RAMSEY/WASHINGTON COUNTY
RESOURCE RECOVERY PROJECT
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Report: System Changes to Achieve the Scope for Resource Management

Introduction

As part of its policy evaluation in 2013-2015, the Ramsey/Washington County Resource Recovery Project Board developed a Scope for Resource Management (Attachment 1). That scope followed extensive evaluation of waste conversion technologies and development of guiding principles for future waste management. The Scope is a vision, and is a system view of using technologies and techniques appropriate to the materials discarded by residents and businesses in the East Metro. The Scope is intended to build on an already successful solid waste system, and provides guidance for future decision-making.

Implementing the Scope depends on participation by a host of players. It begins with the generators of discarded materials, and choices they make (Reduce? Reuse? Recycle? Compost? Trash?). It continues with recyclers, municipalities, the waste industry, and, of course, the counties. The foundation for the Scope is, notably, that discarded materials in the future are viewed not as waste, but as a resource.

Pivoting the view from "waste" to "resource"

One of the principles adopted by the Project Board is to pivot the view from waste to resource. The current system is centered on "waste." Statutes and plans view discarded material as a liability – items without value. Recovering value from those discards is frequently seen as the exception – we "remove" recyclables from the trash; we "separate" food waste for composting.

Pivoting our view means, in practical terms, that decisions about discarded materials take into account the value they have as a feedstock or energy resource. There are two sides to this.

- First, waste is inefficiency – at a household, business, or community level. Conserving the resource, by recycling, for example, allows us to increase efficiency in production.
- Second, there is value in discarded resources. Recovering the value of the material, or recovering energy from it, means that there is economic opportunity to be realized.

Policy Issues

The waste management system in the state has evolved –

- It began primarily with a concern for sanitation -- the State Solid Waste Act in 1969 aimed to control open burning, vermin, and water runoff with a permitting process, moving from open dumps to landfills with cover, and addressed burning.

- A more planned system emerged in the 1970's – in the early years efforts were still focused on "sanitary" disposal, but concerns about groundwater contamination emerged, and the business of recycling some commodities began receiving attention.
- The public policy framework for waste management in Minnesota was built in 1980, with the adoption of the Waste Management Act (WMA).

In the WMA the goal of environmental and public health protection is followed by an outline of ways to improve how waste is managed. The goal of the State is an integrated system, managing waste appropriately, and protecting the environment and public health. At its core, the WMA is about reducing and managing risk: environmental, public health, and economic risk – by broadly prescribing that Minnesotans take a road away from land disposal and toward an integrated system.

Our current policy framework arose out of concerns about water, health, the environment, and at the time, concern that landfill capacity was in short supply. As it has evolved, and it has been substantially amended since 1980, the law has moved from being general, to quite specific – but it has focused on that issue of reducing risk. The State goals established in 1980 aimed at abating landfills, and included a list of preferred technologies in an order of preference: a hierarchy. The State put counties in charge of planning, and continues to hold counties accountable to meet the State's objectives.

Since that time a successful system has emerged in the East Metro area – with significant advances in material, water and energy conservation. Regulations and incentives have reduced the toxicity of the waste stream. The public is well informed and supportive of the system.

Policy discussions at the state and local level are showing an additional focus in recognizing that discarded items have value, and are not simply a liability to be managed. These discussions are setting the stage for how the East Metro will view waste/resource management in the coming decades.

The Scope for Resource Management bridges the past - a focus of managing risk, to the future and pivoting from viewing discards as waste to a resource.

System changes to advance toward a 75% recycling goal

The Scope includes the expectation that there will be increased performance of the system to advance toward a 75% recycling goal by 2030. Policy work is needed at the State and local level in this campaign.

State of Minnesota:

1. *Market Development* – The Project Board and SWMCB have adopted policy positions that advocate for a strategic approach to market development for discarded materials. Creating a market "pull" is necessary to establish the economics necessary to sustain high recycling levels.

2. *Embrace Emerging Technologies* – The State needs to identify, understand and evaluate new and emerging technologies that can recover materials for recycling. New technologies may not clearly fit into the State's current planning approaches, and flexibility is needed.
3. *Extended producer responsibility* – Continued emphasis on this approach, well designed, and aimed particularly for difficult to manage or expensive items.
4. Incentivize the hierarchy – Identified by the Legislative Auditor in the 2015 report, finding and implementing methods to discourage landfilling, and viewing materials as having value.
5. *Focus beyond MSW* – The State has focused almost exclusively on MSW, yet there are significant resources in construction and demolition waste, and industrial waste.
6. *Measurement and Goal Setting* – The Resource Recovery Project Board and SWMCB have also adopted recommendations for realigning measurement of progress related to the WMA.

Local Government in the East Metro

Counties are required by State law to plan and implement systems to achieve State goals. Solid waste master plans and associated policies guide other public and private entities as they make waste management decisions. At the local level there are a substantial number of actions that have been taken to increase source separation of recyclables and organics, and there are also more that can be taken.

Attachment 1 "Strategies for increasing recycling" is a comprehensive evaluation of these actions with a notation on the current progress for each strategy.

System Changes to Implementing New Waste Conversion Technologies

The Scope identifies new technologies for the East Metro to consider: Mixed waste processing, anaerobic digestion, and gasification. Attention is needed at the State and local level to further evaluate use of these technologies.

State of Minnesota

1. *Research and evaluation of emerging technologies* – The MPCA has taken a responsive approach to emerging technologies – waiting for the private sector or local governments to bring ideas forward. This approach takes time and hinders innovation. Importantly, in a "resource management" view compared to a "waste management" view, decisions to implement new technologies occur in a competitive environment; delay means Minnesota could lose opportunities.
2. *Clear processes for permitting and developing* – a corollary to the first point, is that the State's processes for permitting emerging technologies is unclear and unspecified. This creates uncertainty for local governments and private developers, which can dampen innovation.

3. *Incentivize innovation* – Managing waste as a resource is an economic development opportunity for Minnesota. Creating incentives for innovation helps the state – an example is a proposal under consideration in the 2015 legislature that creates an incentive for production of biofuels from various materials. Production of CNG from organics used in anaerobic digestion would qualify.

Ramsey and Washington Counties

Ramsey and Washington Counties will be in the principal position to decide whether to develop new resource management technologies. Moving forward the counties will consider a number of factors in making those decisions, including

- The efficacy of the technologies;
- Selecting technologies that will support the East Metro system;
- Assuring flexibility to accommodate change;
- Identifying strong local partners; and
- Strategic local investment.

At this time the Scope identifies three technologies that should be further evaluated and considered, building on the foundation of the current Resource Recovery Facility. Foth has prepared a memo with an update on each technology, and recommendations in each for further analyses and steps that would be taken to fully evaluate the technologies. These are found in Attachments 2 – 4.

Attachment 1

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Strategies for Increasing Recycling

The following are strategies in use in North America for increasing quantities of recyclables recovered from source-separated recycling (SSR) and source-separated organics (SSO) programs from both the residential and commercial sectors. Many of these strategies are already being implemented at some level within Ramsey County, Washington County, and communities within the counties.

RESIDENTIAL

Strategy	Description / Examples	Ramsey County and/or Washington County Implementation of Strategy	Municipal Implementation of Strategy
CURBSIDE RECYCLING			
City-contracted curbside recycling	Collection arrangements in decreasing order of municipal control: • contract recycling & trash; • contract recycling only; • no contract – recycling by subscription		In Ramsey County, 10 communities have recycling and trash contracts, 6 have recycling contracts only and one has no contracted services. In Washington County, 9 communities have recycling and trash contracts, 10 have recycling contracts only and 13 have no contracted services.
Single-sort recycling	Paper/cardboard & glass/metal/plastic containers; convenience increased for residents; often coupled with wheeled carts (see below)		Offered in almost all communities in East Metro
Collection frequency greater than every other week (EOW)	Weekly collection service offers more opportunities for participation, EOW decreases truck traffic & is more efficient		Ramsey County has 11 communities with EOW collection and 6 with weekly (including majority of residents) collection. Washington County has 10 communities with EOW collection and 1 with weekly collection.

Wheeled carts	Carts, typically 64 gallon or 90 gallon, increase convenience with larger capacity than bins plus wheels; lids reduce rain/snow in recyclables		Most communities have wheeled carts, although bins still in a few, including Saint Paul.
Wheeled carts with radio frequency identification tags (RFID)	RFID allows for data collection for uses such as tracking cart inventory, & targeting rewards and education programs; add costs for carts		
Require collection of standard list of recyclables	Minimum list in metro area typically includes several types of fibers (cardboard & paper), metal cans, glass & plastic bottles & jars, other plastic containers, cartons (milk, juice, soup, etc.)		All communities
Additional materials collected curbside	Additional materials increase tonnage, such as: regular collection of scrap metals & clothing/linens/shoes; separate collections for recyclable bulky materials such as appliances, mattresses. Recently many haulers have expanded collection of aseptic packaging and gable top cartons.		Varies by community
MULTI-UNIT/MULTIFAMILY RECYCLING			
Service at multi-unit/multifamily locations	Ensure adequate multi-unit/multifamily housing recycling opportunities and infrastructure is in place: all units have recycling service available on-site, with adequate recycling containers, capacity & good signage	BizRecycling currently is piloting a multifamily recycling pilot project in both counties.	Most units have service "technically" available; convenience & use varies by community & building.
RECYCLING/REUSE DROP-OFF			
Periodic drop-off opportunities	Drop-off events for specific items, such as e-waste, paper shredding, cardboard, pumpkins, college moving days, & other events. Community clean-up/clean sweep events accepting variety of items that could include recyclable & reusable materials, as well as trash & other items for discard.		Majority of communities in Ramsey County have clean-up events & a few have events for specific items. Several communities in Washington County have drop-off or clean-up events. Woodbury moved away from drop-off event & tested an organized curbside collection day for bulky waste with local haulers.
Ongoing drop-off opportunities for specific items	Ex.: for items banned from trash such as used oil/filters, appliances, vehicle batteries, tires	County HHW sites accept used oil/filters.	
Ongoing drop-off centers for multiple items	Accept variety of recyclable materials & sometimes other materials as well. Convenience is key to the success of this service. Upgraded centers are conveniently located in communities & open during evenings & weekends when residents are in need of service—such as when moving, hosting events, or completing projects. Sites cannot be un-attended due to contamination.	Washington County Environmental Center accepts recyclable materials from residents when open for business, as well as household hazardous waste (HHW).	Municipal sponsored drop-off site in St Paul for standard recyclables.

