWT)	Pyrolysis / High Temperature Gasification	312 tpd (1 unit) 624 tpd (2 units) 935 tpd (3 units)	Syngas (Electricity) Mixed Metals Aggregate
NTech Environmental (NTech)	Low Temperature Gasification	413 tpd	Syngas (Electricity)

Methodology for Technology Evaluation

Information required for the technology evaluation and for evaluation of the resources and qualifications of the technology suppliers was gathered through a detailed Request for Information (RFI). The RFI described Los Angeles County's objectives for the demonstration project, and disclosed the technical, economic, and qualifications criteria that were established for the Phase II evaluation process. The RFI also identified the candidate MRF/TS sites, provided contact information for the MRF/TS site owner/operators along with key site information, and provided waste composition assumptions. The RFI was issued in October 2006, and responses were received in December 2006. A copy of the RFI is provided in Appendix B to the report. The evaluation criteria are identified in the report, as a preface to the review of resources and financial qualifications of the technology suppliers (Section 4) and the technology evaluations (Section 5).

In January 2007, after submittal and initial review of the RFI responses, interviews and working meetings were conducted with each of the technology suppliers in Los Angeles. This direct interaction with the technology suppliers provided the opportunity to confirm

information and gather additional data and materials as needed. Throughout the review process, direct interaction and coordination with the technology suppliers continued, including visits to reference facilities from February through April 2007, to ensure the most accurate and complete information was available for review. Upon analysis of information obtained during the presentations and site visits, preliminary findings were summarized and a workshop was conducted with the Subcommittee to review and discuss the preliminary findings. Following the Subcommittee's review, the preliminary findings were shared with the technology suppliers in June 2007, to provide a final opportunity for data confirmation and input. Information in this report is current through June 2007.

Selection of Candidate Sites

The Phase I study recommended six MRF/TS facilities as preferred locations for development of a conversion technology demonstration facility. Early in the Phase II process (July 2006), the owner/operators of the six potential sites were contacted and site visits were conducted to determine interest in continued participation in the County's demonstration project. Four of the original six sites expressed a willingness and ability to participate. Two of the sites, both identified in Phase I as "second priority" sites, dropped out: the Central Los Angeles Recycling Center and Transfer Station (CLARTS), because it is a potential site for the City of Los Angeles conversion technology project, and the proposed facility in Santa Clarita, because of uncertainty regarding the approval of the entire industrial development that would have encompassed the MRF/TS. Late in the Phase II process, a new MRF was added to the project, specifically in consideration of their relationship with one of the selected technology suppliers (International Environmental Solutions). This additional MRF (Rainbow Disposal in Huntington Beach) was evaluated under this project exclusively in partnership with IES. The five MRF/TS sites evaluated in Phase II are identified in Table 2, listed in alphabetical order.

Table 2. MRF/TS Sites Evaluated in Phase II

MRF/TS Facility	Location
Community Recycling/Resource Recovery Inc.	Los Angeles County (Los Angeles)
Del Norte Regional Recycling and Transfer Station	Ventura County (Oxnard)
Perris MRF/Transfer Station	Riverside County (Perris)
Rainbow Disposal Company, Inc. MRF(1)	Orange County (Huntington Beach)
Robert A. Nelson Transfer Station and MRF	Riverside County (Unincorporated)

(1) The Rainbow Disposal MRF was evaluated under this project exclusively in partnership with IES.

Methodology for Site Evaluation

Criteria were established to evaluate the suitability of each facility to host a conversion technology demonstration facility. The criteria included the fundamental prerequisite of ability and willingness to partner with a technology supplier for development of a demonstration facility, along with primary criteria (e.g., space availability, feedstock quantity) and secondary criteria (e.g., ability to assist in marketing products, accessibility to major transportation routes). Information required for site evaluations was gathered through a series of site visits and meetings with each of the individual site owner/operators. The criteria that were established for the Phase II site evaluations (see Section 6 of the report) provide a template that may be useful by other entities that are similarly working on development activities for a conversion technology project.

