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2020
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2030

Circular Economy Case Study: Kent County's Sustainable Business Park

International Society for Industrial Ecology 2023 Webinar
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Today's
Speakers

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GBB is an international solid waste management consulting firm that helps public- and private-sector organizations craft practical, customized and technically sound solutions for complex solid waste management challenges.

Since 1980, GBB has been a trusted resource at the forefront of the industry, creating success stories that integrate smart planning with effective management of solid waste services. Our staff enables our clients to do more with less.



ENVIRONMENT



SOCIAL



GOVERNANCE



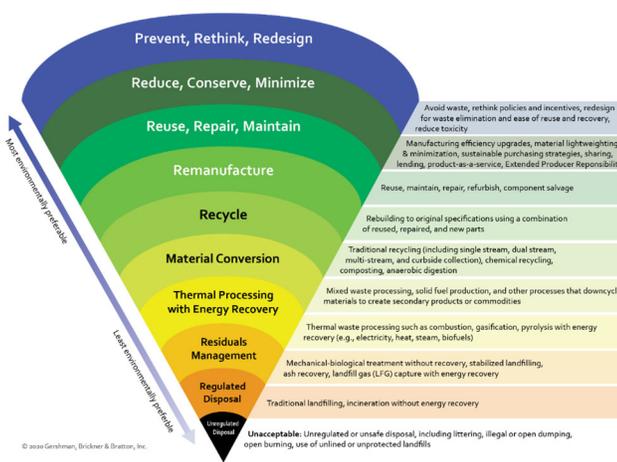
CARBON neutral



The SMM Hierarchy

- The sustainable materials management (SMM) waste hierarchy is a tool used to establish preferred management practices for waste materials – such that waste generation prevented in the first place. This hierarchy is in line with GBB's vision and mission to use discarded materials as resources rather than allowing them to be wasted. Such a strategy has significant environmental, economic, and social benefits.

Sustainable Materials Management Hierarchy



Prevent, Rethink, Redesign	Avoid waste, rethink policies and incentives, redesign for waste elimination and ease of reuse and recovery, reduce toxicity
Reduce, Conserve, Minimize	Manufacturing efficiency upgrades, material lightweighting & minimization, sustainable purchasing strategies, sharing, lending, product-as-a-service, Extended Producer Responsibility
Reuse, Repair, Maintain	Reuse, maintain, repair, refurbish, component salvage
Remanufacture	Rebuilding to original specifications using a combination of reused, repaired, and new parts
Recycle	Traditional recycling (including single stream, dual stream, multi-stream, and curbside collection), chemical recycling, composting, anaerobic digestion
Material Conversion	Mixed waste processing, solid fuel production, and other processes that downcycle materials to create secondary products or commodities
Thermal Processing with Energy Recovery	Thermal waste processing such as combustion, gasification, pyrolysis with energy recovery (e.g., electricity, heat, steam, biofuels)
Residuals Management	Mechanical-biological treatment without recovery, stabilized landfilling, ash recovery, landfill gas (LFG) capture with energy recovery
Regulated Disposal	Traditional landfilling, incineration without energy recovery
Unacceptable	Unregulated or unsafe disposal, including littering, illegal or open dumping, open burning, use of unlined or unprotected landfills

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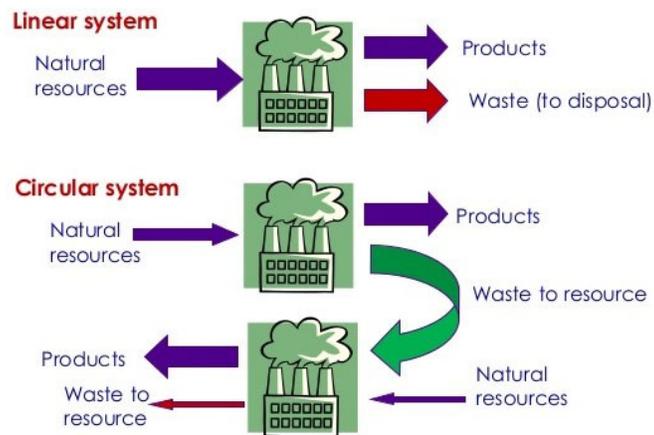
The Circular Economy

- The goals of the circular economy (CE) are to design out waste and pollution, to keep products and materials in use, and to regenerate natural systems.
- Using a SMM hierarchy and a CE model for how we think about and act on materials and waste serves to underpin *a world where discarded materials are used as resources rather than wasted* by limiting dependence on raw materials and resources, localizing economic activity, and using materials that are already in the system as manufacturing inputs.