FOOD SCRAPS & SOURCE-SEPARATED ORGANICS (SSO)			
Drop-off SSO	Site where residents may bring food scraps & acceptable soiled paper, in a compostable bag; materials will be transferred to a composting or other organics processing facility	Available at 6 of the 7 Ramsey County yard waste sites.	An additional private site is located in Mac-Groveland, Saint Paul.
Curbside SSO	Weekly curbside collection of bins or carts, either organics only or combined with yard waste		Not yet available in the east metro
Backyard composting	Encourage residential backyard composting of food scraps (exc. meat, dairy) & garden/yard waste through education/promotion, compost bin price reduction programs, appropriate ordinance language	Ramsey County promotes through Master Gardeners outreach contract and backyard bin program.	
Allowing co-collection of residential SSO with yard waste during warmer months		Not yet available in the Twin Cities region as the MPCA regulations of SSO vs. yard waste sites. Counties through SWMCB tried in 2014 to change rules to allow SSO sites to be regulated more like yard waste compost sites to increase service areas & keep transportation costs low without success.	
AWAY FROM HOME & EVENT RECYCLING	Recycle at home, recycle everywhere		
Public space recycling	Recycling containers/bins, paired with trash containers, at all public properties, such as buildings, parks & athletic fields; can also include SSO	Provided at county public spaces. Both counties have funded public space recycling equipment for public entities for use at buildings, parks, schools, athletic fields.	Most municipalities & schools have recycling bins, although not necessarily completely. 15 of 17 communities have taken advantage of Ramsey County recycling bin grants for public spaces.
Event recycling	Recycling containers/bins, paired with trash containers, at public or private events; can also include SSO	Both counties have a program to loan out recycling collection containers for events.	Some communities also have containers for loan/rental. Demand has been strong during select times such as graduation season.
Other away from home recycling	Message In a Bottle (MIB) program with the Recycling Association of Minnesota (RAM) for the collection of beverage containers at convenience stores & gas stations. County technical assistance provided including working with vendors.	RAM has partnered with Holiday, Quick Trip & Super America stores to implement MIB in both counties.	Availability depends on funding & service routes for collection sites.

EDUCATION/PROMOTION	Provide effective & culturally appropriate outreach, education & promotion to all residents		
Municipal recycling program information	Accurate information provided to residents by city or hauler one or more times per year; include education requirements in recycling contracts or ordinances	Both counties provide information via websites and newsletters	Information is provided by communities; however, the quality varies by community and hauling system
City/Township webpage dedicated to recycling/waste information specific to that municipality	Each municipality should dedicate at a minimum one webpage on their website for recycling/waste information. Include recycling info, links to haulers, links required by their county, & Rethink Recycling.	No uniform system due to variety of hauling systems and requirements	Varies by and within communities by system type
Recycling/waste hotline	Phone number answered by government or contractor staff regarding resident inquiries about "how do I recycle/dispose of X" & other related information; 24/7 preferred; translator availability desirable; publicize hotline number widely	Ramsey County has the (651) 633-EASY hotline which is answered 24 hours a day, 7 days a week and translation is available.	
Web "how do I recycle/dispose of X" guide	County or municipal web page with user-friendly, accurate, regularly updated info regarding how to recycle, reuse or properly manage a wide variety of items residents seek to discard; publicize web site address widely	Ramsey County provides an "A to Z Guide" on county web page (www.RamseyAtoZ.com); Washington County has the Residential Disposal Guide available its web site: (http://www.co.washington.mn.us/documentcenter/view/1776) SWMCB's web site www.rethinkrecycling.com has information at the regional level	
Target education to multi-unit/multifamily housing (MFH)	Work, including contract/ordinance enforcement as needed, with landlords/owners & haulers to ensure all residents have recycling service, adequate containers, & good signage, including culturally appropriate information	Ramsey County provides assistance through cities, including recycling bags and signage/materials. Materials are translated into various languages	A few communities focus on multi-units/MFH (such as Maplewood)
Use social media & other evolving communication tools		Ramsey County uses Facebook & Twitter. Counties jointly began some social media promotion in 2014.	
Coordinate communications to support county or regional campaigns	Coordinate communications to ensure cross-promotion of recycling campaigns happening at the city, county or regional level. A key goal is consistency of messages to the degree possible, such as regarding types of materials recycled & preparation requirements, so that people have same/similar recycling requirements regardless of where they live or work.	Many communities use info provided by Ramsey County (e.g., discount on compost bins, upcoming gas can exchange)	

Recycling information provided at events	Offer recycling information such as guides, magnets, reusable bags or other "how-to's" at municipally-sponsored or other events in the community	Ramsey County works with sponsors of events; information is available on green events at www.rethinkrecycling.com; Washington County has provided recycling information at a variety of events and has helped establish recycling best practices and organics collection at some.	
Provide new resident info	Where new resident guides are provided in communities, use opportunity to provide information on recycling & related items		Some communities & some landlords
Incentives/motivators	Ex.: block leader education—resident in community/neighborhood educates fellow residents face-to-face; "get-caught recycling"—residents can be eligible for a drawing for a prize/$ when place recyclables out for pickup; Recycle Bank—residents eligible for retail coupons based on how much they recycle; hauler provides comparison of recycling progress for other communities; promote "recycling pledge" to get commitment by residents to recycle; set & publicize recycling goals specific to communities--to provide them something to work toward		
Educate schoolchildren, such as facility tours and delivering presentations	RRP provides funding for tours of Newport.	Washington County staff deliver many educational presentations on recycling, reuse, composting & waste reduction in schools.	Varies by district.
FINANCIAL			
Recycling fees paid by all residents who have service available	Removes a financial disincentive for residents not to recycle		Generally, yes
Revenue-sharing in city contract with hauler	Provides incentive for community to promote recycling to increase potential revenue		Ramsey County has 8 communities with revenue sharing programs
Tiered trash rates to allow for downsizing trash container size	Volume-based prices for trash with significant price differences between 30/60/90 gallon container sizes (plus every-other-week collection), so residents have incentive to recycle more, including SSO where available, & thus be able to subscribe to a smaller container with lower rate		A few organized collection communities where city bills residents have such volume-based prices
SSO collection combined with every-other-week (EOW) trash service	Participating in SSO collection shifts putrescible materials from trash to SSO, thus reducing the need for weekly trash protection; having municipal ordinances allow for		Not yet available in the East Metro

	lower-price EOW trash collection can make it financially more desirable for residents to participate in SSO collection		
Grants & other incentives	Grant funding made available to municipalities, recycling haulers or other entities to promote recycling, SSO	Ramsey County has the following funding available for municipalities: SCORE, Public Entities Incentive Grants (PEIG), recycling bin grants, consulting assistance. Washington County has the following funding available for municipalities: SCORE and specialty grants.	In Ramsey County, 10 communities have received PEIG grants
Incentives to residents	Ex. Recycle Bank (see Incentives/motivators above)		Not yet available in the East Metro
REGULATORY OR CONTRACTUAL			
Volume-based fees	Unit-based pricing for waste collection; required by MN law for trash haulers but not very effective because little difference between 30/60/90 gallon container sizes		Not yet available in the East Metro
Mandatory requirements	More effective with active vs. complaint-only enforcement, & when coupled with education		Not yet available in the East Metro
On trash haulers	Must offer recycling collection in communities without contract collection, or for multi-unit/multifamily not includes in contract		Very common
On multi-unit owners / landlords	Must provide for recycling on-site		Some communities
On residents	Must recycle & not place specific materials in trash		In Ramsey County, ordinances in 2 communities, but only enforced when a complaint is received; , In Washington County, 7 communities have mandatory recycling for residents via ordinance
Banning recycling and/or SSO in trash with enforcement	Flip side to mandatory recycling. Ex.: hauler can skip collection if an abundance of recyclables are observed in the trash		Not yet available in the East Metro
Aligning municipal ordinances, hauler licensing, contract language	Improve reporting requirements, reduce inconsistencies, provide appropriate of contracts and/or hauler licensing Ex.: several cities in Ramsey County now require contracted hauler to report those low & non-participating households for purposes of targeting education		Work underway in several communities in both counties
Higher-level policy initiatives	EPR (extended producer responsibility) & disposal ban initiatives		Electronics and paint

COMMERCIAL

Strategy	Description	Ramsey Co. and/or Washington Co.	Communities
**The following list of tools is primarily from the SERA commercial cost/billing report for SWMCB*			
Regional collaboration	Regional collaboration between agencies, counties & municipalities for consistency in programs, regulation & communication/ education	Efforts through the Solid Waste Management Coordinating Board (SWMCB)	
Hauler licensing & reporting	Require trash hauler to also offer recycling as a condition of a license haulers must report tons diverted & disposed		Several municipalities require hauler reporting for commercial collection
Recycling requirements for generators	Takes many forms including mandates to source separate, disposal bans, or a requirement to have recycling service.		Not yet available in the East Metro
Mandatory requirement enforcement	In increasing order of effectiveness: complaint-only enforcement; active enforcement; active enforcement coupled with education; active enforcement coupled with education & technical assistance and/or incentives		In Ramsey County, one city mandates businesses to recycle, but only enforced by complaint
Waste audits & assessments	Can be conducted by hauler, government, third party or combination. Waste assessments include how to set up service & some include billing & contracting education	BizRecycling contracts with Waste Wise & J.L. Taitt for such services	
Advice on bidding & contracting	Communities have used web sites, mailers, lunch-and-learn-type seminars, & waste audits to help commercial generators better set up commercial contracts	BizRecycling contracts with Waste Wise & J.L. Taitt for such services	
Taxes, fees, surcharges	Economic tools that incentivize recycling compared to MSW disposal. In some cases similar to the MN state waste management tax & county hauler-collected service charges/CEC's; in others only charged on tipping fees	Ramsey County & Washington County's County Environmental Charges (CEC) provide an incentive in some cases for businesses to begin or improve recycling & food scraps/SSO programs	
Rebates for service or other financial incentives	Includes ongoing rebates or incentives for diversion-related collections or "free" recycling service (paid for by jurisdiction) for a set amount of time (3 months to 1 year)	BizRecycling is offering such a rebate program for the first 3 months of organics collection service costs.	
Peer-to-Peer program	Community-fostered program to encourage businesses to mentor or demonstrate to or assist each other with starting recycling programs	BizRecycling is offering grants to local business associations, the program is called BizAware, to provide these peer-to-peer outreach efforts	

