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Memorandum

To:	Heidi Melander, City of San Jose		
From:	Michael Greenberg, HDR	Project:	Review of City RFI Responses
CC:	Ruth Abbe, HDR		
Date:	March 24, 2008	Job No:	

HDR Engineering Inc. in conjunction with Clements Environment has prepared the following qualitative analysis of the responses to the City's Request for Information (RFI). We have summarized the "pros" and "cons", our conclusions and potential questions for the each of the Respondents. For Bay Biodiesel LLC, who responded with a technology outside of the realm of handling Municipal Solid Waste (MSW) or biosolids (growing algae to produce oil), we have provided a summarized review, conclusions and specific questions.

The reviews are summarized below by Respondent:

International Environmental Solutions (IES)

Proposed a technology based upon gasification of MSW and subsequent combustion of the gas to create steam and generate electricity through a simple cycle process.

Pros

- Provided complete response on time to the City
- Have demonstration plant (46 TPD) in Romoland, California; constructing an 8 TPD unit with different design for testing; constructing 125 TPD commercial module based on demo plant experience
- Granted authority to construct by SCAQMD
- Demonstration plant is generating emissions data; although only at testing levels, data is real, not theoretical
- Passed Tier 4 Health risk assessment at 0.6/million (more than 10 times below the limit)
- Uses post-MRF residual from one of the major MRF/transfer stations in southern California; this could potentially fit in with zero waste plan
- Plans a ramp up from 125 TPD to 500 TPD using 125 TPD modules; allows time to run at lower volumes while acclimatizing to City's waste stream
- Modular design, requiring 3 to 6 acres (depending on build-out)
- Competent team including; One Planet Energy for financing, Rainbow for MRF processing expertise, Brownco Construction, Air Products (potential hydrogen production)
- Approved for CEC Renewables Portfolio Standard (RPS)
- Will finance or provide equity for 100% of plant costs
- Is designed to use recycled water
- Is participating in several major procurements (LA City, LA County, Santa Barbara)
- Is in permitting process for commercial medical waste plant at Romoland, California
- Power generation would be good fit for location adjacent to the Water Pollution Control Plant (WPCP)

Cons

- Demonstration plant has no power generation capabilities, so complete heat balance and power generation capability only theoretical
- Demonstration plant not scheduled to be fully operational until late Spring 2008; no actual operating data available for plant; only testing level figures
- SCAQMD permits restrict operation, so the demo plant has not run 24 hours a day over extended periods of time. Not sure if their air emissions testing was performed while unit was running at full design capacity.
- Intermediate gas clean up before combustion is not performed; opening possibility of criticism as just another form of incineration
- Relatively small company with limited resources, but in process of raising additional capital
- Costs are only estimates because demo plant is not a complete system (no power generation) and the fact that it has not operated continuously over an extended period of time

Conclusions

The technology has the potential of diverting materials from landfill while generating renewable energy. Currently operating on post-MRF feedstock which could provide good integration with other San Jose programs and facilities that remove materials from the waste stream prior to use of this technology. Need operating data from Romoland Facility when fully permitted and operational. The City should include IES in next step of the procurement process.

US Science and Technology (USST)

Proposed using plasma arc gasification of MSW to produce power (no information on power production side provided).

Pros

- Westinghouse Plasma technology has been proven on homogeneous materials in a number of auto plants; utilization on non-homogeneous materials such as MSW is the key.
- Highly qualified team members; ERM is based in the Bay Area; Alter Nrg/Westinghouse Plasma Corp (Westinghouse has substantial experience with plasma technology); Georgia tech for research support
- Claim to have two operating plants in Japan; one on MSW & automobile shredder waste (200 TPD, not sure percentage of MSW); the other on MSW and biosolids (24 TPD; could be advantage for City if available to run on biosolids as well as MSW)
- Have signed agreement with St. Lucie County, Florida for what would be the largest gasification plant in the world.
- Finance at no cost to the City, maintaining current tip fee schedules
- Willing to enter into revenue generation and cost-reduction opportunities with City