Industrial Symbiosis

- Industrial symbiosis focuses on synergies among the organizations for recycling of industrial wastes.
- Circular economy focuses on extending the product life cycle through product design, slowing and narrowing resource use through technological innovation, and re-gaining value in the product cycle.





Kent County, Michigan

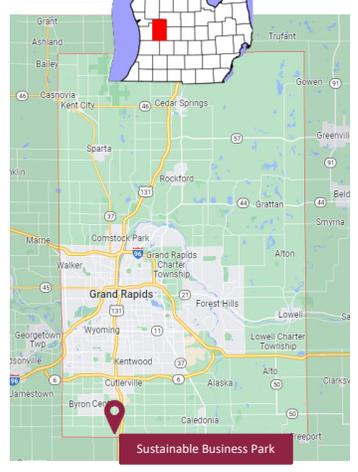


-  Economic hub of Western Michigan
-  Home to the City of Grand Rapids
- 2 Second largest city in Michigan
-  Manufacturing & agriculture-based economy
-  625,000 tons / year of municipal solid waste

Department of Public Works manages public solid waste management infrastructure:

- ✓ Single Stream, 30,000 TPY MRF
- ✓ 600 TPD Waste-to-Energy Facility
- ✓ 1,000 TPD landfill w/LFG-to-electricity facility
- ✓ Ancillary transfer station, HHW & citizen drop off amenities
- ✓ Responsible for two closed legacy landfills
- ✓ Managed as an Enterprise Fund

A 1990's Integrated Solid Waste Management System



What led to a need to Reimagine Trash?



>10 years	Landfill capacity
30 years old	Waste-to-Energy facility
15 years old	Single-stream MRF
2.3% compound growth rate	Waste generation increase
17% Only	Recycling rate

-  Citizens asking for more effective recycling services
-  Local industry demanding zero waste to landfill options
-  Increasing scrutiny → long-term landfill monitoring costs

Changes were needed!

What is the Kent County Sustainable Business Park?

How did it come about?

Public Private Partnership (PPP) to establish an integrated material recovery & manufacturing complex



Established by the Kent County Department of Public Works to advance an ambitious goal



On 250 acres of landfill purchased to host a new landfill

Project Development agreement in place to build, own and operate the Anchor Tenant Facility



Sustainable Business Park Master Plan



2017 Vision:
Reduce landfill waste by **90% by 2030**
• 625,000 TPY of MSW currently generated



Vision's Centerpiece:
Sustainable business park on 250 acres owned by DPW for landfill expansion



Master Plan:
Developed by GBB-led multidisciplinary team

The Master Plan development included:

- ✓ Waste evaluation and characterization
- ✓ Processing technology reviews
- ✓ Site suitability investigation
- ✓ Economic modeling
- ✓ Tipping fee impact analysis
- ✓ Public/stakeholder outreach & education