Reference Facility Tours

Reference facility tours were an important component of the Phase II technology evaluations. The tours provided the opportunity to gather and confirm technology-specific information, and to gather valuable insight for development of a demonstration project in Southern California.

Each participating technology supplier was required to identify an operating reference facility that could be visited to observe the technology. Members of the Subcommittee, Department of Public Works staff, and representatives of the ARI team participated in the tours, which took place from February through April 2007. When possible, meetings were also held with regulators and local government officials to gather insight regarding the development and operational history of the facilities. Table 3 identifies the reference facilities that were visited. Additional information on the reference facilities and relevant findings from the tours and meetings are integrated with the technology evaluations in Section 5 of the report.

Table 3. Reference Facility Visits

Technology Supplier	Reference Facility Visited (Location)
Arrow Ecology	Hiriya, Israel
Changing World Technologies	Carthage, Missouri
International Environmental Solutions	Romoland, California
Interstate Waste Technologies	Chiba, Japan Kurashiki, Japan
NTech Environmental	York, England (pre-processing) Bydgoszcz, Poland (gasifier)

Project Economic Analysis

Planning-level cost and pricing estimates provided by the technology suppliers, including the estimated tipping fees, were independently reviewed and evaluated to determine:

- completeness and reasonableness of cost and pricing assumptions;
- consistency of estimated tipping fees with cost and pricing assumptions and technical data (e.g., annual waste throughput, quantity of products, quantity of residue); and~~,~~
- sensitivity of estimated tipping fees to outside influences.

The evaluation included economic modeling to independently estimate tipping fees.

The tipping fees estimated by the technology suppliers and confirmed by modeling as achievable fall in the range of approximately $50 to $70 per ton. In comparison, current waste disposal costs in the region vary considerably based on location, extent of MRF processing, and long-term disposal agreements. Current landfill gate fees for MSW range from approximately $30 to $40 per ton. Costs including transportation and additional processing (as indicated by gate rates at MRF/TSs) are somewhat higher, ranging from approximately $40 to $50 per ton.

The Puente Hills Landfill is the largest operating landfill in the United States at 13,200 tpd, and a dominant force in setting market prices in the Los Angeles County area. The Puente Hills Landfill will close in 2013, and the Sanitation Districts of Los Angeles County, will develop a system for long haul by rail from the Puente Hills MRF, adjacent to the Landfill, in order to compensate for a fraction of the disposal capacity no longer available upon closure of the landfill on October 27, 2013. This "waste-by-rail" system is estimated to be operational by 2011 and will direct waste to the Mesquite Landfill, several hundred miles from Los Angeles. The Sanitation Districts estimate the cost for rail haul from the Puente Hills MRF at approximately $75/ton, requiring a ramped increase before the Landfill closes in order to prevent a sudden spike in cost and provide for a levelized rate.

The Sanitation Districts projects this "levelized" gate fee (i.e., tipping fee) at Puente Hills for rail haul and disposal will be approximately $45 per ton in 2013, which corresponds with the potential initial operating year for a conversion technology facility ($50 to $70). Five years thereafter (i.e., by 2018) the gate fee for rail haul and disposal is expected to be approximately $70 per ton, and within ten years (i.e., by 2023) the gate fee is expected to be over $100 per ton. These prices are expected to reflect overall market conditions.

The estimated tipping fees for the conversion technologies compare favorably with projected costs for haul and disposal in the immediate future, and are estimated to be directly cost competitive with landfill disposal within 5-10 years. On a life cycle basis (e.g., over 20 years of operation), the conversion technologies could be less costly than rail haul and disposal. However, in the initial years of conversion technology operation (e.g.,

up to the first five years of operation in the scenario presented above) there may be a need to "bridge" the economic gap, if any, in order to make up the difference between those new facility costs and prevailing transfer and landfill disposal prices until such time as market waste disposal fees equal those for conversion technologies.

