The *BurCell* ®
System

CORNERSTONE RESOURCES

A disruptive technology for the recovery and repurposing of

waste organics

BURCELL

The Technology

The *BurCell* ® System converts otherwise wasted organic materials into highly efficient feedstock by increasing the available free sugars and surface area of the material that it processes. The process combines non-potable water with the incoming waste material utilizing a combination of heat (< 300^{O}F) and changes in operating pressures (from a deep vacuum to as much as 30 PSIG) to swell the organic material in the process cycle. The moisture in the process converts to a gas at low temperatures and explodes the cell walls of the organic materials. By keeping the process vessel in continuous motion a homogenous organic feedstock is produced which is then easily separated from the non-organic materials in the waste.

Alternatively, for gasification of the waste stream, by including the mixed plastics, the *BurCell* ® System produces a homogenous, engineered feedstock with a predictable Btu content.

BENEFITS

- **Recovers waste organics and waste paper products and combines them into a homogeneous and energy rich feedstock**
- **Functions without a boiler using untreated waste water while maintaining the purity of the organics. A zero discharge design**
- **Maximizes the organics recovered and enhances the biogas production of these materials**
- **Has the ability (when necessary) to pasteurize the material it processes, killing any pathogens**

Strategic Partners

Marathon Equipment Company

- A part of Dover Corporation's Environmental Solutions Group.
- Dover is a Fortune 500 company.
- ESG is a fully integrated equipment group serving the solid waste and recycling industry.
- Invested their own funds in the fabrication of a *BurCell* ® Demonstration System.
- Cornerstone's exclusive manufacturing and distribution partner.

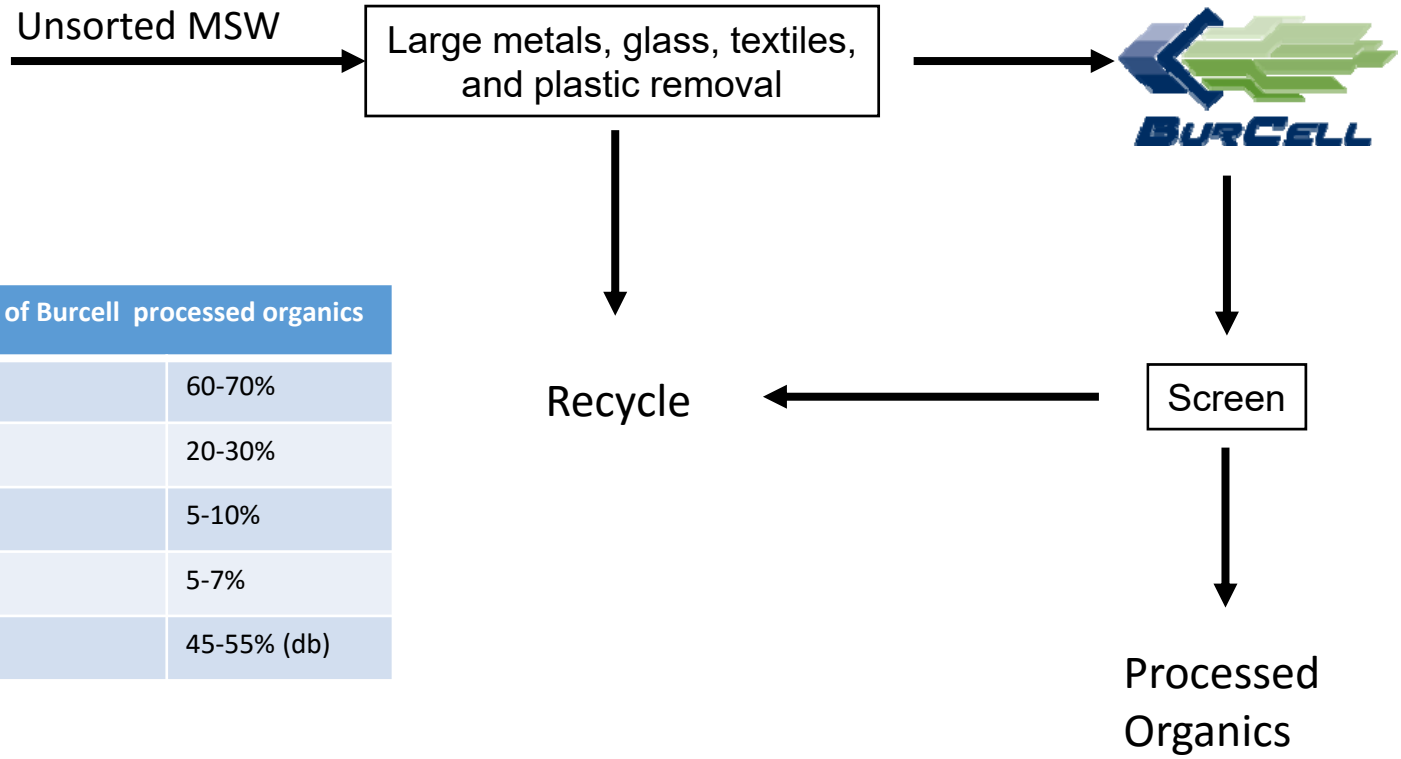
Organix Solutions LLC, a division of Randy's Environmental Services, Inc.