Approved by the DPW Board in August 2018

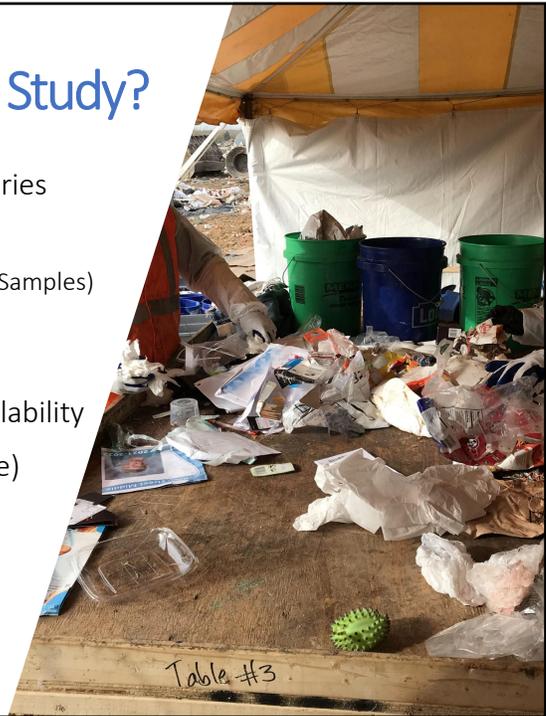
2020
20%

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2030
90%

What is a Waste Characterization Study?

- Material sorted by hand into pre-determined categories
- Kent Study followed **ASTM D 5231 Guidelines**:
 - 200 lb. or greater sample size (Avg. 227 lbs. per Sample, 57 Samples)
 - 50 Material Categories
 - Chosen to give insight to the processing system needs
- Trucks chosen at random based on truck type & availability
- Each sample was linked to truck type (generator type)
- Sort philosophy guided by how the equipment would *process or recover each item*