Collateral material	Case studies, recycling "how-to" guides, & other collateral to encourage & teach businesses how to start programs, bid on services, encourage participation, etc.	Available on BizRecycling's website, www.LessTrash.com, communicated monthly through blog and promoted weekly on Twitter campaign.	
Business recognition	Program to recognize "green" businesses publicly		Available in several cities include Oakdale and Saint Paul. Also available through local chambers and organizations such as Environmental Initiative.
Business recycling hotline	A dedicated number that businesses can call to answer questions about starting recycling service	Ramsey County has the (651) 633-EASY hotline which is answered 24 hours a day, 7 days a week and translation is available.	
Business recycling website	A dedicated website that businesses can access to learn about recycling opportunities	BizRecycling has a website, www.LessTrash.com.	
Social marketing	Using traditional marketing tools & sociological tools to encourage businesses to start programs	BizRecycling has an active Twitter and YouTube campaign.	
Free or discounted bins	Interior bins for free or wholesale prices	BizRecycling offers a $10,000 grant to cover costs of bins. Through the grants businesses are able to purchase bins through the State Contract at reduced price.	Many business do not have bins for collection
Start-up grants	Small grants to businesses to pay for the cost of starting a new recycling or diversion program	BizRecycling offers a $10,000 grant to startup costs for new or enhanced programs	
Small business efforts	Range of programs to incentivize recycling by making services "free," deeply discounted and more affordable for small businesses		A few communities in Ramsey County that contract for recycling allow interested small businesses & institutions access to curbside recycling services
Food scraps & source separated organics	The next generation of commercial programs are focusing on separation and recovery of food scraps and compostable organic materials	Resource Recovery Project have supported since the early 2000s through consulting assistance & CEC incentive; now expanded through BizRecycling	

Franchises or districts	Setting franchise rates or districts for commercial haulers to operate in. Has been done at state level & can be used to set rates for commercial generators that encourage recycling		Not yet available in the East Metro
Single hauler contracts	Contracting with a single commercial hauler with rates that encourage recycling, embed recycling, etc.		Not yet available in the East Metro
Higher-level policy initiatives	EPR (extended producer responsibility) & disposal ban initiatives for specific products to encourage desirable environmental & health outcomes by shifting responsibilities for management		Not yet available in the East Metro
Other	Clear & simple messaging using plain language. Using psychology, publish positive results "report card" for a community or area business (vs. "shaming").		Not yet available in the East Metro
Banning recycling and/or SSO in trash with enforcement	Flip side to mandatory recycling. Ex.: hauler can skip collection if an abundance of recyclables are observed in the trash		Not yet available in the East Metro
Mandatory requirements	More effective with active vs. complaint-only enforcement, & when coupled with education		Not yet available in the East Metro
Mandatory requirements on tenanted properties	Must provide for recycling on-site		Not yet available in the East Metro

Memorandum

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Ramsey/Washington Counties Resource Recovery Board (Project Board)
Joint Staff Committee

CC: Jennefer Klennert, Foth Infrastructure & Environment, LLC (Foth)

FR: Nathan Klett, Foth
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RE: Mixed Waste Processing – Update on Technology Status

This memorandum is intended to provide an update on the current technology status of mixed waste processing (MWP) equipment, economics of MWP, and marketability of recycled materials. The focus is on what additional information is needed to continue forward with this technology.

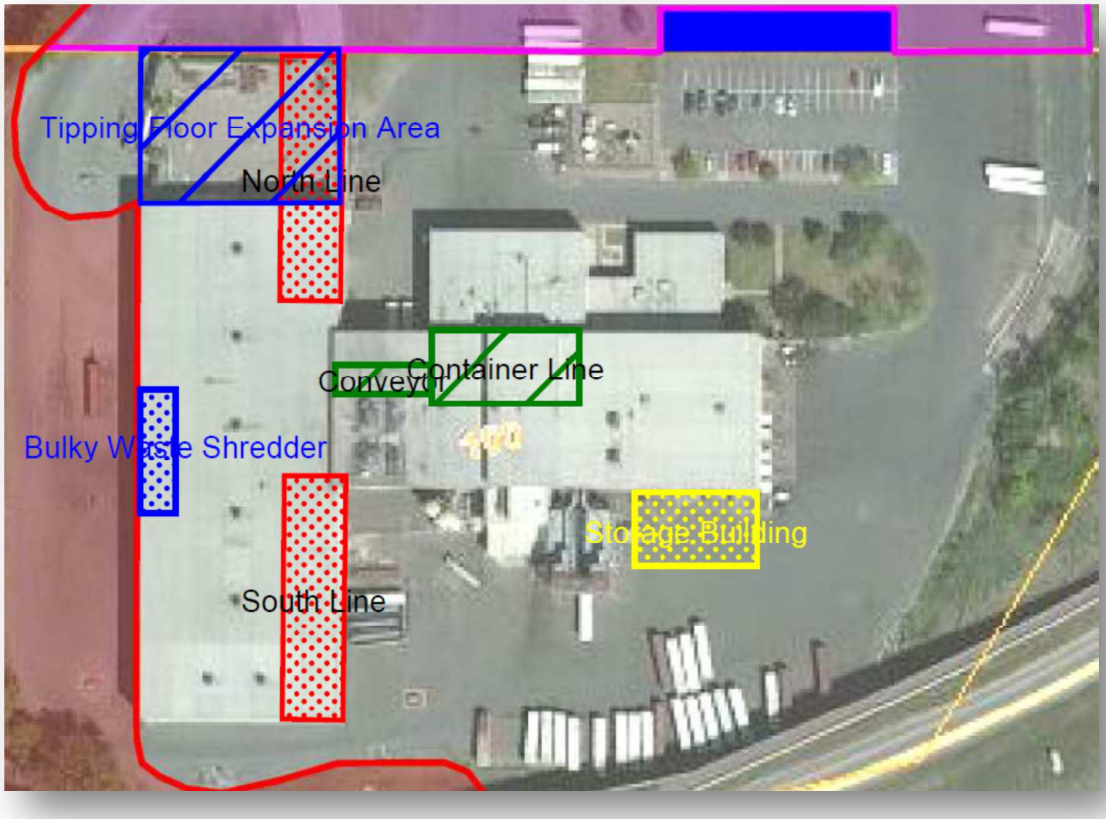
The Scope of Resource Management includes significant efforts to increase collection and recovery of source-separated recyclables (SSR) and source-separated organics (SSO). The State set a goal for the Counties to reach a 75% recycling level. Previous analysis has shown that the 75% recycling goal may not be reached solely by SSR/SSO. The MWP system provides a method to recover the highest overall percentage of recyclables and particularly organics.

1 Mixed Waste Processing at the Newport Facility

Foth previously performed a preliminary analysis to determine if a MWP system targeting ferrous, non-ferrous, plastic containers, and commercial cardboard could be co-located at the Newport Facility with the RDF processing equipment. The analysis concluded that there is sufficient space for a MWP system with a capacity of 340,000 tons municipal solid waste (MSW) per year at the Newport Facility. This will require an addition to the current tipping floor, relocating the bulky waste shredder, and constructing an additional storage building in order to move stored materials from within the current building.

Figure 1 shows a potential layout option for adding the MWP equipment at the Newport Facility.

Figure 1
Potential Site/Equipment Layout



The time line for final system and building modification designs, processing equipment system procurement, completing renovations, construction of the necessary new facilities and installation of the MWP equipment is estimated to be approximately 2 years. Additional waste sorts will be necessary to quantify the variability of the incoming waste during different seasons.

1.1 Necessary Permits

As noted previously, adding MWP equipment at the Newport Facility would require renovations and construction of new facilities, which will require a Building Permit and a construction stormwater permit. Most of the existing permits for the facility (industrial stormwater, air emissions, solid waste, etc.) would require modification to include the MWP equipment. A completely new or separate permit for MWP is not anticipated since the same volume and types of material will be managed at the facility as are currently managed.

The Prairie Lakes Municipal Solid Waste Authority recently added a MWP system to the Perham Resource Recovery Facility in Perham, Minnesota as part of a facility expansion. They noted that the MWP system was a very minor part of the total waste-to-energy/recycling facility permit process. The only comments for the MWP system were related to what MSW could be allowed to by-pass the MWP system.

1.2 Material Flow

Addition of MWP equipment at the Newport Facility would result in changes to the flow of material at the facility as well as additional materials being removed prior to entering the existing refuse derived fuel (RDF) lines. Approximately 340,000 tons of the assumed 400,000 tons per year (TPY) of MSW delivered to the facility would first be processed with the MWP equipment to remove ferrous, non-ferrous, cardboard, plastic containers, and organic material. It is anticipated that any MSW remaining after processing through the MWP line would be transferred (via conveyor) back to the beginning of the RDF lines. It is assumed some additional ferrous and non-ferrous recovery will occur in the RDF lines since there is equipment on these lines intended to remove these materials and the MWP will not process the entire 400,000 tpy. Other materials that are not currently removed include cardboard, plastic containers and organics.

1.2.1 Recyclables

Materials that the MWP equipment will be designed to remove are anticipated to include:

- Ferrous
- Nonferrous (primarily aluminum)
- Cardboard (commercial loads only)
- Plastic containers (HDPE and PET plastic)

The MWP equipment will also target organics in the waste stream, which will be discussed in the following section. It is important to note that newsprint and other recyclable fibers are not targeted for recycling recovery as these are the most sensitive recyclable materials to contamination from garbage. These fibers can be recovered as part of the RDF.

The specific equipment used in the MWP system for targeting these recyclable materials has been proven to provide reliable recovery rates for recyclables. With the addition of the MWP equipment at the Newport Facility, it is anticipated that there will be an increase in the amount of ferrous and nonferrous captured (the current system removes some ferrous and nonferrous) and additional materials will be removed/recycled prior to processing into RDF. The MWP system is anticipated to assist the Counties in working toward the 75% recycling goals. In addition, the recyclable materials discussed in this section have a market value to provide some revenue for system operation. Some of the ferrous and non-ferrous metals are already being sorted and are being marketed successfully. The additional plastic containers are anticipated to also be successfully recovered and can be marketed to existing plastics recycling markets. The cardboard targeted for recovery is currently planned to only be sorted from commercial wastes with the focus on cardboard with minimal contamination to ensure the marketability of cardboard bales.

1.2.2 Organics

The current preliminary design for the MWP system at the Newport Facility includes equipment intended to remove organic material from the input MSW. This organic material will need to be loaded on trucks and hauled to a privately owned facility for beneficial reuse in either a composting operation or anaerobic digestion facility (i.e. will not be hauled to the Xcel combustor plants). Removal of organic material will assist the Counties in working toward the 75% recycling goals, but will present an additional cost to transport and to pay a vendor to further process the organic material.