- Randy's is the largest independent waste management company serving the Twin Cities, MN area.
- Nationally recognized as an innovative leader in organics recovery and reuse due to their innovative BLUE BAG ORGANICS program.
- Currently developing and permitting the Organix Solutions project, a game changing waste processing project centered around the BurCell System.
- Randy's has an ownership interest in Cornerstone.

BurCell System manufactured by Marathon Equipment Co.

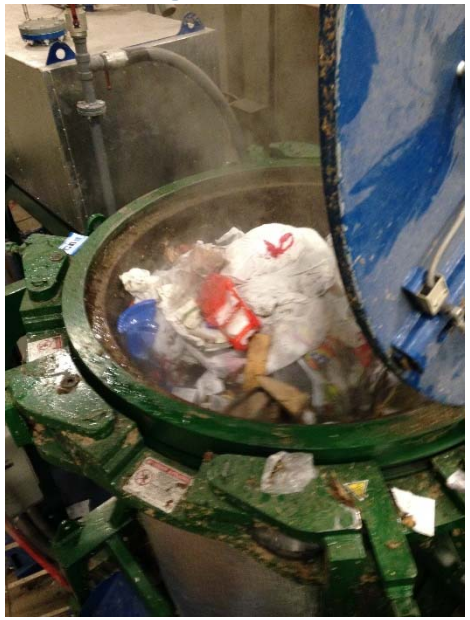
BurCell System Demonstration unit operating at Randy's Environmental Services, Delano MN.

Burcell. Pretreatment, homogenization and separation of organic part of MSW



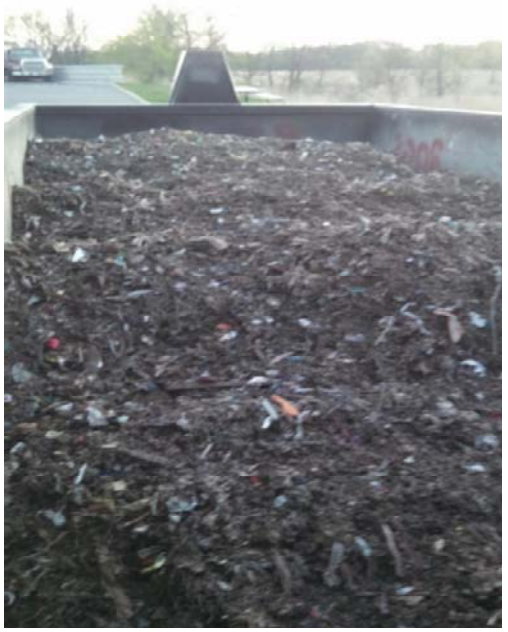
Average composition of Burcell processed organics	
Moisture	60-70%
Cellulose	20-30%
Hemicellulose	5-10%
Lignin	5-7%
Volatile solids	45-55% (db)