Kent County Waste Characterization Study

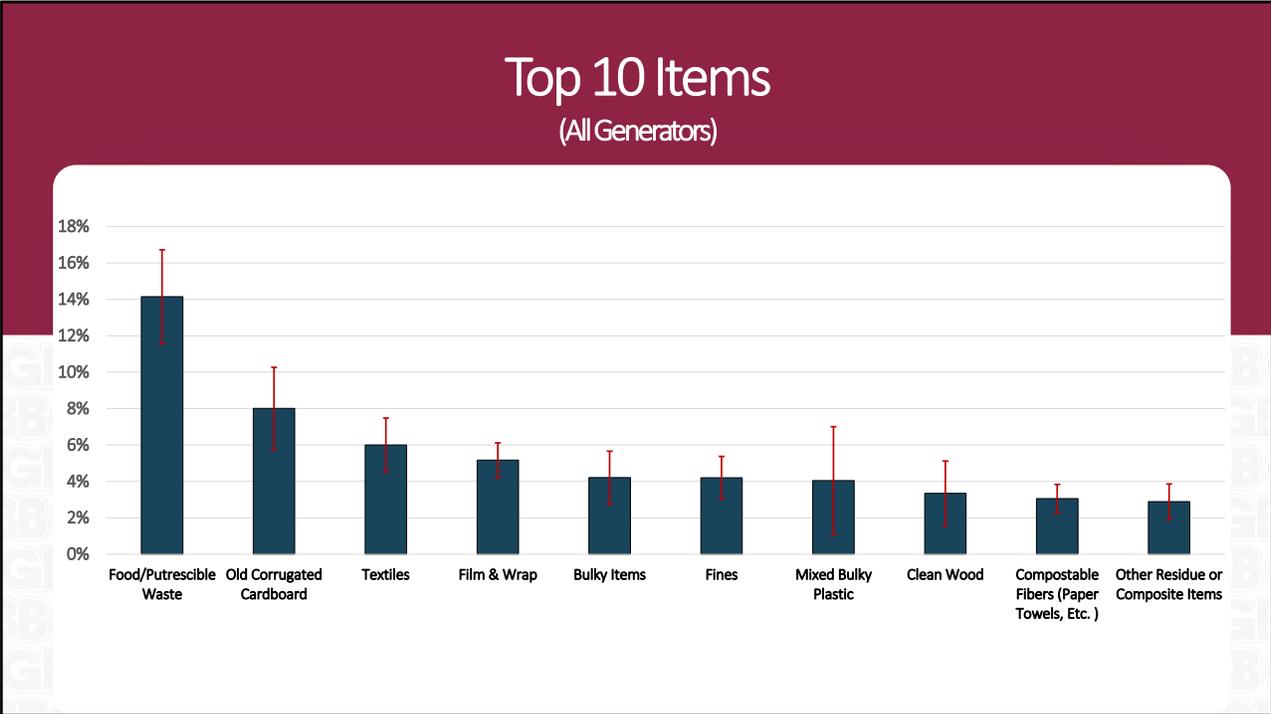
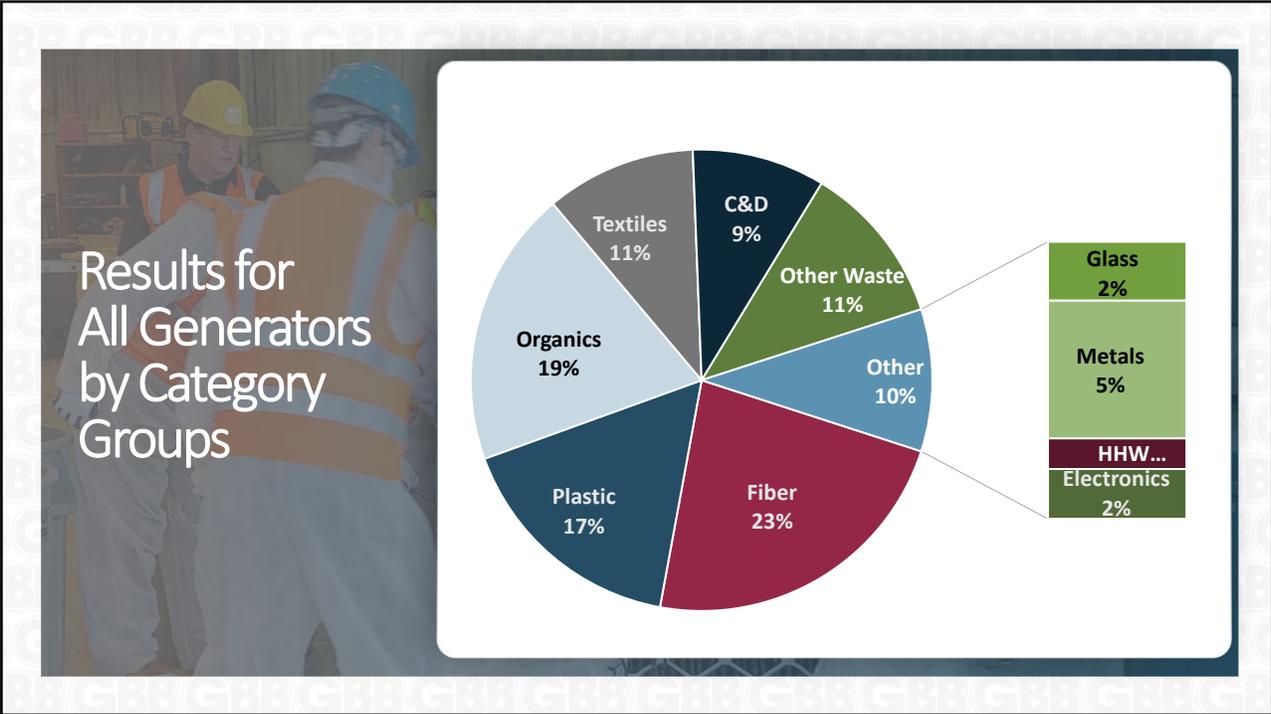
12-day field data collection phase

- Monday, October 25th – Friday, November 6th
- 12,935 pounds of waste sorted across 3 locations
 - WTE Facility
 - Transfer Station
 - SKL

Waste designated by truck type to evaluate
Composition by Generator Type



Side / Rear-Load Packer	Front Load Packer	Compactor	Roll-Off	Self-haul
				
Residential	Commercial	Commercial	C&D	C&D or Residential



The Anchor Tenant RFP

Procurement for accepting **400,000 TPY of MSW** to:

- ✓ Recover traditional recyclables
- ✓ Convert organic waste into renewable natural gas and compost
- ✓ Produce proprietary products

- ✓ World-wide procurement
- ✓ Conducted through Kent County Department of Fiscal Services