1.2.3 Remaining MSW

The majority of the MSW will pass through the MWP system to the existing RDF processing system. The current preliminary design for adding MWP equipment at the Newport Facility includes conveyors to transfer this remaining MSW to the RDF lines after processing through the MWP system so the material can be further processed into RDF. It is anticipated that this will result in further ferrous and nonferrous recovery, which are currently included in the RDF processing lines.

1.2.4 Material Flow Summary

Table 1 provides a summary by material category of the estimated breakdown of the 400,000 tpy delivered to the Newport Facility.

Table 1
Material Flow Summary

Material	Tons			
Total MSW	400,000			
Bulky Waste to Landfill		26,800		
MWP System		340,000		
Bypassed Material to RDF process		33,200		
Nonferrous Recycled			2,515	
Ferrous Recycled			14,060	
Organics to Private AD Contractor			42,500	
HDPE Recycled			1,530	
PET Recycled			2,805	
Cardboard Recycled			5,985	
Process Residue to Landfill			14,001	
RDF to Xcel Combustion Plants			289,804	
Ash from Combustion to Landfill				83,029

The bulky waste materials are removed prior to processing and are typically landfilled. The bypassed material would go directly into the current processing equipment for processing into RDF. The process residue is material that remains after processing into RDF that is not suitable as RDF and is currently landfilled. The addition of a MWP system increases the amount of material that is recycled or otherwise diverted from the landfill by approximately 69,000 tpy.

2 Technology Updates

2.1 Reference Facility – Montgomery County, Alabama

The MWP equipment currently being used at the Montgomery facility was considered as a "reference facility" for installation at the Newport Facility. It is a proven technology designed and manufactured by Bulk Handling Systems (BHS). The BHS MWP system includes bag breakers, manual sorting, disc screens, eddy current separation, magnets, air sorting (Nihot), and optical sorting (NRT) technologies for recyclable material removal.

2.2 MWP System Vendors

Numerous MWP system equipment vendors offer turnkey systems for material recovery from MSW and include:

- CP Manufacturing
- Machinex Technologies Inc.
- Vecoplan
- Bulk Handling Systems (BHS)
- Bollegraf
- Van Dyk

The list above is not intended to provide an endorsement or be all inclusive. It simply indicates there are multiple companies in business to develop and provide proven systems for MWP. The main difference in these systems is related to separation of fine materials (organics). Some of these systems use disc screens for size separation and others use trommel screens.

3 Economics

The economics associated with the addition of MWP system at the Newport Facility include initial renovations, construction, and procurement of the MWP equipment, operating costs and potential revenues from marketable materials.

3.1 Renovation, Construction and Procurement Costs

The costs associated with the addition of MWP equipment at the Newport Facility include renovations/additions to the current facility, construction for additional support facilities, and procurement/installation of the MWP system.

The total site related renovation and construction costs for adding MWP equipment to target ferrous, nonferrous, cardboard, plastics, and organics in the MSW delivered to the Newport Facility is estimated to be $6.2 to $7.35 million, using 2016 dollars. This includes the estimated MWP equipment installation costs.

The total equipment cost associated with MWP equipment from the tipping floor through the end of the container sort line (including uncaptured MSW return conveyor) is estimated to be $12.55 to $13.40 million, using 2016 dollars

The total cost for adding MWP equipment, as well as the site related renovation and construction is estimated to be between $18.75 and $20.75 million.

Table 2 provides a summary of the estimated capital costs associated with the addition of a MWP system at the Newport Facility.

Table 2
Estimated Capital Costs

	Site and Building	MWP Equipment	Total
Estimated Capital Cost ($)	6,200,000 - 7,350,000	12,550,000 - 13,400,000	18,750,000 - 20,750,000

3.2 Operating Costs

Operating costs include labor, added electrical usage, and maintenance associated with operation of the MWP equipment. Based on the estimated labor rates and assuming an operating schedule similar to the current schedule, the total estimated labor cost for adding MWP is approximately $4 million, using 2016 dollars.

The increased cost associated with electrical usage based on installation of the MWP system is estimated to be $375,000 annually, using 2016 dollars, for electrical usage to operate the entire system. This represents approximately a 50% increase over the electrical cost estimated for the current RDF system.

The MWP system equipment maintenance generally includes costs associated with the conveyors, air classifiers, optical and eddy current separators and the polishing screen. Based on the anticipated maintenance items and communication with equipment vendors the estimated maintenance cost in 2016 dollars for the MWP system is estimated to be $600,000/year.

The total annual operation and maintenance cost associated with operation of a MWP system at the Newport Facility are estimated to be approximately $4,980,000 (not including the cost of organic material management).

3.3 Potential Revenues

Plastic containers (PET and HDPE), cardboard, ferrous and non-ferrous are marketable products that are considered a potential revenue source resulting from separation with MWP equipment. The market for these materials is dependent on the quality (cleanliness) and is subject to fluctuations. Table 3 presents the estimated revenue from the sale of these marketable materials.

Table 3
Estimated Potential Revenue from
Materials Recovered Using a MWP System at Newport

Material	Current Market Rate/Ton[1]	Assumed Market Price/Ton[2]	Estimated Annual Revenue
PET	$252	$176	$493,680
HDPE	$475	$332	$507,960
Cardboard	$70	$49	$293,265
Ferrous (Tin/Steel containers)	$90	$63	$404,900
Non-ferrous (Aluminum)	$1,430	$1,000	$2,310,000
		Estimated Total Annual Revenue	**$4,009,805**

1. Current market prices from RecyclingMarkets.net accessed on March 16, 2015.
2. The assumed market price is approximately 70% of the current market price to be conservative given market variability.

The estimated revenue associated with the marketable materials recovered using a MWP system is estimated to be approximately $4.0 million annually. Recyclable materials are commodities in markets with dramatic variations in pricing due to supply and demand. The commodities are marketed globally. Historically and continuing, there are peaks and valleys in the market pricing. Experienced recycling facility operators have learned to budget for lower range pricing and carry through down times with reserve funds generated during high markets.

There are costs associated with the recovered organics from the MWP system. Currently there is no established market for the organic material recovered from the MWP system.

3.4 Potential Jobs Created

Installation of MWP equipment at the Newport Facility will create construction jobs during renovations of the facility and construction of necessary support facilities. It is anticipated that approximately 35 to 40 temporary construction jobs will be created and will have a duration of approximately 18 months. Once the MWP equipment is installed and operational it will require approximately 60 new full time employees.

4 Additional Data Needs

4.1 Material Quality and Markets

Additional information pertaining to the quality of the material resulting from processing MSW with MWP equipment will be beneficial to determine both the market value for the recyclable materials as well as the cost to manage the organic fraction of the MSW that will be captured.

4.1.1 Recyclables

The main concern with the recyclable materials recovered from MSW using a MWP system is the quality or "cleanliness" of the material. It is anticipated that the ferrous and non-ferrous will be similar or "cleaner" than the current RDF processing system, which has a market for these materials.

The containers (HDPE and PET plastics) and cardboard may be "contaminated" with food waste and other wet organic material which may reduce their value. It is important to obtain additional information pertaining to other operations that are currently capturing these materials from the MSW stream using MWP equipment.

4.1.2 Organics

Similar to recyclable materials, the quality of the organics captured using MWP equipment is an important factor related to the cost of organics management. The quality of the organics will also impact the material produced from the organics (e.g. biogas and compost). The MWP equipment will target organics from the fine material in MSW, which means there is potential to also capture broken glass fragments, grit, and "small" plastic pieces. These "contaminants" will affect the cost to have a private vendor take the material as well as the quality of the end product produced by the private vendor.

The main options for the organics are to send them to a composting facility or an anaerobic digestion facility. Additional information pertaining to the quality of the organic fraction from processing MSW using MWP equipment is necessary. Also, it is important to determine the status of possible anaerobic digestion vendors given the current market for the biogas they produce. It is also important to determine if additional steps will be necessary to further process the organic material into a Class I or Class II compost. Minnesota Administrative Rule 7035.2836 indicates that Class I compost must not contain greater than three percent inert materials and Class II compost must not contain greater than four percent inert materials. Since there is currently not an operational AD facility in the immediate vicinity of the Newport Facility, is it assumed that composting the material may be a required interim step to achieve the Project Board's Scope of Resource Management.

4.2 Documented Recovery Rates

Removal of recyclable material using MWP equipment is a proven technology. It has been used to process single stream recyclables since the 1990's. However, current information pertaining to specific recovery rates for ferrous, nonferrous, plastics, and organics using MWP equipment from a MSW stream is limited. Therefore, it is important to obtain additional data about the recovery rates from processing MSW with MWP equipment, which includes information about the composition of the waste stream entering the MWP system.

4.3 Waste Composition Data – Montgomery

Considering the Montgomery facility was considered as a "reference facility" for installation at the Newport Facility, it is important to obtain data about the incoming waste composition in order to compare the waste stream with the Ramsey/Washington waste stream. Related to the waste composition is obtaining additional data about operational characteristics of the MWP System installed in Montgomery. Additional waste composition data should be obtained for the material entering the Newport Facility in order to get a better understanding of how seasonal variation affects the incoming waste stream.

4.4 Impacts of Adding MWP at Newport

4.4.1 Change Vehicle Traffic

No significant change in vehicle traffic (incoming and outgoing) is anticipated to result from the addition of MWP at the Newport Facility.

4.4.2 Change in Odor

The material entering the facility will remain unchanged with the addition of MWP equipment. The organics removed will not be stored onsite so the addition of MWP equipment at the Newport Facility is not anticipated to result in a change in odors at the facility.

4.4.3 Change in Noise

All of the MWP equipment is anticipated to be within the facility so no significant change in noise is anticipated.