Delano testing – initial cycles on unprocessed residential MSW



Residential
MSW being loaded

Processed
MSW



2” screen organics

A recent AD trial

Baled MRF residuals (~ 70% waste paper and organics;30% film plastics and textiles)
prior to loading

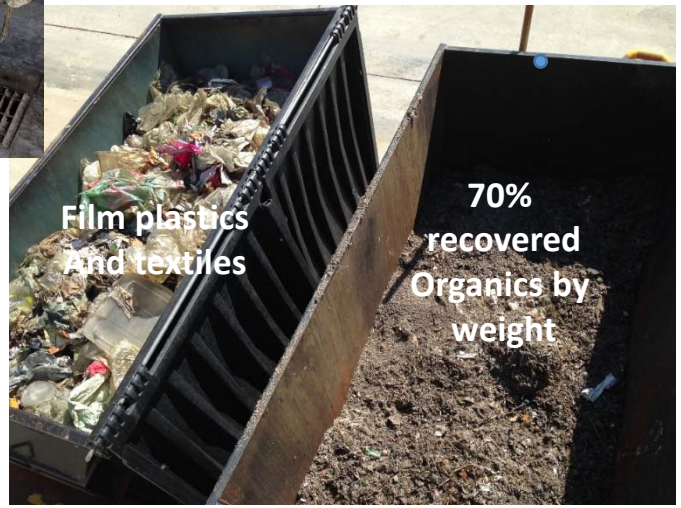
20 tons of unscreened *BurCell* Derived Feedstock delivered to Digester

+20% improvement in biomethane production

SCREENED (~1”) BurCell Derived Feedstock for a compost trial

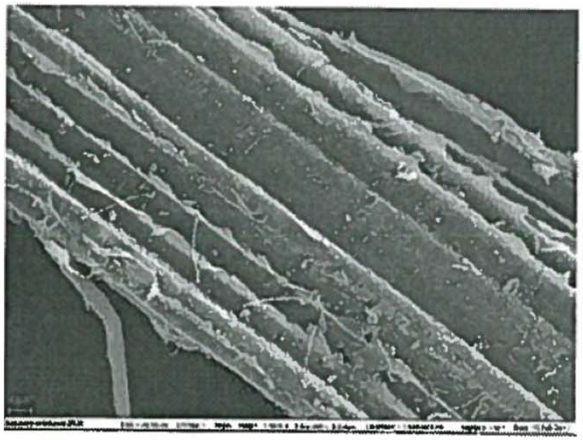
Material Characterization on next slide

Click here for a video

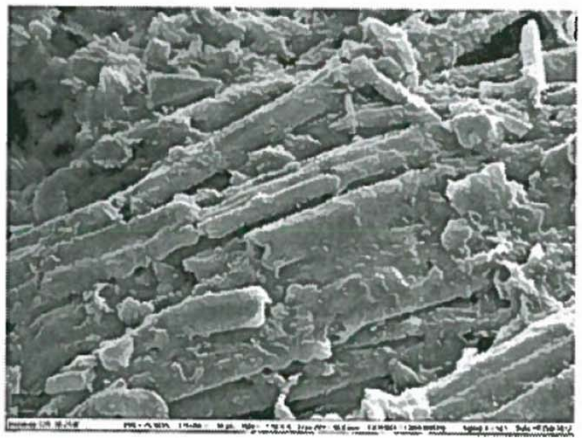


Effect of Burcell on MSW organics

- Solid reduction
- More uniform size
- Increased biogas potential for anaerobic digestion
- Reduced residence time in reactor
- Increased biodegradability and digestibility