June 2020

- Issuance of a Request for Proposals for an Anchor Tenant



September 2020

- 7 responses received
- Extensive Review / Evaluation



September 2021

- Joint venture recommended to Board of Public Works as anchor tenant



March 2022

- Project Development Agreement approved by the DPW Board

Anchor Tenant Facility

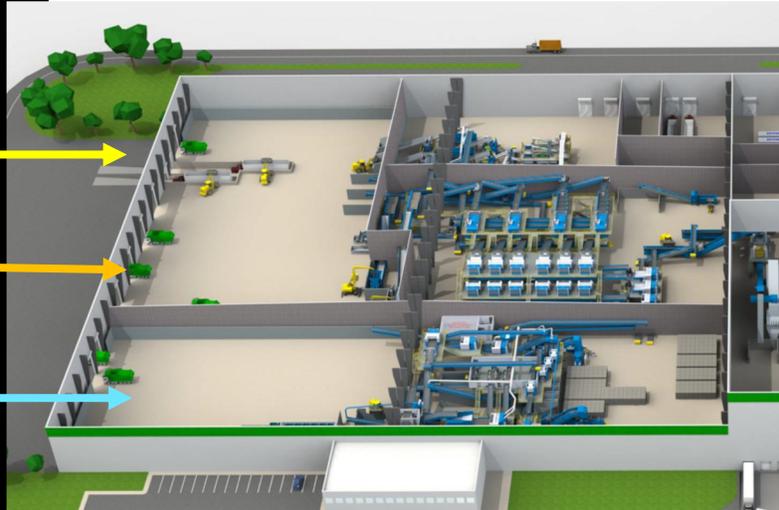


Waste Receiving

Source Separated
Organics

Mixed MSW

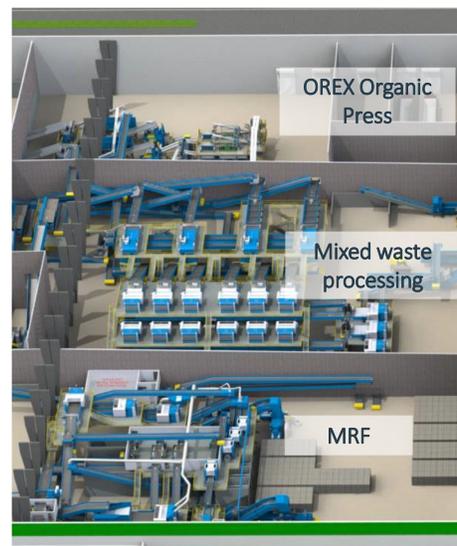
Single Stream Recycling



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Processing

- Mixed MSW is processed through series of screens and sorters to fractionate the stream based upon size and densities.
- Recovered recyclables are conveyed to the material recovery element
- Organic waste is separated and sent to the OREX press to produce an organic slurry
- Plastic film and low-grade fiber are recovered and transferred to the board manufacturing element
- Residue is consolidated for shipment to either a landfill or the County's waste-to-energy facility



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Anaerobic Digestion for Pipeline RNG

Feedstocks may include:

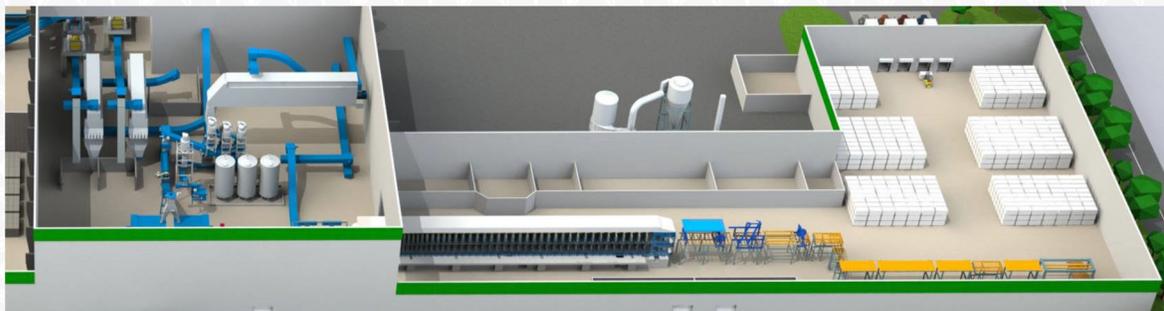
- Organic waste slurry from the MSW process
- Manufacturing waste from regional manufacturers
- Fats Oils and Grease