Cons

- Did not complete the forms according to RFI request. No layouts, no mention of scale-up potential via modules.
- The St. Lucie project is in very initial stages; USST state “currently approved, financed and scheduled for construction…”; we understand that actual permitting through the local

agencies is in initial stages; agreement in place with St. Lucie has “outs” for County depending on Company’s progress.
- No information available for permitting and constructing in US on US waste stream; thus no relevant operating data available
- USST seems to be a small project development company with a massive team under it. Coordination of this team may be an issue.
- Wants guarantee of City’s waste stream for 20 years
- No cost information submitted, just statement that they will maintain existing tipping fees. This seems unrealistic. Need to see economic pro forma and supporting assumptions.
- Huge jump in scale from 200 TPD plant in Japan (using some amount of auto shredder waste) to 1,500 TPD plant proposed in St. Lucie
- Only provided list of potential investors for financing

Conclusions

There are still questions as to the applicability of this technology to MSW and the ability to permit in the US. This technology, if viable would divert materials from landfills and has the potential to fit in as a “back-end” processor of residuals to other City planned programs and facilities for diversion of the waste stream. The success of this technology in the US currently hinges on the development of the St. Lucie project. The development and potential operation of this project will need to be monitored carefully. The City should include USST in next step of the procurement process.

INTERSTATE WASTE TECHNOLOGIES (IWT)

Proposed gasification of MSW combusting the generated syngas in a combined cycle plant to generate electricity.

Pros

- Highly ranked in other California procurement processes
- Strong, experienced team with Thermoselect, Burns & Roe, Morgan Stanley, etc.
- Seven commercial facilities in Japan; two in Europe – proven technology at large scale (however, non-US)
- Proposes to pay for development, design, contracting and permitting phases of project
- Proposes to finance the facility using a combination of debt and equity
- Claim no residue requiring landfill disposal will be produced ;100% diversion assuming slag can be recycled
- Gas cleaned before combustion
- Reports show acceptable emissions
- Requires only 8 acres to site 704 TPD plant
- Proposes two units; 352 TPD each; gives some contingency & flexibility
- No process water discharged from plant

Cons

- Responded to RFI late; did not complete all forms
- Wants guarantee of City’s waste stream for 25 years
- No facilities in US, thus no data operating on US waste stream
- Did not complete the cost forms; provided costs in appendices although wants City to pay negotiated tipping fee which is not indicated.

Conclusion

IWT proposes a technology that has been operating and proven outside the US. A facility still needs to be permitted and operated on a US waste stream. This technology, if viable in the US, would divert materials from landfills and has the potential to fit in as a "back-end" processor of residuals to other City planned programs and facilities for diversion of the waste stream. IWT needs to develop a project in the US. The City should include IWT in next step of the procurement process.

ENERGY VISIONS

Proposed a process using catalytic depolymerization of screened MSW to produce synthetic diesel fuel.

Pros

- Production of #2 diesel equivalent would be a strong, valuable product, with increasing value if technology is viable
- Claim fuel produced is low-sulfur
- Will finance, construct and operate
- Uses recycled water
- Requires only 1 acre for 700 TPD facility
- Touts 100% diversion or close to it, assuming ash and salts can be marketed
- Original inventor is still involved.

Cons

- Submitted response late and somewhat incomplete
- Although mention six plants worldwide, reference plant is original small R&D facility in Germany
- No operational history of significance using MSW as feedstock
- No costs provided (stated cost about $18 to $20 million). Tip fee requirement mentioned, but no dollar amount stated.
- Wants waste stream commitment; 15 year contract with 5 year option
- Still need proof of concept initial stage
- Other similar technologies (all apparently originating with Dr. Christian Koch) exist; and potential exists for patent battles
- Cost and availability of critical catalyst could present economic unknowns.
- Some unfavorable press releases circulating in other areas of the country where previously introduced.

Conclusion

The technology appears not to have been proven on MSW at any significant level. Would suggest City gather more information from Energy Visions on operations using MSW. From a zero waste perspective, this technology would compete for the organics portion of the waste stream. The technology calls for removing all other non-organics and the City would need to find another technology to supplement. Could consider for small pilot/demonstration project.

ZEROWASTE ENERGY COMPANY (ZWE)

Proposed a phased project: first phase would be a 5-10 MW gasification facility to power the Zanker and WPCP facilities; second phase would include the SlurryCarb process (Enertech) for converting biosolids from the WPCP to fuel for the gasifier; final stage would be conversion of syngas to fuel instead of electricity. An intermediary step would be to construct new dirty MRF using the fines for feedstock. In other back-up information proposes to build 40MW biomass gasification combined cycle power plant.