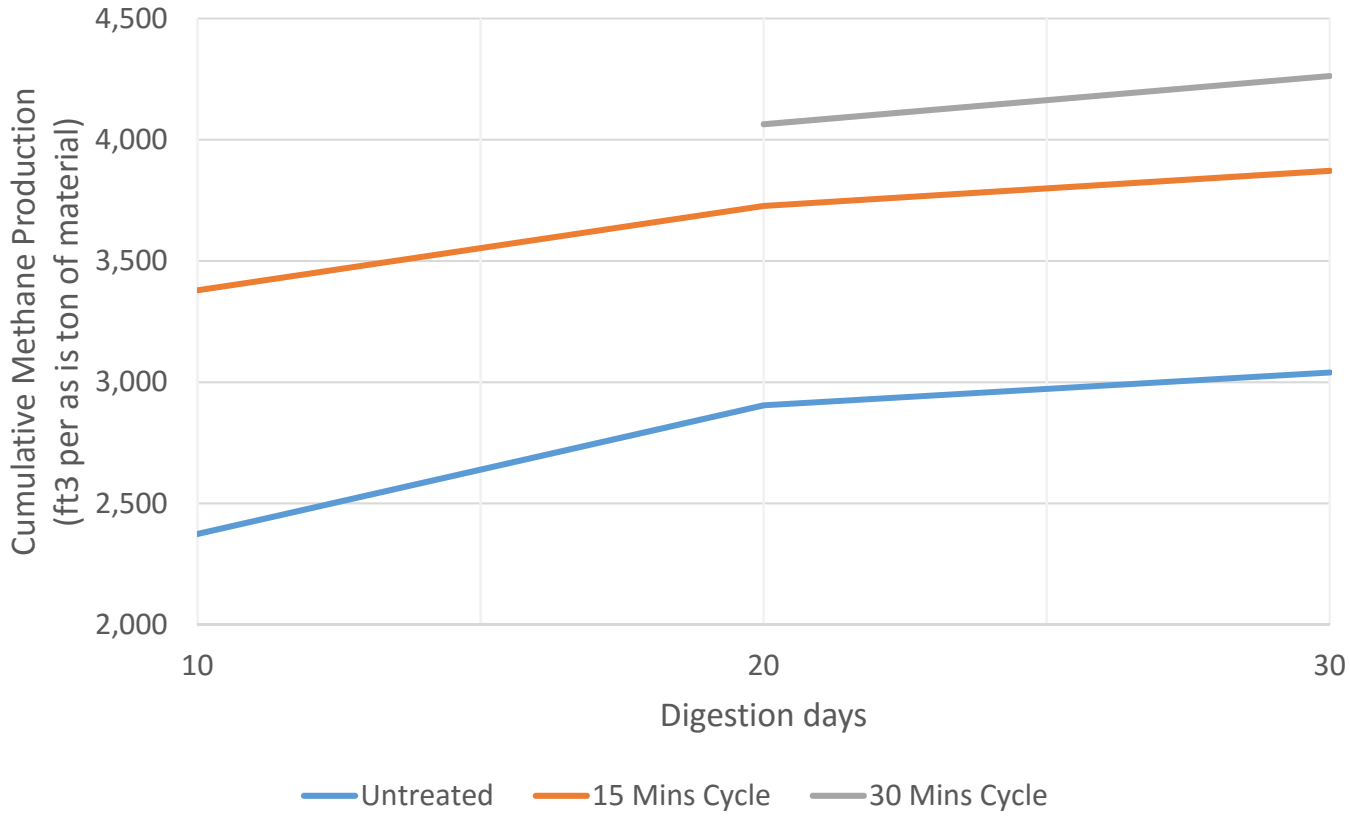


Untreated



After Treatment

Biogas Methane Potential of treated material



Consistent and significant increase in biogas potential because of increased digestibility