Integrated Board Manufacturing

Low quality fiber and plastic film feedstocks

- Transforms negative value material in high value product
- Up to 150 million sq ft per year of roofing cover board
- Enough to re-roof 1,500 Department Stores per year



SBP
Benefits

- 43,000 tpy of incremental recyclables recovered
- 76,000 tpy of low-grade fiber and film converted into construction board
- 370,000 MMBTU per year of pipeline Renewable Natural Gas
- 93,000 tpy of digestate cake fertilizer



Sustainable Business Park

- Assumes 400,000 TPY MCW capacity at MWP; remaining MCW to WTE
- Assumes no C&D processed
- Residue from MWP goes back to WTE facility
- Assumes current collection system, not single bin system
- Estimates current MWP proposed recovery
- MRF recovery includes single-stream processing and other recovery from MWP including board manufacturing



GHG Equivalent Emissions (MTCO2E) Avoided: (364,418)

Incremental Difference from Current System: (301,214)

Material Flow

490,610
Kent Generated
Processible Tons

WARM Material Destinations - Sustainable Business Park

Destination	Percentage
MRF/MWP	34%
Landfill	17%
WTE	34%
Organic	16%

Environmental Justice Impacts of SBP

Selected Variables	State Percentile	EPA Region Percentile	USA Percentile
Environmental Justice Indexes			
EJ Index for Particulate Matter 2.5	14	17	11
EJ Index for Ozone	14	17	12
EJ Index for 2017 Diesel Particulate Matter*	25	34	25
EJ Index for 2017 Air Toxics Cancer Risk*	17	22	20
EJ Index for 2017 Air Toxics Respiratory HI*	20	28	25
EJ Index for Traffic Proximity	25	18	13
EJ Index for Lead Paint	25	28	15
EJ Index for Superfund Proximity	22	20	14
EJ Index for RMP Facility Proximity	5	10	6
EJ Index for Hazardous Waste Proximity	42	49	36
EJ Index for Underground Storage Tanks	23	17	10
EJ Index for Wastewater Discharge	N/A	N/A	N/A

Non-Monetized Health Impacts

Health Endpoint	Change in Incidence (cases, annual)		Monetary Value (dollars, annual)	
	Low	High	Low	High
Mortality *	0.095	0.214	\$1,036,067	\$2,346,859
Nonfatal Heart Attacks *	0.009	0.081	\$1,400	\$13,008
Infant Mortality	0.001	0.001	\$6,392	\$6,392
Hospital Admits, All Respiratory	0.020	0.020	\$715	\$715
Hospital Admits, Cardiovascular **	0.020	0.020	\$1,018	\$1,018
Acute Bronchitis	0.111	0.111	\$69	\$69
Upper Respiratory Symptoms	2.013	2.013	\$86	\$86
Lower Respiratory Symptoms	1.415	1.415	\$38	\$38
Emergency Room Visits, Asthma	0.045	0.045	\$25	\$25
Asthma Exacerbation	2.086	2.086	\$155	\$155
Minor Restricted Activity Days	59.319	59.319	\$5,200	\$5,200
Work Loss Days	10.006	10.006	\$2,003	\$2,003
Total Health Effects			\$1,053,169	\$2,375,570