3.0 SUMMARY OF KEY FINDINGS AND RECOMMENDATIONS

Summary of Findings

As described in this report, the Los Angeles County Solid Waste Management Committee/Integrated Waste Management Task Force (Task Force), its Alternative Technology Advisory Subcommittee (Subcommittee), and the Los Angeles County Department of Public Works have been working to facilitate the design, construction and operation of a conversion technology demonstration facility(ies) in Southern California, to demonstrate the capabilities and benefits of conversion technologies, and to forge permitting and legislative pathways for future projects. This report describes Phase II of the County's project facilitation activities. Key activities of Phase II included: (1) verification and evaluation of technology supplier qualifications; (2) verification and evaluation of technology capabilities (including technical, environmental and economic factors); and (3) evaluation of candidate MRF/TS sites and verification of their ability and willingness to partner with a technology supplier. Phase II activities also included identification of: project funding opportunities and financing approaches; financing requirements; and County incentives needed or helpful to facilitate project development. Tables 4 and 5 identify, respectively, the technology suppliers and sites recommended to participate in the next step of the Phase II process. It should be noted that the listing is alphabetic, and the ordering does not signify any ranking or preference. Key findings are as follows:

1. **Technology Readiness and Reliability.** Four of the five technology suppliers have demonstrated the technical capabilities of their conversion technologies with MSW (Arrow, IES, IWT and NTech Environmental) and are "ready" for application as part of a conversion technology demonstration project in Southern California. It should be recognized, however, that each of these technology suppliers would be incorporating one or more new aspects into its design concept, such as the unique integration of pre-processing equipment and/or other facility components. Also, specific waste characteristics, waste receiving and separation requirements, State and local regulatory requirements, and specific product markets will need to be addressed in an application of these conversion technologies in Southern California.

   CWT has demonstrated its depolymerization technology with agricultural waste, but has not yet demonstrated its technology with MSW. Additional development work is necessary for application of CWT's technology to MSW (particularly for processing MRF residuals and post-recycled MSW). CWT was not recommended for further consideration for this project because its technology is not yet demonstrated for MSW, although, CWT's technology may be applicable to other waste streams. CWT's technology may be suitable for consideration in a future phase of Los Angeles County's project development activities (Phase III).

Table 4. Technology Suppliers Recommended for Next Step of Phase II
(Listed Alphabetically)

Technology Supplier	Technology Type
Arrow Ecology and Engineering (Arrow)	Anaerobic Digestion
International Environmental Solutions (IES)	Pyrolysis
Interstate Waste Technologies (IWT)	Pyrolysis / High Temperature Gasification
NTech Environmental (NTech)	Low Temperature Gasification

Table 5. MRF/TS Sites Recommended for Next Step of Phase II
(Listed Alphabetically)

MRF/TS Facility	Location
Del Norte Regional Recycling and Transfer Station	Ventura County (Oxnard)
Perris MRF/Transfer Station	Riverside County (Perris)
Rainbow Disposal Company, Inc. MRF(1)	Orange County (Huntington Beach)
Robert A. Nelson Transfer Station and MRF	Riverside County (Unincorporated)

(1) The Rainbow Disposal MRF was evaluated under this project exclusively in partnership with IES.

2. **MRF/TS Site Suitability.** Four sites were found to be technically and environmentally suitable for co-location of a conversion technology project: Del Norte Regional Recycling and Transfer Station (Oxnard); Robert A. Nelson Transfer Station and MRF (Unincorporated Riverside); Perris MRF/Transfer Station (Perris); and Rainbow Disposal Company, Inc. MRF (Huntington Beach). Community Recycling/Resource Recovery, Inc. MRF/TS in Los Angeles was limited by available space and is faced with an active LEA Cease & Desist Order that may pose a constriction for project development at this site. The Community Recycling site was not recommended for this project because of those constraints. However, Community Recycling has access to a larger site, which may be suitable for consideration in a future phase of Los Angeles County's project development activities (Phase III).

   With only one exception, the MRF/TS sites have continued to express a willingness and ability to partner with a technology supplier and participate in Los Angeles County's conversion technology demonstration project. The only exception is the Del Norte Regional Recycling and Transfer Station in Oxnard (Ventura County), which has not yet made a commitment to continue to participate in the County's project. As the only publicly-owned MRF/TS under consideration, the Del Norte site requires a more formal and lengthier process for making a project commitment. In addition, the City of Oxnard has received and is evaluating a project offer that could result in development of the land adjacent to the MRF/TS, which was identified for location of a conversion technology facility. The future of Oxnard's participation in the County's project is uncertain.