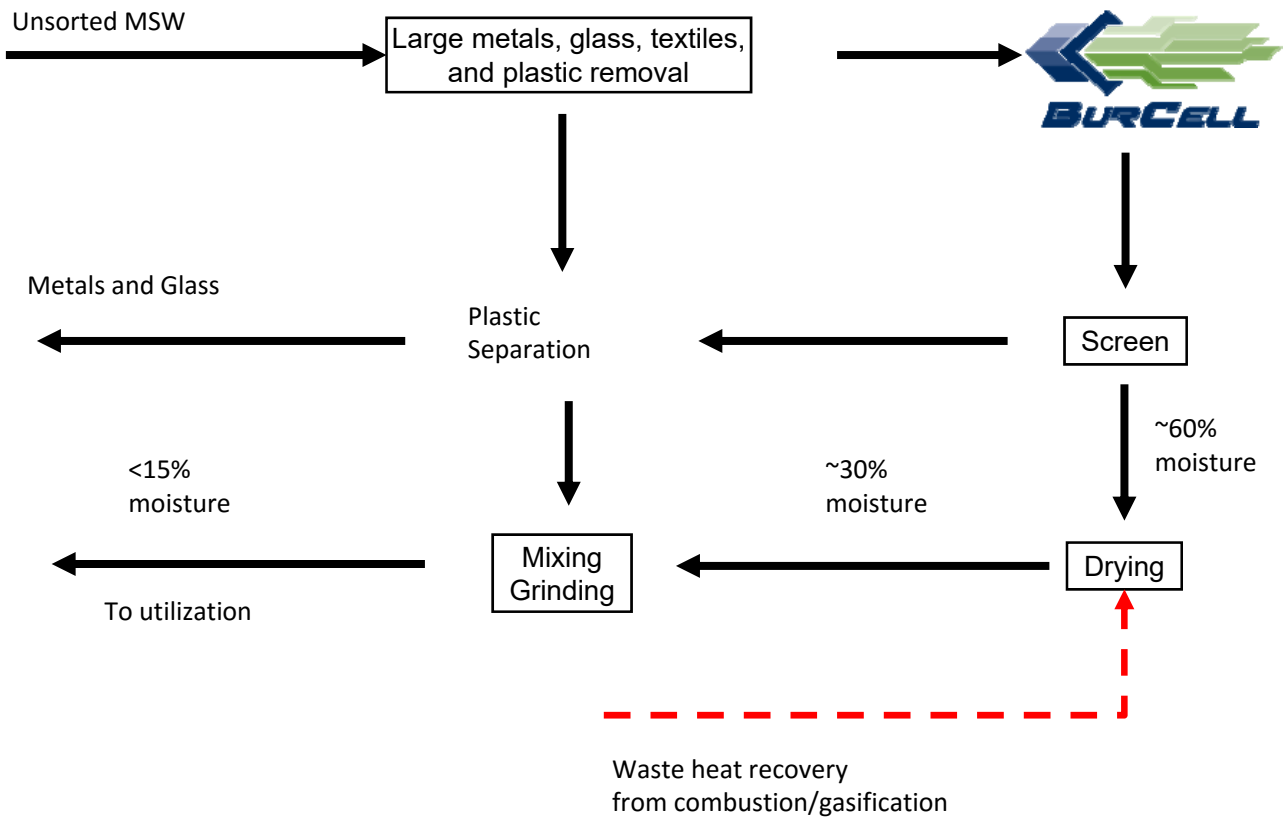
Characterization of BurCell Derived Feedstock from a fiber rich MRF residual stream

Based on a July 2015 laboratory analysis of the material derived from the demonstration unit, after screening to ¾" minus, compared to the MN Class 1 and Class II Compost Standards.

Feedstock meets all standards with the exception of C:N ratio and Reduction in Organic Matter.