Local Economic Impacts

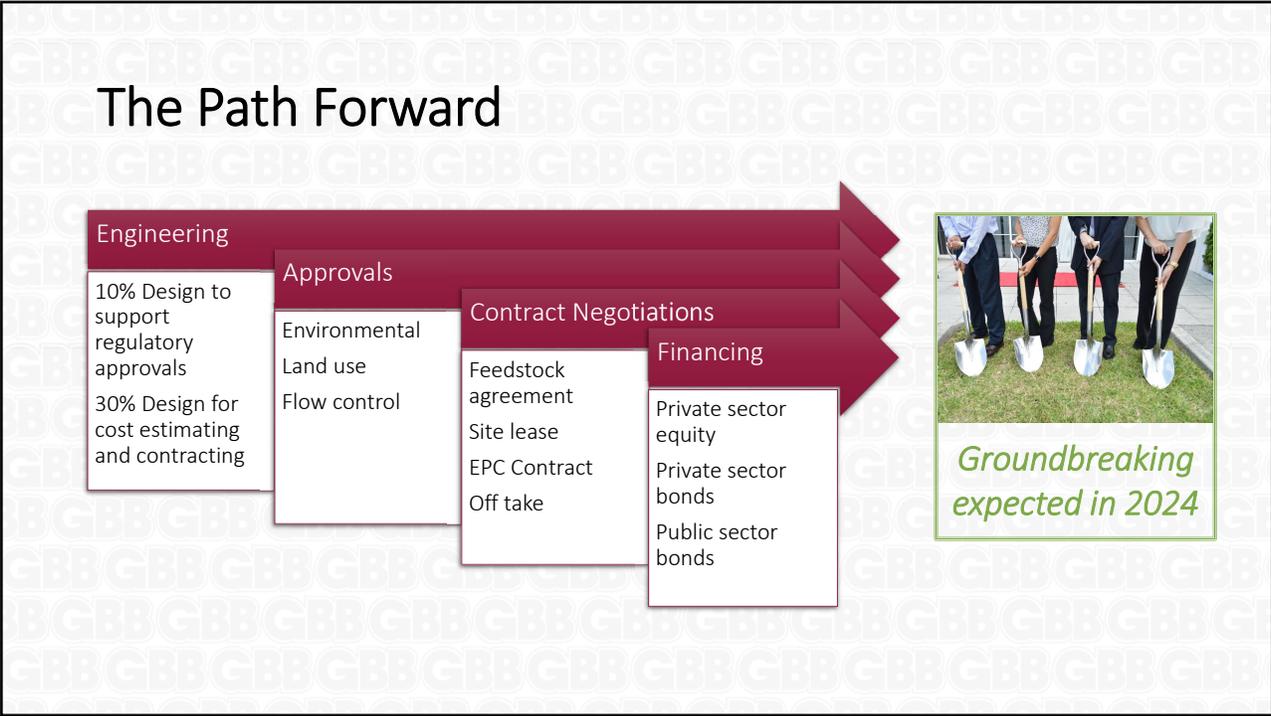
Parameter	Value			
Model Input				
Project Location	Michigan			
Year Construction Starts	2023			
Construction Period (months)	36			
Plant Feedstock Rate (US Tons/day)	2,212			
Service Factor (On-line time)	95%			
Money Value (Dollar Year)	2026			
Local Economic Impacts - Summary Results				
During construction period	Jobs	Earning (Millions)	Output (Millions)	Value Added (Millions)
Project Development & Onsite Labor Impacts	89	\$9.5	\$17.9	\$12.5
Local Revenue & Supply Chain Impacts	354	\$30.8	\$112.9	\$47.1
Induced Impacts	175	\$10.5	\$30.9	\$17.6
Total Impacts	618	\$50.8	\$161.7	\$77.2
During operating years (annual)				
Onsite Labor Impacts	64	\$3.4	\$3.7	\$3.4
Local Revenue & Supply Chain Impacts	58	\$4.9	\$19.1	\$7.7
Induces Impacts	39	\$2.5	\$7.2	\$3.3
Total Impacts	161	\$10.8	\$30.0	\$14.4

Air Pollution: Landfill to Anaerobic Digestion

Air Pollutant	A. Landfill (kg pollutant / metric ton waste)	B. Dry AD RNG to Pipeline (kg pollutant / metric ton waste)	Difference (B - A)	Project impact (kg Pollutant/yr)
PM _{2.5}	0.005	0	-0.005	-1175
VOC	0	0	0	0
NH ₃	0	0.75	0.75	176,250
NO _x	0.015	0	-0.015	-3,525
SO ₂	0.05	0.01	-0.04	-9,400

From Concept to Planning to Implementation

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Keys to Success So Far



-  Visionary leadership in the Public Sector Agency
-  Acknowledgment that doing the right thing will cost more in the near term than landfilling
-  A willingness to pay more now for long term benefit
-  Multidisciplinary project development team
-  Extensive public outreach and communication
-  Public control of a suitable site

Contact Us



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