3. **Corporate and Team Resources.** The teams assembled include technology suppliers and experienced team members in key roles such as finance, design and construction, and operations, and are capable of developing a project.

4. **Financial Resources.** Although in most cases, technology suppliers have not been in business in the U.S. market long enough to have built extensive U.S. project inventories or financial track records, the inclusion of major experienced financial, engineering and construction and/or operations team members, and their teaming with MRF/TS owners, will enhance their overall financial resources and capability, providing sufficient resources for project development and operations. In particular, these teaming arrangements will strengthen the ability to provide design, construction, operations and performance guarantees, and the taking of risks associated with these types of guarantees.

5. **Diversion Potential.** The conversion technologies have the potential of achieving significant diversion of MRF residue and post-recycled MSW from landfill disposal, ranging from approximately 87 percent to 100 percent by weight of the waste received, provided reliable markets can be identified for secondary products.

6. **Conversion Capability, Marketable Products.** The technologies have the capability of recovering recyclables, converting waste into intermediate fuel products (e.g., biogas, syngas, steam, biodiesel), efficiently using the fuel products on-site for power generation, and producing secondary material products. On-site power generation is currently the proposed alternative due to strong market demands for electricity, particularly from renewable energy sources.

7. **Environmental Soundness.** The technologies are expected to be permittable in Southern California, meeting applicable environmental standards. Appropriate air pollution controls will be required. The fuel gas (e.g., biogas, syngas) can be collected and cleaned prior to use for power generation, as necessary for permitting. Phase II addressed three key pollutants: nitrogen oxides (NOx); dioxins; and greenhouse gas (GHG) emissions.

   - NOx is a criteria air pollutant of concern as established by the U.S. EPA. NOx was selected as a key indicator of environmental acceptability of conversion technologies because ground level ozone (smog) is one of the most significant pollution issues in Southern California, and NOx is the most significant pollutant generated by conversion technologies that contributes to smog. The U.S. EPA classifies the Los Angeles South Coast Air Basin as being a severe non-attainment area for ozone, a precursor to smog. Smog poses a threat to humans because it can irritate the respiratory system and lead to severe respiratory health problems. The conversion technologies evaluated would apply control technologies to reduce NOx emissions, and would have potential, controlled NOx emissions that are significantly lower than the Federal requirements for large municipal waste combustors (i.e., approximately 10 times less).

   - Dioxin was selected as a key indicator of environmental acceptability of conversion technologies, because it is a toxic air pollutant of great public concern. Potential dioxin emissions from conversion technologies are expected to be very small compared to Federal requirements for large municipal waste combustors (i.e., approximately 10 to >100 times less).

   - Greenhouse gases are those gases in the atmosphere that increase global warming. Conversion technology facilities have the potential to significantly contribute positively towards the State's Global Warming Solutions Act goals. These technologies achieve significant diversion from landfill disposal and convert organic waste material into renewable energy, fuels and other products, resulting in a net reduction in greenhouse gas emissions.

- The net generation of emissions can be reduced when considering the life-cycle impact of conversion technologies. By design, conversion technologies offset emissions from other sources, including the transportation of waste to remote disposal that is no longer necessary, as well as the combustion of fossil fuels offset by the generation of renewable energy in the form of electricity or green fuels. Co-location of conversion technology facilities with MRFs maximizes this transportation reduction of residual solid waste. When factoring in diversion of materials from disposal as well as offsets from transportation and energy production, conversion technologies are likely to reduce net emissions.

8. **Estimated Tipping Fees.** The tipping fees estimated by the technology suppliers, and reviewed in this study, fall in the range of $50 to $70 per ton, excluding IWT's single-unit, 312-tpd project, which is not considered economically viable. Sensitivity analyses (conducted to determine the impacts on tipping fees of certain contingencies) do not result in a significant change to the overall tipping fee range.