5 Potential Specific Steps

Related to the additional data needs are the potential specific steps to use to gather the necessary information and to move through the implementation process and meet the schedule of the Scope for Resource Management. These steps include:

MWP Pre-procurement Planning	January 2016 to June 2016
Data acquisition re: organics recovery	
♦ Focused, seasonal waste composition	
♦ Test sorts of commercial and residential wastes	
♦ Data comparison to operating facilities	
♦ Operating facility site visits	
♦ Effectiveness of different organics sorting equipment/methods	
Discussions/input from Existing Plant Management	
MWP system vendor tours of Newport	
Monitor status of private AD facility developers	
Determine interest/needs of existing composting facility owners	
Meet with various regulatory bodies regarding any impacts to permits and MPCA specifically re: classification of organics recovered via MWP	
Discussion of various procurement methods for the MWP system	
Determine/develop interest in this project opportunity with potential MWP	

system vendors, gather input/ideas, thoughts on procurement process, etc.	
Procurement (Assuming Turnkey, Design/Build/Start- Up Contractor for a System)	July to December, 2016
Develop procurement document(s)	
"Market" project to potential contractors	
Gain approvals to issue	
Determine Proposal Evaluation Team	
Go through procurement process of pre- proposal conference, questions, addenda	
Evaluate proposals, potential partnerships formed, etc.	
Select/contract with vendor best fitting needs	
Finalize contract	
Board authorization	
Final Design/Permitting	January to June, 2017
Contractor develops construction documents	
"Board " reviews/accepts	
Prepare/finalize any permit documents and submit	
Develop coordination plan for installation and maintaining RDF processing	
Consider staffing needs, approaches, and select preferred option	
Recruit MWP system manager	
Construction/Installation	September to December, 2017
Monitor equipment construction/installation with on- site construction observation	
Monitor project according to contract	
Review/accept start- up testing procedures	
Operations coordinate work with contractor to maximize continued operations	
Monitor start- up and performance testing	
Recruit/hire operations staff	

Memorandum

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April 15, 2015

TO: Zack Hansen, Judy Hunter, and Kate Bartelt
Ramsey/Washington Counties Resource Recovery Board (Project Board)
Joint Staff Committee

CC: Jennefer Klennert, Foth Infrastructure & Environment, LLC (Foth)
Curt Hartog, P.E. Foth

FR: Nathan Klett, Foth
Warren Shuros, Foth

RE: Anaerobic Digestion (AD) – Update on Technology Status

This memorandum is intended to provide an update on the current planned scope of anaerobic digestion (AD); status of select vendors and existing projects providing AD systems; and economic and marketability of AD products (i.e. biogas and compost).

The focus of this memorandum is on what additional information is needed to continue forward to include AD as a component in Scope of Resource Management and potential next steps for Ramsey/Washington Counties.

AD was the identified technology in the Scope for Resource Management to provide an outlet for the organics recovered using Mixed Waste Processing (MWP) equipment. These technologies used together will increase recovery and provide a perceived better use for food waste and other organic materials.

The use of AD also provides another outlet for source separated organics (SSO) as that increases in the East Metro area. The organics could be sent directly to a properly permitted composting facility, but AD processing has the advantage of first recovering the energy and is, therefore, considered a higher and better use.

In response to the question, “Does it work?,” yes, AD technology works. AD has been used in the United States since the 1930’s and the US EPA estimated there were 157 commercial scale livestock digester project operational in 2010 in the US. Most of the facilities are using agricultural feedstock not MSW but the technology works.

1 Anaerobic Digestion (AD) Included in the Scope for Resource Management

Currently the organics in the MSW delivered to the Newport Facility are either sent to the Xcel facilities as a portion of the RDF or landfilled as a part of the residue from RDF processing. The concept for using the proven AD technology is to provide a beneficial/higher use for the organics that would be removed from the waste stream.

Previous characterization of the MSW entering the Newport Facility indicates approximately 25% is considered targetable organics (food waste and yard waste) material potentially suitable for AD. In the *Analysis of Mixed Waste Processing (MWP) Report,* September 2014 prepared by Foth, the MWP equipment is projected to recover 50% of the available organics from the MSW processed by the MWP equipment, which results in an estimated 42,500 ton per year of organics available for an AD process. Currently there are no operational AD facilities located in the vicinity of the Newport Facility using MSW as a feedstock. There are operational AD facilities using agricultural feedstock.

1.1 Necessary Permits and Regulatory Agencies

The necessary permits for an AD facility will depend on the capacity of the facility (i.e. if the facility were to have the capacity to utilize 250,000 dry tons or more per year of input - for fuel conversion - an Environmental Impact Statement (EIS) would be mandatory per Minn. Statue 4410.4400). The permitting requirements will apply to the AD system owner/operator, not the Project Board.

The anticipated permits necessary and associated regulatory agencies involved include:

- Environmental Assessment Worksheet (MPCA)
- Water Permits (MPCA)
  - Wastewater Discharge/NPDES/SDS Permit
  - Industrial Stormwater Permit (included in NPDES/SDS Permit)
  - Water appropriations permit
- Air Permit (MPCA or Federal depending on combustion device)
- Storage tank permits – If applicable (MPCA)
- Waste Permit (MPCA solid waste rules)
- Construction permits (Local and MPCA)
  - Building permit
  - Construction Stormwater
- Local/County Permits
  - County solid waste processing permit
  - Conditional use permit
  - Grading and utility permits.

Depending upon the volume of biogas generated and the end use selected, a permit may also be required from the Public Utilities Commission (PUC).

As there are no facilities currently permitted specifically using MSW as the feedstock for AD, the timeline for permitting and exact permit needed are unclear.

1.2 Material Flow

The flow of material at the Newport Facility includes recovery of approximately 42,500 tpy of organics that will be sent to a private AD contractor. The remaining material flows are summarized in Table 1.

Table 1
Material Flow Summary

Material	Tons			
Total MSW Delivered	400,000			
Bulky Waste to Landfill		26,800		
MWP System Input		340,000		
Bypassed Material Input to RDF process		33,200		
Nonferrous Recycled			2,515	
Ferrous Recycled			14,060	
Organics to Private AD Contractor			42,500	
HDPE Recycled			1,530	
PET Recycled			2,805	
Cardboard Recycled			5,985	
Process Residue to Landfill			14,001	
RDF to Xcel Combustion Plants			289,804	
Ash from Combustion to Landfill				83,029

The anticipated 42,500 tons per year of organics would be delivered to a privately owned and operated AD facility. After the AD process, it is anticipated that approximately 38% material by weight (i.e. 16,150 tons) will be remaining.

The ultimate goal for the material remaining after the AD process is to have a class I or class II compost with minimal landfilled material. However, this may be dependent on the AD system vendor and the amount of contamination (glass, plastic, etc.) contained in the organics provided to the AD vendor. Further processing of this remaining material may be necessary to remove contaminants, which may add to the cost of delivering organics to an AD vendor.

2 AD Technology

The use of AD for decomposing organic materials in a controlled oxygen-deficient (anaerobic) environment is a proven technology that has been used for low solids waste stream such as manure, waste water solids, etc. for centuries. The use of AD for decomposing high solids organic waste (e.g. organics from MSW) has been used to a lesser extent, but is gaining popularity with increased waste diversion goals in many communities and an increased emphasis on renewable/biofuels.

There are two primary AD technologies in use today: Wet and Dry.

2.1 Low Solids (Wet) AD

In a low solids or wet AD system, the organic materials typically enter the AD process at less than approximately 10% solids content (as low as 5% or less). This solids content is typical of waste water sludge, manure, rendering waste, etc. Note: This is the technology proposed by SaniGreen in South Saint Paul.

2.1.1 Advantages

The main advantage of a wet AD system that may be applicable to the organics recovered using MWP is the ability to remove plastics from the incoming material prior to undergoing AD. A low solids AD system may also provide some added flexibility when considering feedstock (i.e. the ability to mix organics from MSW with other organic rich liquids).

2.1.2 Disadvantages

Some of the disadvantages of a wet AD system include the need for additional energy to heat and pump water and to dewater digester contents. There is a potential for more loss of volatile solids and potentially lower gas quality. With respect to the organic fraction removed from the MSW, a low solids AD system would require additional low solids feedstock to be mixed with the high solids organics from MSW. This could result in an increase in capital and operating costs of the system.

2.2 High Solids (Dry) AD

In a high solids or dry AD system, the organic materials typically enter the AD process at between 15 and 40% solids content. The higher solids content is generally more representative of the organics separated from MSW using MWP technology. Note: Project Board Commissioners and Staff saw Dry AD at the 2014 Renewable Energy from Waste Conference in San Jose, CA.

2.2.1 Advantages

The high solids systems require less energy input into the process and typically have more energy available for export. Additionally, the organics separated from MSW may be able to be used directly in a high solids AD process with minimal liquids addition.

2.2.2 Disadvantages

Some disadvantages to high solids AD systems may include addition of bulking agents for system efficiency and a high solids system cannot handle liquids as well as wet AD systems which may limit the available feedstock options.

3 Technology Updates

In the *Preliminary Resource Recovery Feasibility Report,* January 2014, Foth presented information pertaining to AD technology and several large-scale developing or developed AD facilities. This section is an update on the status of development and technology previously presented as well as additional updates in the AD market.

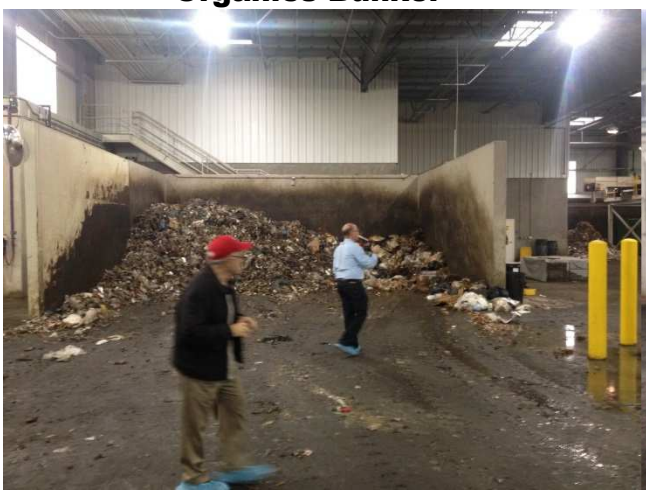
3.1 AD Facilities – Current Status

3.1.1 ZeroWaste Energy, LLC – San Jose, CA

Commercial operation of the first phase of the ZeroWaste Energy Development Company (ZWEDC) facility began December 2013. The first phase includes a 90,000 tpy (250 tpd based on 365 days) thermophilic dry AD facility utilizing Kompoferm technology. A news release from November 25, 2014, from the EPA, indicated "During its first ten months of operation in 2014, the ZWED facility has recycled more than 30,000 tons of food scraps…"

This facility was visited by some of the Project Board representatives in November 2014 as part of the Renewable Energy from Waste Conference. No specific details were provided pertaining to the amount of organics entering the facility from processed MSW.

Photograph 1
Organics Bunker



Photograph 1 is a bunker containing organics for the AD system in San Jose. These organics were recovered using MWP equipment.

Photograph 2
Loaded Vessels

Photograph 2 shows the vessels that are loaded with organics for AD.