Pros

- Large local recycling company (Zanker) has facilities to divert materials from landfill, produce feedstock for gasifier and has need for energy produced
- Handles 1,336,020 tons of local materials annually
- Being local, understands the City's need for zero waste and renewable energy
- Is adjacent to WPCP
- Could also provide independent site
- Partnership with Enertech possible
- Wants to work with WPCP and using the biosolids and providing energy for WPCP use

Cons

- No response to RFI forms – letter only; City sent some back-up information
- No mention of private financing
- No cost or revenue information supplied
- Have only included preliminary design info (Taylor Gasification system) – still working on selection of final gasification technology

Conclusion

Include in City's procurement process if they can align with proven gasification technology. Have great potential for assisting with the City's zero waste plan through integration of their current and future planned recycling activities, discussion of using waste residuals as fuel for gasification and integration with the WPCP and potential use of biosolids as fuel for gasifier. Need more information on technology proposed.

PLASCO ENERGY GROUP

Proposed plasma arc gasification of MSW to produce power through reciprocating gas engines and steam turbines using recovered heat.

Pros

- In start-up operations of a 100 TPD demonstration plant in Ottawa, Ontario (first waste processed in February 2008; first electricity generated in March 2008)
- Operating on MSW
- Complete plant including power generation and full gas cleaning
- Represents the complete commercial scale module at 100 TPD – would be replicated with 4 units in San Jose – no scale up issues

- Claims it meets all Ottawa air emission standards and tests show that it could also meet California standards
- Propose no cost to City
- Six other projects in development in Canada
- Schedule of 15 to 18 months after permitting
- 99.9% diversion touted – but dependent on slag recycling as construction aggregate or cement ingredient.
- Experienced in public outreach and gaining public and political support.
- Zero emissions from process itself – only emissions are from power generation, and are comparable to natural gas fired plants.

Cons

- Submitted response late and not in form requested by City; did not complete RFI forms.
- Ottawa demonstration plant is still in start up and gas cleaning and slag vitrification has not operated yet. Slag sale and reuse not accomplished yet. Operational data still needed.
- Large tipping fee range: $65-90/ton – competitive at low end, perhaps not at high end. However, these costs are based on real plant construction, start-up operation and performance
- Under current State regulations, gasification (with use of oxygen) does not qualify as renewable energy – however, this may change in the future.

Conclusion

The technology has the potential of diverting materials from landfill while generating renewable energy. Currently operating on MSW feedstock. Potential to provide good integration with other San Jose programs and facilities that remove materials from the waste stream prior to use of this technology. Need operating data from Ottawa Facility when fully operational. There is concern as to the use of oxygen in the gasification process and it not currently being considered renewable energy under US regulations. The City should include Plasco in next step of the procurement process, however inquire about how they would plan to operate in the US as a renewable energy project.

MAN Ferrostaal Inc. (MFI)

Proposing joint project with Silicon Valley Biomass Energy Center (SVBEC) based on Choren gasification technology. Not aware of SVBEC project.

Pros

- Large international corporation with vast experience in power generation and ancillary areas
- Partnered with Choren Industries (apparently a leader in European gasification, although not aware of them)
- Claim have San Jose office

Cons

- Didn't provide proposal
- No info on Choren gasification system
- MAN has little biomass experience beyond traditional biodiesel plants (assume using soybeans, canola oil or similar)

- No cost or other information supplied; nothing submitted to evaluate

Conclusion

There is not enough information to properly evaluate MAN under this RFI process.

ENERTECH (Biosolids only)

Proposed a technology to handle the biosolids from the WPCP and convert them into a renewable fuel product.

Pros

- Provided thorough response on time
- Unique process to transform biosolids to fuel pellets
- Reference project (883 TPD) approved, financed, permitting (EIR certified) and under construction in Rialto, CA
    - Involves major players (LACSD, OCSD among others)
    - E-Fuel agreement with Mitsubishi (cement kiln) in place
    - Planned operational 1/09
- CH2MHill study recommended SlurryCarb as winner of competition as consultant for OCSD
- Have demonstration plant of 1.6 TPD in Atlanta, GA; 20 TPD demo plant in Japan in operation for 3-years (1997-2000)
- Ability to finance, design, permit, and construct
- Strong financials: Funded Rialto at $162 million. Completed Round B Financing at $42 million
- Strong management personnel experienced in biosolids industry
- Proposing either 350 TPD local plant or 700 TPD regional plant
- Approximate $70-85/wet ton tipping fee
- Claim that plant in San Jose would reclaim 1,000 acres of ponds
- E-Fuel certified by CEC as “Renewable”
- Good synergies with co-location near WPCP and alternative technology energy facility