9. **Competitiveness of Estimated Tipping Fees.** As noted above, tipping fees needed to support a conversion technology project range from approximately $50 to $70 per ton. While these estimated tipping fees may be competitive with the future tipping fees associated with rail haul and landfill disposal, they are greater than current waste disposal costs in Los Angeles County. To support financing and successful project development and operation, there may be a need to "bridge" this economic gap, if any, until such time as market waste disposal fees equal those for conversion technologies.

   Many alternatives could be considered to help meet this need, including one or more of the following:

   - funding provided by the Sanitation Districts, consistent with the conditions of the Puente Hills Landfill C.U.P.;
   - funding provided by BFI, consistent with the conditions of the Sunshine Canyon C.U.P;
   - funding provided by the cities in Los Angeles County and the County itself;
   - development of public waste supply agreement (or private agreement with public "back stop") with supporting tip fees;
   - increasing the amount of the project financing to provide surplus funds to "subsidize" initial tip fees being paid;

- instituting a ramped tipping fee (i.e., a structured annual increase that is kept in place until the prices charged cover the cost incurred, similar to the funding subsidy formulated by the CSD for the Waste by Rail Project);

- instituting a "green fee" to be paid by MRF/TS customers for waste processed at the conversion technology facility;

- eliminating the Solid Waste Management Fee (currently $0.86 per ton) for waste originating in Los Angeles County going to the conversion technology facility, to provide a reduced tip fee for waste delivered to the conversion technology facility;

- increasing the Solid Waste Management Fee (currently $0.86 per ton) imposed on each ton of solid waste being disposed to provide a dedicated funding source for promoting development of conversion facilities;

- providing tax incentives that may result in lower facility construction or operating costs; and

- successful acquisition of State and Federal grants to augment other funds as discussed above.

The level of support needed and alternatives to address needed support would require evaluation in the next step of this process, when firm, competitive offers from the project developers are made, and proposed tip fees and project-specific market conditions are known.

10. **Financing Approach.** Given the experience and corporate and team resources of the technology suppliers, and assuming waste supplies would be provided or assured by a public entity or credit-worthy private source with assignable public contracts at a sufficient tipping fee for the term of financing, the technology suppliers could structure financable projects applying customary U.S. solid waste market project financing techniques. However, specific means for providing or assuring the waste supply need to be developed, as does a means of providing a supporting tipping fee. Tax-exempt, private activity bonds would most likely be the least-costly means of private project financing. Support from the County and/or other public agencies may be needed to secure allocation of "volume cap" from the State for such financing.

    State and Federal funding opportunities are limited, but could be used to assist in project development and/or project financing. Securing such funding is competitive and requires project definition.

Recommended Next Steps – Competition for Selection of Project(s)

Although substantial evaluation work has been completed, resulting in selection of acceptable technologies and sites for one or more demonstration facilities for Southern California, formal project offers have not yet been presented. As a next step, it is recommended upon approval from the County Board of Supervisors that the Task Force, Subcommittee and Department of Public Works establish a competition to solicit formal, site-specific offers from the acceptable technology suppliers in partnership with the acceptable MRF/TS sites. Such a process would establish a defined mechanism by which one or more projects would be selected to receive County support to further facilitate project development activities.

The competition would not be a formal procurement process, and it would be open only to the technology suppliers and sites identified in this report as "recommended". The process would differ from a procurement in its formality and the extent of detail requested, both of which would be streamlined. However, the competition would still require clear project definition and commitments on the part of the development team making the offer, including a tipping fee and project guarantees, and it would need to meet standards set by the Task Force, the Subcommittee and the Department of Public Works. In return, the selected project(s) would be offered County support to facilitate development activities. Potential options for support are described below, and ultimately must be selected and approved by the County before being formally offered.

The advantage of the competition is that it would allow the marketplace to establish the most beneficial pairing of sites and technologies, a process most appropriate for a privately developed project, and it would encourage the development of site-specific projects that meet the objectives of the County, the Task Force and the Subcommittee. In this way, specific offers would be evaluated to enable selection of the best project(s) as offered by a team that includes a technology supplier and site, rather than selection of a preferred technology and site for which a partnership has not yet been established or may not be possible, and a project that is not yet defined. The competition would also strengthen the County's negotiation position as a project facilitator.