3.1.2 Big Ox Energy (aka partner with Sanimax to form SaniGreen) – Denmark, WI

The proposed SaniGreen facility in South St. Paul, MN is a partnership between Big Ox Energy and Sanimax. Big Ox Energy currently has an operational wet AD facility in Denmark, WI with a capacity of 60,000 to 78,000 tons per year based on a daily receiving rate of 250 to 300 TPD (on a 260 days per year operating schedule, normally six days per week, 12 hours per day).

The process components include a tipping floor and receiving tank for the slurry delivered in large tanker trucks. The tipping floor also has a pre-processor mixer and conveyor where food waste or other solid feedstock is size reduced and fed into slurry. The system has been operational for approximately 5 years.

Photograph 3
Receiving Area

Photograph 3 shows the receiving area for low solid and organic materials delivered to the Big Ox facility.

3.1.3 SaniGreen BioEnergy (aka Big Ox Energy and Samimax) – South St. Paul, MN

SaniGreen BioEnergy has received a planned unit development (PUD) amendment for land use as a part of the overall permitting process for an AD facility for processing of organic materials. The AD facility is anticipated to process organics from Sanimax's adjacent rendering operation in South St. Paul, MN and is continuing to search for organic materials from other off-site sources.

The system is designed as a wet (8%-12% solids) AD plug flow reactor using the GEP group/Big Ox Energy design and will have an operating capacity of 150,000 tpy (410 tpd based on 365 days). The facility will be able to handle both solid and liquid wastes and is designed to allow flexibility to address input variabilities. The adjacent rendering facility alone generates approximately 300,000 gallons of effluent per day. Biogas from AD is anticipated to be cleaned/scrubbed to pipeline quality and injected in the area natural gas distribution system. Electricity produced will be either sold or used at the Sanimax rendering facility. Liquid wastes from the digesters will be disposed in the sanitary sewer. Solid wastes from the digesters, estimated by Sanimax at 50-60 tpd, will be dewatered, dried, and pelletized for RDF or will be sent to one of SaniGreen's strategic partners for composting. It is unclear when SaniGreen anticipates breaking ground for the facility.

Discussions with Dan Ostrenga (Sanimax) on March 31, 2015 indicated that during the initial permitting discussions, for the proposed SaniGreen AD facility in South St. Paul, with MPCA, there were representatives from Air, Water and Solid Waste divisions and that the Air division appeared to be taking the lead relative to the SaniGreen AD facility permit with support from Water and Solid Waste divisions. Dan also indicated that SaniGreen is considering voluntarily preparing an Environmental Impact Statement to avoid potential future limitations related to throughput capacity (i.e. in order to utilize 250,000 dry tons or more per year of input for fuel conversion an Environmental Impact Statement (EIS) is mandatory per Minn. Statue 4410.4400).

One final "permitting" note provided during communication with Dan is that the MPCA would be the responsible government unit (RGU) for construction or expansion of a mixed municipal solid waste compost facility or refuse derived fuel production facility with a capacity of 500 or more tons per day, which is considered applicable to the proposed SaniGreen facility if this capacity is reached.

Dan also indicated that Sanimax is planning to complete an application for grant money from the Metropolitan Council's Industrial Pretreatment Partnership and Incentive Program (IPPIP), which is due June 30, 2015. The Sanimax application needs to specify if they will be simply installing additional wastewater pretreatment at the current rendering plant or if they will be constructing an AD plant to create an energy by product as well as the enhanced wastewater pretreatment. It is believe that either scenario would be a candidate for the IPPIP grant opportunity. However, Sanimax may not want to invest the additional money necessary to construct the AD facility without having feedstock commitments for the facility.

Currently the proposed facility does not have feedstock commitments required to proceed with the AD project. In previous discussions it was indicated that commitments for minimally 100,000 tpy of organics would be required. Currently, SaniGreen has commitments for approximately 50% of the necessary organics. Related to the necessary feedstock commitments, Dan indicated that having a commitment for the estimated organics from MWP at the Newport Facility would be a "game changer". That is to say it would result in SaniGreen having adequate committed feedstock to keep moving forward with the AD project.

3.1.4 Avant Energy – Minnesota Municipal Power Agency (MMPA) – Le Sueur, MN

The "Hometown Bioenergy Project," in Le Sueur, MN is currently processing a combination of corn silage and manure through wet AD to ultimately produce electricity. The facility is owned by MMPA, which is a partnership of twelve municipal utilities around the State of Minnesota, and was developed by Avant Energy of Minneapolis, which manages the MMPA.

Two anaerobic digesters produce methane from trucked-in corn silage, manure, and potentially other organic waste. Biogas from the digesters is stored in three fabric domes until it is needed for electrical production, which is produced in four internal combustion engine/generator sets. The plant design includes a total plant output of 8 megawatts generated 12-15 hours per day during peak demand. The plant will process about 45,000 tpy (125 tpd based on 365 days) of agricultural residuals, including corn silage, potato waste and chicken manure. The current plan is to generate additional revenue from the sale of post-digestion liquids as fertilizer and dried solids (digestate) as boiler fuel or animal bedding.

3.1.5 Organix Solution (aka Randy's Sanitation) – Delano, MN

Information presented at the 2014 RAM/SWANA by representatives for the Organix Solutions Project generally indicated that the material recovery facility at Randy's Sanitation is designed to separate recyclables and recover 2 to 3 inch minus material which is comprised mostly of organics. Pre-sorted MSW will also pass through the BurCell ™ process to recover organics and non-recycled paper to produce a processed engineered feedstock (PEF). The PEF will be screened then enter a SmartFerm (Zerowaste) AD process. The digestate will be composted and is assumed to meet Minnesota Pollution Control Agency's "Class 1" compost standards, but

remaining small glass fraction will likely prohibit retail sale. The current proposed completion date is 2015. The AD portion of the process is currently permitted for 80,000 tpy.

Jim Wollschlager from Randy's Sanitation indicated that a demonstration facility for the process proposed at Randy's is anticipated to be operational in early June 2015. The demonstration facility is anticipated to be capable of processing 1 ton batches.

4 Economics

The economics associated with adding AD as a component to the Scope of Resource Management will be dependent on the quality of the organics resulting from the use of MWP equipment at the Newport Facility for sorting MSW. Foth believes that an initial step towards the use of AD for management of the organics from Newport would be to issue a Request for Expressions of Interest (RFEI) to vendors for organics management (compost and/or AD). The RFEI could be structured to encourage AD as the organics management option.

Based on the available information from established markets and preliminary information for organics from MWP supplied by current AD vendors, Foth has estimated net costs for adding AD to the Scope for Resource Management to be an increase to the cost of the existing system. Currently this additional cost is estimated to be $40-$60/tons of organics, but will ultimately be dependent on the quality of the organics resulting from MWP of MSW delivered to the Newport Facility and the distance from Newport to the AD facility.

The current plan is to contract with a private contractor that would own and operate an AD facility. Thus, financing and the capital costs associated with operating, and marketing of the outputs will be under the control of the private contractor. To obtain specific data for the Project Board will require a formal, competitive procurement process. The contractual economic terms could be structured around a per ton of delivered organics arrangement. This structure will need to be determined as one of the next steps for including AD processing as a part of the Scope of Resource Management.

4.1 Potential Jobs Created

Inclusion of AD as a component to the Scope of Resource Management is expected to create new jobs regionally. However, there is not a specific location determined for an AD facility accepting organics from the Newport Facility. The projected number of jobs created for the proposed SaniGreen facility in South St. Paul included 20 new full time positions, 150 temporary construction jobs over a 2 year time period, and 475 indirect jobs based on projections from SaniGreen. Data pertaining to jobs creation was presented by Organix Solutions at the 2014 RAM/SWANA conference and indicated that the AD project will generate 60-80 short term jobs (assumed construction) and 12-15 long-term employment opportunities.

5 Additional Data Needs

5.1 Material Markets and Quality

The main options for the organics are to send them to an AD facility or a composting facility. As indicated previously additional information pertaining to the quality of the organic fraction from

processing MSW using MWP equipment is necessary. This information is necessary for both determine the cost associated with managing organics as well as determining the quality of the final product (e.g. compost). It is also important to determine if additional steps will be necessary to further process the organic material into a Class I or Class II compost. Minnesota Administrative Rule 7035.2836 indicates that Class I compost must not contain greater than three percent inert materials and Class II compost must not contain greater than four percent inert materials. The Organix Solutions (Randy's Sanitation) AD system is anticipated to result in a compost that meets Class I standards, but is believed to contain glass fragments that will inhabit retail sale (Organix Solutions RAM/SWANA presentation 2014).

Currently there is no established AD facility in the vicinity of the Newport Facility using MSW as feedstock. Both SaniGreen and Organix Solutions (Randy's Sanitation) have most or all of the permitting process complete and are solidifying finances or planning for construction. Additional discussions with potential AD vendors for establishment of a facility are necessary.

An interim option for the organics resulting from processing MSW with MWP equipment is to explore options for composting until an AD facility is established. This allows time to determine the quality of the organic from processing with MWP and will provide the Project Board with a better understanding of the cost associated with managing the organic fraction.

5.2 Documented Recovery Rates

The recovery rate of the material is important to understand since the Project Board and AD vendor receiving the material will need to have an understanding of the annual volume to expect. Based on how the MWP equipment will target organics (small heavy fraction of MSW), it is anticipated that the "cleaner" the organics are required to be, the lower the expected rate of recovery. However, the cleanliness required will ultimately be driven by the AD or compost vendor contracted to manage the organics.

6 Potential Specific Steps (Next Steps)

In order for staff to be confident in a recommendation to the Project Board, Foth suggested the following next steps.

AD Pre-procurement Planning	January 2016 to December 2016
♦ Focused waste composition studies in spring, fall and winter for targeted materials.	
♦ Physically processing residential and commercial loads from Ramsey/Washington Counties at Randy's Sanitation to help determine organics quality and potential recovery percentages.	
♦ Explore composting options for organics management until a local AD market is established and as a transition and/or back up technology.	
♦ Gather additional information on the effectiveness of different MWP equipment related to organics recovery and quality.	