Cons

- No discussion of the use of MSW
- With this technology treatment of the effluent to site specific conditions will need to be taken into consideration and could effect costs
- Would be ancillary to prime project, but synergistic with it in that SlurryCarb would produce medium Btu fuel for an alternative technology facility.
- Need to build or utilize fuel in near-by facility
- Rialto plant not yet operational; so performance of plant in U.S. not yet proven.

Conclusion

Could be interesting ancillary component of the MSW project, providing additional quality fuel, while solving biosolids problems. Need to check economics vs. present biosolids system. Also need to check if they could incorporate use of any portion of the MSW stream in process. Should consider as separate project (non-MSW), however tie to other proposed technologies that need fuel.

BAY BIODIESEL

Bay Biodiesel LLC (BBD: www.baybiodiesel.com) has proposed to build a facility at the City of San Jose / Santa Clara Water Pollution Control Plant that would grow algae from wastewater to be used as a feedstock for biodiesel production. BBD currently has expertise in biodiesel production from vegetable oil, with a processing facility in Martinez, and is also linked to Golden Gate Petroleum (GGP: www.ggpetrol.com), "one of the largest petroleum distributors in Northern California and Nevada."

BBD is correct to point out that algae biofuel production holds significant promise, with algae growing up to 100 times faster than traditional biofuel crops, and oil yields as high as 50%. BBD claims that algae can clean up nitrogen and carbon dioxide pollution are valid, which makes algae biodiesel production incorporated with wastewater treatment an attractive technology. There are several well capitalized firms that are already marketing technology pioneered by the U.S. Department of Energy's National Renewable Energy Laboratory (NREL), which operated an algae biofuels program from 1978 to 1996 under the Office of Fuels Development. The most prominent of these companies are Solix (www.solixbiofuels.com) and GreenFuels (www.greenfuelonline.com).

BBD has not proposed a specific design for algae biodiesel, but rather to further explore several design options with the City of San Jose. BBD favors using the existing storage ponds to minimize cost, but would also like to explore bioreactors. BBD proposes using 200 acres of existing ponds for initial algae production, with associated capital costs $2,125,000, and expected sales of 1 million gallons per year of biodiesel (estimated revenue of $2.31 million per year). BBD also provides revenue estimates for 800 acres of algae production, and would like to explore with the City how much additional land would be available for further expansion. Algae feedstock could be sent to the existing BBD facility in Martinez for oil extraction and biodiesel processing, or facilities for biodiesel processing could be constructed on-site.

Conclusion

While the algae biodiesel production from wastewater concept is quite promising, economically growing and producing biofuels from algae is not easy. The continued escalation of oil prices are now furthering competitiveness, as technology development drives down production costs, but entering the industry still will require significant microbiology and process technical expertise, which BBD has not demonstrated in its response to this RFI. It is therefore recommended that the City ask BBD to elaborate on its design concept, technical expertise, and business development strategy. A few suggested questions are outlined below:

1) Most DOE research and current algae systems have been proposed for sunny desert environments. Is there documentation that the latitude and climate in San Jose are warm and sunny enough to support economical algae biofuels production?

2) Open pond systems (vs. closed bioreactors) tend to suffer intrusions from other algae species which have lower oil yields. How will BBD ensure that optimal species composition and growing temperature is maintained in a large (200 or 800 acre) open pond system?

3) Has BBD considered using CO2 from a power plant or industrial emissions to foster algae growth and sequester carbon?

4) Has BBD considered using carbohydrate constituents of algae for cellulosic ethanol production?

5) How does BBD's algae biodiesel technology compare to Solix and GreenFuel?

6) Has BBD developed any proprietary IP that gives the technology an inherent advantage over other algae systems?

7) Does BBD have any demonstration algae facilities that can be visited?

8) What institutes of higher education has BBD been working with, and who are the researchers involved in algae?

9) What is the BBD cost of production target for algae biodiesel (per gallon)?

10) What is the ownership and management structure in BBD? How will BBD finance this project?