The competition would be initiated with issuance of a "letter of invitation" to the recommended technology suppliers and MRF/TS sites, outlining the standards and incentives and other elements of the competition. A time limit would be set for project offers to be made. Approximately 3 to 4 months is recommended, to allow time for the technology suppliers and MRF/TS owners and operators to explore partnership opportunities and develop site-specific project offers. Upon receipt of project offers, the Task Force, Subcommittee and Department of Public Works would review, evaluate and rank the offers and select one or more projects to recommend receiving the support of the County of Los Angeles. Support activities would be negotiated with the project development teams, based on ranking and selection of project(s). As proposed, this competition would allow the County to support more than one project, perhaps with the highest level of benefits offered to the highest-ranked offer.

Standards set for the competition would include those that promote the overall objectives and goals of the project. Suggested standards could include the following:

Project Standards

- The project must be of a certain minimum size; e.g., 100 tons per day.
- The project must be capable of achieving operation by a specified date.
- The project must be capable of sustained operation at a market-competitive tip fee, if not initially, over the term of operation.
- The project must be designed to process MRF residuals and/or post-recycled municipal solid waste, and must have the potential to divert at least 75% (by weight) of this waste from landfill disposal.
- The project must have the ability to capture the gas produced and to generate electricity or a fuel product (e.g., biogas, synthesis gas, oil) and must have a defined use for the electricity and/or fuel product.
- The project must have the ability to capture and pre-clean the intermediate gas as necessary to meet permit requirements.
- The project must provide a permitting plan that demonstrates a reasonable chance of successful permitting.
- The project must provide a financing plan and assurance from the intended financing party that financing can be accomplished.
- The project must have a marketing plan for all products intended to be recovered and marketed, including power and secondary products, with provision of letters of intent to purchase from intended customers of key products.
- The project must be structured to provide for disclosure of non-proprietary project information to the County for public release, including technical, environmental and economic information, to promote the development of future projects.
- The project developer must offer a commitment to develop a "flagship facility", to encourage and facilitate public tours, and public education programs.
- The project developer must provide assurance of its commitment to ensuring project success

The County could consider offering support to meet those needs essential to project development and other support activities that can facilitate project development. A suggested listing of such benefits is presented below. In addition to selecting specific support levels, or offering tiered levels of support based on rankings of proposed project offers, the County may wish to offer a menu of options to the facilities, and evaluate the project offers submitted based on the level of support requested in the offer.

Essential Support Activities for Private Project Development

- Provide for public waste supply agreements, or provide for public "back stop" to guarantee private waste supply agreements for the term of financing.
- Provide economic incentives in the form of a "bridge" that closes the gap, if any, between needed conversion technology tipping fees and market waste disposal fees, until such time as market waste disposal fees are sufficient to support a conversion technology project.
- In addition, if private activity tax-exempt bond financing is sought, lend County support to qualify for "volume cap" for such financing.

Other Support Activities to Facilitate Private Project Development

Develop Information, Facilitate Information Exchange

- Continue the development of information on technology suppliers and make the information available to MRF/TS site owner/operators.
- Continue the development of site information and make the information available to technology suppliers.

Funding Opportunities

- Continue to track and identify potential funding sources (e.g., grants, low interest loans, etc.) from state and federal sources to assist in payment of project development costs, construction costs and operating costs. Apply for and secure available state and federal grants (or assist project developers in doing so). Assist the facility developer in applying for and obtaining low interest loans available from the state or federal Government. Consistent with the CUP issued for Puente Hills Landfill, Public Works will request that CSD consider funding a pilot conversion technology facility.

Legislative Efforts

- Continue state legislative efforts to foster change in the solid waste management hierarchy in order to place conversion technologies within the context of beneficial uses rather than disposal.

- Continue state legislative efforts to ensure all conversion technologies that generate renewable energy are eligible to receive renewable energy credit.

Promote Beneficial Use of Products, Product Sales

- Assist site owner/operators and technology suppliers in identifying markets for products and in negotiating power or fuel sales agreements.