♦ Continue to monitor status of potential/proposed AD facilities.	
♦ Meet with regulators (MPCA, Washington County, City of Newport, etc.).	
♦ Comparison of data from reference facility (ies) with particular focus on organics.	
♦ Tours/Presentations:	
▶ Potential presentations from active AD vendors to include status updates from local proposed or "in the works" AD projects.	
▶ Site visit to the Montgomery County Facility with Project Board members and staff to see the facility and to engage in policy and technical discussions.	
▶ Tour to the Hometown Bioenergy Project in Le Sueur, MN to observe similarities and differences in feedstock and operations.	
▶ Discuss the status of the proposed AD facility with Randy's Sanitation.	
♦ Preparation of an RFEI for interested vendors for organics management with emphasis on AD technology.	
♦ Potentially consider a transition period with a compost contractor.	
Procure Private Contractor for Organics Management	January 2018 to June 2018
♦ Examine/test organics produced from MWP (quality and quantity)	
♦ Develop procurement document(s)	
♦ "Market" project to potential contractors	
♦ Gain approvals to issue	
♦ Determine Proposal Evaluation Team	
♦ Go through procurement process of pre- proposal conference, questions, addenda	
♦ Evaluate proposals, potential partnerships formed, etc.	
♦ Select/contract with vendor best fitting needs	
♦ Finalize contract	
♦ Board authorization	

MEMORANDUM

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April 13, 2015

TO: Zack Hansen, Judy Hunter, and Kate Bartelt
Ramsey/Washington Counties Resource Recovery Board (Project Board)
Joint Staff Committee

CC: Jennefer Klennert, Foth Infrastructure & Environment, LLC (Foth)

FR: Nathan Klett, Foth
Warren Shuros, Foth

RE: Gasification – Update on Technology Status

Exploration of Gasification as a market for Refuse Derived Fuel (RDF) is an integral part of the Scope of Resource Management. The scope includes a multi-year time period to monitor potential progress with different gasification technology vendors. Gasification shows promise to be an emerging, cost-effective technology, but is not yet a proven technology to manage MSW. The Project Board requires a proven technology to reliably manage MSW in the future.

This memorandum provides a summary of the potential material flows, an update on the current status of gasification technology, and progress on implementation of gasification. The focus of this memorandum is on additional information needed to continue consideration of this technology as a resource management option and what potential next steps may be taken by the Project Board.

The gasification technology being developed to process RDF is not yet a proven technology. There are commercial scale facilities in various stages that may be viable. Therefore, the timeline for the Scope for Resource Management shows evaluating the development of gasification from 2015 through 2017. If the gasification technology is proven during this evaluation period, a procurement process could be used to select a system vendor for siting, permitting, construction, and testing.

1 Gasification Included in the Scope for Resource Management

1.1 Preliminary Concepts

The gasification concept developed to date is to take refuse-derived fuel (RDF) produced at the Newport Facility to a new gasification facility capable of handling the entire RDF output from the Newport Facility. Gasification would replace combustion of RDF at both of the Xcel combustion facilities. The RDF is anticipated to be made into a syngas and converted to high value fuels such as ethanol and/or other specialty chemicals.

The location of a gasification facility has not been determined. It is not clear that the gasification facility will fit at the Newport Facility site and the financial analysis completed to date has the RDF hauled to a gasification facility that is within a ten (10) mile radius of the Newport Facility.

1.2 Material Flow

Table 1 shows the potential tonnage of RDF for gasification.

Table 1
Adding Gasification to SSO/SSR/MWP/AD

	Tons
Ramsey/Washington MSW Delivered	
Ramsey/Washington Direct	290,070
Ramsey/Washington - Transferred	72,520
Total Tons Delivered	**362,590**
RDF to Gasification	284,037
Ethanol Produced (Gallons)	22,722,960
Separated Materials	
Non Ferrous Recycled	1,270
Ferrous Recycled	5,900
PET Recycled	1,925
HDPE Recycled	1,035
OCC Recycled	2,090
Organics to Anaerobic Digestion	25,810
Bulky Waste Residue to Landfill	26,800
Process Residue to Landfill	13,723

There will be some inert char and ash residues remaining from the gasification process (estimated to be approximately 15% of the tons of RDF to Gasification). This material would be landfilled.

2 Technology Updates

2.1 Reference Facility

Since gasification applied to RDF is not a proven technology, there is not a specific facility to use as a reference facility. The facility that is close to operating at full capacity is the Enerkem facility in Edmonton, Canada. For this update, information was provided by companies that are actively developing gasification technologies. Costs and performance information is stated as estimates.

2.2 Gasification System Vendors

Gasification is an emerging technology for processing MSW and RDF. For purposes of describing different approaches, four (4) companies were evaluated including:

- Ineos Bios with a commercial plant operating in Vero Beach, Florida;
- Enerkem with a commercial plant in Edmonton, Alberta;
- Fiberight developing potential plants in Iowa and Maine; and
- Fulcrum Energy developing a new plant under construction in McCarren, Nevada.

If these plants or others are shown to be viable at a reasonable tipping fee, further plants may be developed. Following are descriptions of the four selected companies.

2.2.1 INEOS Bio

INEOS Bio started production from a first-of-its-kind advanced bio-energy facility in Vero Beach in Florida. The plant, named the Indian River BioEnergy Center, was built with an investment of more than $130 million. It is the first commercial scale plant to produce third generation bioethanol. INEOS Bio announced their production of cellulosic ethanol on a commercial scale in July, 2013.

The primary feedstock for the facility is vegetative yard waste and land clearing debris collected by the Solid Waste Disposal District (SWDD) curbside collection program. To produce bioethanol, the plant uses 150,000 tons of renewable biomass. On an annual average, yard waste is anticipated to make up approximately 90 percent of the feedstock. With the remainder of the biomass feedstock potentially consisting of clean woody C&D debris and municipal solid waste (MSW).

In an operational update in December, 2013, INEOS Bio reported that it is taking longer than planned to bring the facility to design capacity due to a number of unexpected start-up issues. They noted ongoing efforts to:

> *"Focus on safe operations, optimizing the technology, and de-bottlenecking the plant to achieve full production capacity."*

In another operational update[1] in September, 2014, INEOS Bio noted:

> *"Vero Beach facility has recently completed a major turn-around that included upgrades to the technology as well as completion of annual safety inspections. We are now bringing the facility back on-line. In addition, we will soon finish installation of equipment that will be used to remove impurities from one of our process streams that have been negatively impacting operations. This equipment will be commissioned and brought online over the remainder of the year."*

2.2.2 Enerkem – Edmonton Waste-to-Biofuels Project

Enerkem, through its affiliate Enerkem Alberta Biofuels, has signed a 25-year agreement with the City of Edmonton to build and operate a plant that will produce and sell next-generation biofuels from non-recyclable and non-compostable municipal solid waste (MSW).

As part of the agreement, the City of Edmonton will supply 100,000 dry metric tons of RDF per year. The RDF will be gasified to produce methanol and ethanol. The plant is sized to produce 10 million gallons per year of ethanol. Operations officially started with a Grand Opening in June 2014. The facility successfully created syngas from biomass waste in December 2014. The facility is currently commissioning equipment to turn syngas into methanol or ethanol. In March 2015, correspondence indicated Enerkem plans to conduct continuous reliability campaigns in April with specific goals to prove out the performance of particular components and process elements. Earlier correspondence indicated the equipment components to convert methanol to ethanol have been ordered with installation likely sometime in 2015.

Several members of the Resource Recovery Project Board traveled to Edmonton in late September 2014 to visit the Enerkem facility. Communications regarding the status of the Enerkem facility and its technology are ongoing[2]. Enerkem responded to the Resource Recovery Board's Request for Expressions of Interest (RFEI) for gasification in July 2014 and continues to be interested in the work of the Resource Recovery Project Board.

2.2.3 Fiberight

Fiberight is a privately held company founded in 2007 and is stated to be a leading edge, clean technology company focusing on transforming MSW into next generation renewable biofuels, with cellulosic ethanol as the core product.

Fiberight technology is a Mechanical Biological Treatment (MBT) technology. The system sorts, pulps, processes, digests, and refines the energy content of MSW. Gasification through Fiberight's system is of a biological nature combining low-temperature enzymatic hydrolysis and anaerobic digestion processes to convert the organics into cellulosic ethanol and biogas. Cellulosic ethanol would be marketed as a fuel additive and biogas would be used as a CNG vehicle fuel or sold direct to the gas pipeline.

[1] Future information may be available on the Ineos Bio website at http://www.ineos.com/businesses/ineos-bio/news/
[2] Additional information may be available on the Enerkem website at http://enerkem.com/

The primary reference facility is in Lawrenceville, VA. Fiberight reports it is a pilot and demonstration plant which has over 5,000 hours of operating experience. It was designed to process 20 TPD of MSW. The plant has a material resource recovery facility (MWP equipment), pulper, wash system, pre-treatment, hydrolysis reactors, and a high-rate anaerobic digester.

Fiberight's Project development activity has been underway in Iowa and Maine. In Iowa, Fiberight has a contract with the City of Marion (neighbor of Cedar Rapids) to build an MWP sorting facility with plans to retrofit a corn ethanol plant in Blairstown, IA. Fiberight responded to the Resource Recovery Board's Request for Expressions of Interest (RFEI) for gasification in July 2014 and continues to follow the Project Board's activity.

In an October 2014 announcement regarding Iowa project development Fiberight noted:

> *"…their plans have not moved forward as quickly as first hoped."* They also announced that *"…the EPA ruled that compressed and liquefied natural gas (CNG) produced from biogas now qualifies as an advanced biofuel and, therefore, is assigned a renewable identification number (RIN)."* As a result, "*The Company now plans to digest C5 sugars in its anaerobic digester, to produce CNG rather than convert them to ethanol."*

The announcement covered other activities being conducted to move the technology and project forward.

In February 2015, Fiberight and the Maine Municipal Review Committee (MRC) signed a Development Agreement for Fiberight[3] to develop a $60 million solid waste recycling and processing facility. The Maine participants in the MRC will deliver waste to the facility to be built and operated by Fiberight.

The Development Agreement contains a specific, relatively aggressive schedule for completion of the facility and commitments by MRC members to sign waste delivery agreements with a total of 150,000 tons per year. The schedule lists beginning commercial operation April 2018. The MRC hired a University of Maine team to study Fiberight's plant in Lawrenceville, VA to review whether Fiberight's technology will work in Maine as proposed. The University's conclusion stated was:

> *"…our analysis of the Fiberight technology and their operating plant experiences is that the technology is sound and it's ready to be deployed in Maine."*

2.2.4 Fulcrum BioEnergy

Fulcrum BioEnergy has completed permitting, front-end engineering and site preparation activities for their first MSW to fuels plant, the Sierra BioFuels Plant, located in the Tahoe-Reno Industrial Center, in the City of McCarran, Storey County, NV. The Sierra BioFuels Plant intends to produce approximately 10 million gallons of low-carbon, renewable fuel per year. Fulcrum BioEnergy has also entered into long-term, zero-cost MSW feedstock agreements with

[3] The news releases used to provide the updates and additional information on Fiberight is located on their website at http://fiberight.com/

Waste Management and Waste Connections, two of the largest waste service companies in North America, and a fuel off-take agreement with Cathay Pacific airline and Tenaska BioFuels.

Fulcrum notes on their website that:

> "*Cathay Pacific became a valued equity investor in Fulcrum in 2014. We also entered into a long-term jet fuel supply agreement with Cathay Pacific for the delivery of 375 million gallons of low-carbon aviation fuel over ten years. The fuel will be produced at Fulcrum plants located across North America at locations strategic for Cathay Pacific. Cathay Pacific is a Hong Kong-based airline providing both passenger and cargo services to 188 destinations in Asia, North America, Australia, Europe and Africa using a fleet of more than 140 wide-body aircraft."*

Fulcrum BioEnergy has indicated they expect to begin production by the end of 2015, making the Sierra BioFuels Plant one of the United States' first fully operational, commercial-scale MSW-to-biofuels production plants.

Fulcrum's process that converts MSW into low-carbon renewable transportation fuels including jet fuel, diesel and ethanol begins with the gasification of the organic material in post-recycled MSW to a syngas. This syngas is purified and processed through a Fischer-Tropsch process to produce jet fuel and/or diesel or through Fulcrum's proprietary alcohol synthesis process to produce ethanol.

As part of the RFEI process conducted for the Resource Recovery Project Board, Fulcrum BioEnergy indicated that the Project Board's opportunity was too small for them to consider and did not fit their business plan[4]. As noted above, Fulcrum has long term agreements with Waste Management and Waste Connections to supply MSW, potentially at several existing sanitary landfill locations across the U.S. Fulcrum notes on their website that:

> "*Under these long-term zero-cost agreements, Fulcrum eliminates feedstock commodity supply and pricing risk. In addition, with the zero-cost MSW feedstock agreements, Fulcrum will be able to produce a low-carbon transportation fuel at a very predictable and stable cost of production, a significant competitive cost advantage over both industry peers and transitional fossil fuels."*

3 Economics

3.1 Overall Review

There is currently very limited data available about how the economics of gasification will work out for the Project Board. The technology is still under development and may be viable, but there are very limited commercial scale facilities to draw real data. In general, the revenue associated with the production and sale of fuels and chemicals is projected to result in better economics than other solid waste disposal technologies.

[4] A link to Fulcrum's explanatory video and website is http://www.fulcrum-bioenergy.com/video.html

The projected revenue from one (1) ton of MSW gasified into ethanol is two to three times the projected revenue from one (1) ton of MSW converted to electricity using conventional waste-to-energy technologies.

The City of Edmonton is reported to pay $45 per ton of RDF to Enerkem and have potential to receive some of the revenues in return. The Development Agreement between Fiberight and the Maine Municipal Review Committee has an initial tip fee not to exceed $70 per ton with revenue rebates anticipated to result in a net disposal cost of $57 per ton. Fulcrum BioEnergy notes they have long-term, zero-cost MSW feedstock agreements with Waste Management and Waste Connections (zero-cost of the feedstock as compared to other renewable fuels that use corn or sugarcane).

Based on the available information and preliminary information supplied by current developers, Foth has estimated net costs for adding gasification to the Scope for Resource Management to be less than the cost of the existing system or with the other components of the Scope for Resource Management.

The current plan is to contract with a private contractor for the gasification technology and operation. Thus, the capital cost financing, operating costs, and marketing of the outputs will be under the control of the private contractor.

To obtain specific data for the Project Board will require a formal, competitive procurement process. The contractual economic terms could be structured around a per ton fee with a revenue sharing formula based on project performance resulting in a revenue stream back to the Project Board. All of this is yet to be structured and determined.

3.2 Potential Jobs Created

The addition of gasification to the Scope for Resource Management is projected to create 610 construction jobs over and above any renovations of the Newport Facility for MWP. Once the gasification equipment is installed and operational it will require approximately 30 new full time employees at the gasification facility based on data from Enerkem.

4 Additional Data Needs

4.1 "If it Works"

The comment "If it works" first used regarding the Enerkem facility in Edmonton is now a phrase commonly used in the discussions by the Counties regarding gasification technologies. While there are commercial scale gasification facilities being developed, built, and undergoing start up testing, the bottom line is that there are no gasification facilities using MSW that are successfully operating on a commercial scale in North America.

There are promising technology vendors with sound financing and legitimate partnerships working on facilities. However, no facility has demonstrated the ability to reliably receive, process and dispose of MSW on a daily basis. For the Resource Recovery Project Board to eventually proceed with developing partnerships for a gasification facility, the following will need to be proven.

4.1.1 Long-Term Commercial Technical Viability

Vendors have been successful with pilot and demonstration scale facilities. The move to commercial scale is currently in process. Vendors use different processes whether microbiological fermentation, catalysts, enzymatic hydrolysis, Fischer-Tropsch, or other technology to convert MSW to chemicals and fuels. These vendors are in the process of trying to scale up to demonstrate commercial scale viability. The Project Board is in a position to "wait and see."

Some of the different vendor technologies have some common characteristics that potentially fit the Project Board's overall Scope for Resource Management. The gasification technologies typically include some type of front end processing of the MSW including MWP to remove recyclable materials, organics recovery for anaerobic digestion, and RDF production as a size reduction step for the gasification process. There is also a proven, commercially viable market for the RDF currently produced – Xcel Energy's combustion plants. The Project Board's Scope for Resource Management includes the front end processing technology common to the gasification technologies and time in the schedule for the different gasification vendors to prove the technical viability of their systems.

4.1.2 Marketability

The potential products from gasification include fuels and chemicals. Some processes develop methane which is marketable as natural gas (pipeline quality, combusted for electricity, or compressed as CNG for vehicle fuel). The market selection is typically based upon the best financial return for the project.

Previous estimates for ethanol production based on the RDF currently produced at Newport have been approximately 30 million gallons per year. One question raised is whether there will be a market for this quantity of ethanol. In January 2015, the Great Plains Institute (GPI), an expert in energy issues in Minnesota, prepared a report for Foth and the Project Board "*Market, Policy, and Greenhouse Gas Implications of MSW/RDF to Ethanol Production at Newport."*

GPI concluded in their report that:

> *"…most of the ethanol produced in the Midwest is exported out of the region to other US states and to other countries. Therefore, it is likely that new ethanol produced in Minnesota would be sold outside of the Midwest and in states that have low carbon fuel policies such as California. National ethanol consumption is largely driven by the US Environmental Protection Agency's (EPA) Renewable Fuel Standard (RFS), which requires 15 billion gallons of conventional biofuel each year and annually increasing amounts of advanced biofuels. Because of these factors, an additional 30 million gallons of ethanol produced in Minnesota would likely not have a significant market impact within the state, but instead would be readily subsumed into the national and international ethanol market as a volumetric replacement for gasoline."*

4.2 Project Specific Issues

4.2.1 Facility Location/Site

The location of a gasification facility for the Project Board has not been determined. Additional work will be needed to determine what if any of the gasification system equipment can be located at the Newport Facility. The assumption in the financial analysis is that the gasification facility is located within ten (10) miles of the Newport Facility. An acceptable site for the gasification system is necessary. It would be advantageous to co-locate the gasification equipment at the Newport Facility, another waste management facility or at a refinery.

4.2.2 Potential Project Inter-relationships/Partnerships

There has been some legislative activity in 2015 regarding incentives for non-crop/biomass ethanol production that could provide additional revenues for an MSW gasification facility.

There may be other sources of MSW, C&D wastes, auto shredder residues, etc. that could provide additional tonnage input and improve economies of scale.

4.2.3 Regulatory Processes

The gasification technologies will be new for state and local regulators. Data from the commercial start-up facilities operations will be beneficial in providing information on permitting in other locations and the actual performance of each vendor. Educating the regulators and citizens will be important.

4.3 Economics

As noted, there is a shortage of data regarding the actual costs and revenues associated with gasification technologies although the economics are believed to be favorable. It will be helpful to gather additional information on projects being developed to learn how to properly structure a procurement process to best suit the Project Board.

4.4 Impacts of Adding Gasification

4.4.1 Change Vehicle Traffic

Based on a gasification plant located within 10 miles of the Newport facility, it is anticipated that there would be no significant change in vehicle traffic (incoming and outgoing) from the Newport Facility. If future information indicates that a gasification plant could be co-located at the Newport Facility, there would no longer be transfer trailer traffic associated with the RDF being transported off site but there would be a change in truck traffic to "exporting" the products produced from syngas such as ethanol tanker trucks.

4.4.2 Change in Odor

The MSW entering and materials (recyclables, RDF, etc.) exiting the Newport facility will remain unchanged with the addition of gasification as a component in the Scope for Resource Management. If a gasification plant was co-located that the Newport Facility there may be some additional "refinery related" odors.

4.4.3 Change in Noise

Based on a gasification plant located within 10 miles of the Newport Facility, no change in noise is anticipated since the current system for processing MSW into RDF would be unchanged. If gasification was added to the system at the Newport Facility, it is anticipated to result in minimal change in the amount of noise since refinery operations are not thought of as generating noise off site.

5 Potential Specific Steps for Project Board

Related to the additional data needs are the potential specific steps to use to gather the necessary information. These steps include:

- Continue monitoring start up status of technologies and facilities identified previously and any others that develop
- Continue attending appropriate conferences and conduct site visits
- Seek procurement and contract documents from similar projects around North America
- Establish contacts with public entities representing other communities that are going through their process to develop a facility (Maine, Iowa, etc.)
- Better understand Fiberight technology including activities such as a limited site visit to the demonstration plant, invite them to meet here with staff and consultants including a Newport Facility site visit, discuss use of the Newport Facility site with their specific technology
- Seek better data on economics (costs and revenues, revenue sharing, risks – assignment and mitigation) and performance (planned versus actual)
- Continue trying to connect with Ineos Bio representative
- Preliminary discussion with potential ethanol markets
- Continue relationship with Great Plains Institute regarding ethanol markets
- Monitor legislation related to ethanol production
- Discuss Fulcrum delivery agreements with local representatives of Waste Management and Waste Connections
- Preliminary consideration of potential site locations for gasification system including exploratory interest in partnering relationships

Following these specific steps and obtaining this additional data will provide valuable information for making a decision about proceeding with procurement of a gasification system as part of the Scope for Resource Management.