- Promote the use of more difficult-to-market products, such as compost and aggregate, by educating County and state departments that may use such products and integrating incentives or requirements for purchasing and use of such products into procurement practices for County and state projects. Support payment for testing services to develop engineering specifications for products and establish quality of products.

Foster Project Support with Municipal Leaders and General Public – Public Outreach

- Sponsor meetings and forums to encourage information exchange between technology suppliers, site owners/operators, municipal officials in which sites are located, State and Federal agencies, environmental and other advocacy groups and the general public to gain support for the project.

- Provide County "endorsement" of the project(s) to add credibility for purposes of public acceptance, permitting, financing, and publicity.

- Provide and reinforce public education efforts regarding the project, including publicizing the project, maintaining web and e-communications regarding the project, and seeking additional media coverage as appropriate.

Facilitate Permitting

- Assist the project in permitting efforts by:
    - making staff available to help in identifying permits needed;
    - obtaining information needed for permit applications; and
    - helping the project get priority at agencies in scheduling for permit review and receiving reasonable consideration concerning applicability/ interpretation of regulatory requirements.

Facilitate Design/Construction

- During facility design, assist the project by helping to obtain design related information available at the County, and support "green" building design.

- During facility construction, assist the project in obtaining information on local suppliers of materials and services.

Support Operations and Commercialization of Technology

- Once the facility is operational, participate in facility testing and data exchange for engineering performance and environmental data.
- Continue County promotional support during facility operation to promote facility attributes and enhance public awareness. Serve as a "reference", if requested by the facility developer, to expand the demonstration facility or to enhance the developer's efforts to develop other facilities in or outside of the area.

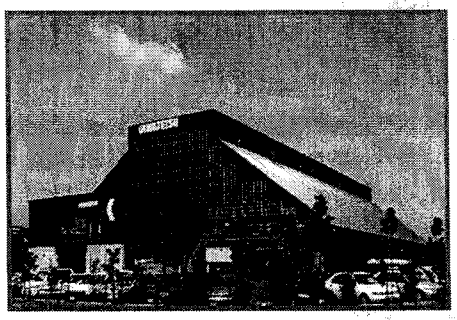
Schedule

The recommendation of this report is that, upon approval by the Board of Supervisors, the Task Force, Subcommittee and Department of Public Works establish a competition to solicit formal, site-specific offers for selection of one or more conversion technology demonstration projects for County support. Upon selection of a project(s) and negotiation of associated support activities to be provided by the County, the project would proceed to permitting, design and construction, and startup. The goal is to implement a project with expedited permitting by December 2011, as summarized in Table 6. More detailed, project-specific schedules would be requested as part of the recommended competition.

Table 6. Preliminary Project Implementation Schedule

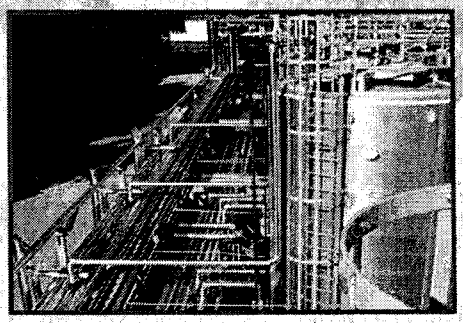
Implementation Step	Time to Complete	Projected Completion
Initiate Competition (Issue Letter of Invitation)		Fall 2007
Offers Submitted	4 months	January 2008
Review, Evaluate and Rank Offers	3 months	April 2008
Selection of Project(s) for County Support	1 month	May 2008
Negotiate Support Activities, Other Agreements	3 months	August 2008
Permitting/Conceptual Design (1)	18 months	February 2010
Detailed Design/Construction	18 months	August 2011
Startup	4 months	December 2011

(1) Assumes permitting can be achieved with an amendment to the existing MRF/TS Solid Waste Facility Permit and an amendment to the non-disposal facility element.



Prepared for:

The County of Los Angeles
Department of Public Works
and
Los Angeles County Solid Waste Management Committee
/Integrated Waste Management Task Force's
Alternative Technology Advisory Subcommittee



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