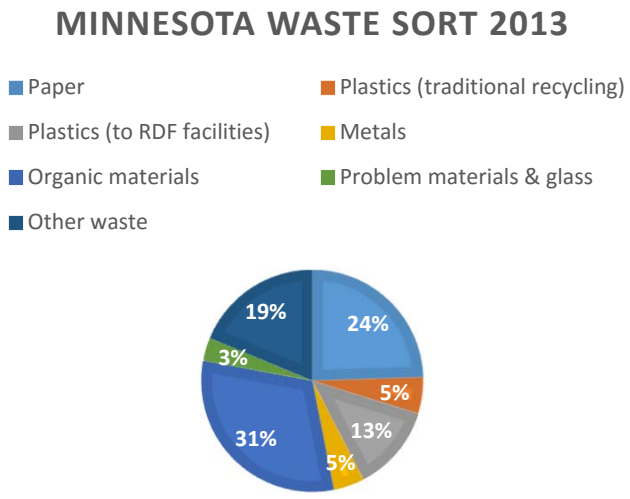
Parameter	Units	Class I	Class II	Original BurCell
Reduction in Organic Matter	%	> 60%	> 60%	73.56%
Compost Maturity, measured by one of the following:				
1. Carbon: Nitrogen Ratio	n/a	10:1 < C:N < 20:1	10:1 < C:N < 20:1	48.4
2. Dewar Temperature Rise	°C	0° < T < 20° C.	0° < T < 20° C.	n/a
3. Respiration, by CO_2 analysis	mg CO_2-C/g-C/day	< 2 -5	< 2 -5	5.15
4. Cress Seed germination	%	> 80%	> 80%	92
5. U of M Z-test	n/a	Cellulose worms > non-cellulose worms	Cellulose worms > non-cellulose worms	n/a
Inert material (> 4mm) content	%	< 3%	< 4%	0.63
Heavy metals limits		Absolute limits:	Cumul. Poll. Load Rate (lbs./acre)	
Arsenic	mg/kg	41	37	1.24
Cadmium	mg/kg	39	34	< 0.18
Copper	mg/kg	1500	1,338	41
Lead	mg/kg	300	267	12.4
Mercury	mg/kg	5	5	< 0.59
Molybdenum	mg/kg	18	16	1.66
Nickel	mg/kg	420	374	3.99
Selenium	mg/kg	100	89	< 0.56
Zinc	mg/kg	2800	2497	141.0
Polychlorinated biphenyls (PCBs)	mg/kg	< 6	< 6	0.04

Engineered high BTU fuel



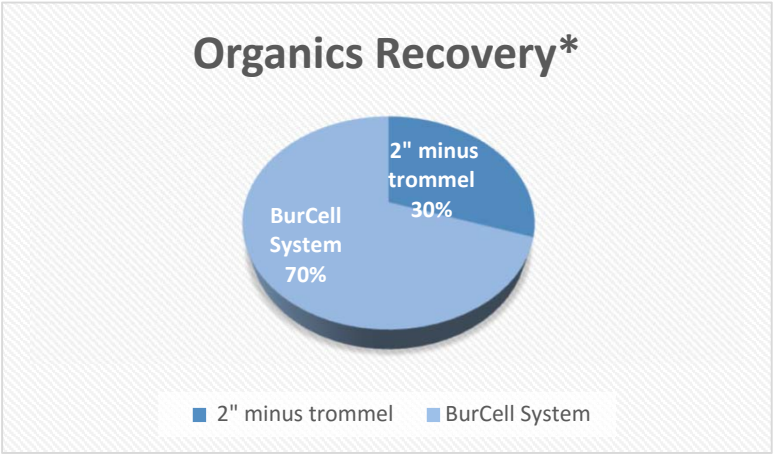
Addition of plastics to homogenized organics allows lowering overall moisture content and control heating value

BurCell System – Predicted Benefits for an MSW based Anaerobic Digestion and Compost Project

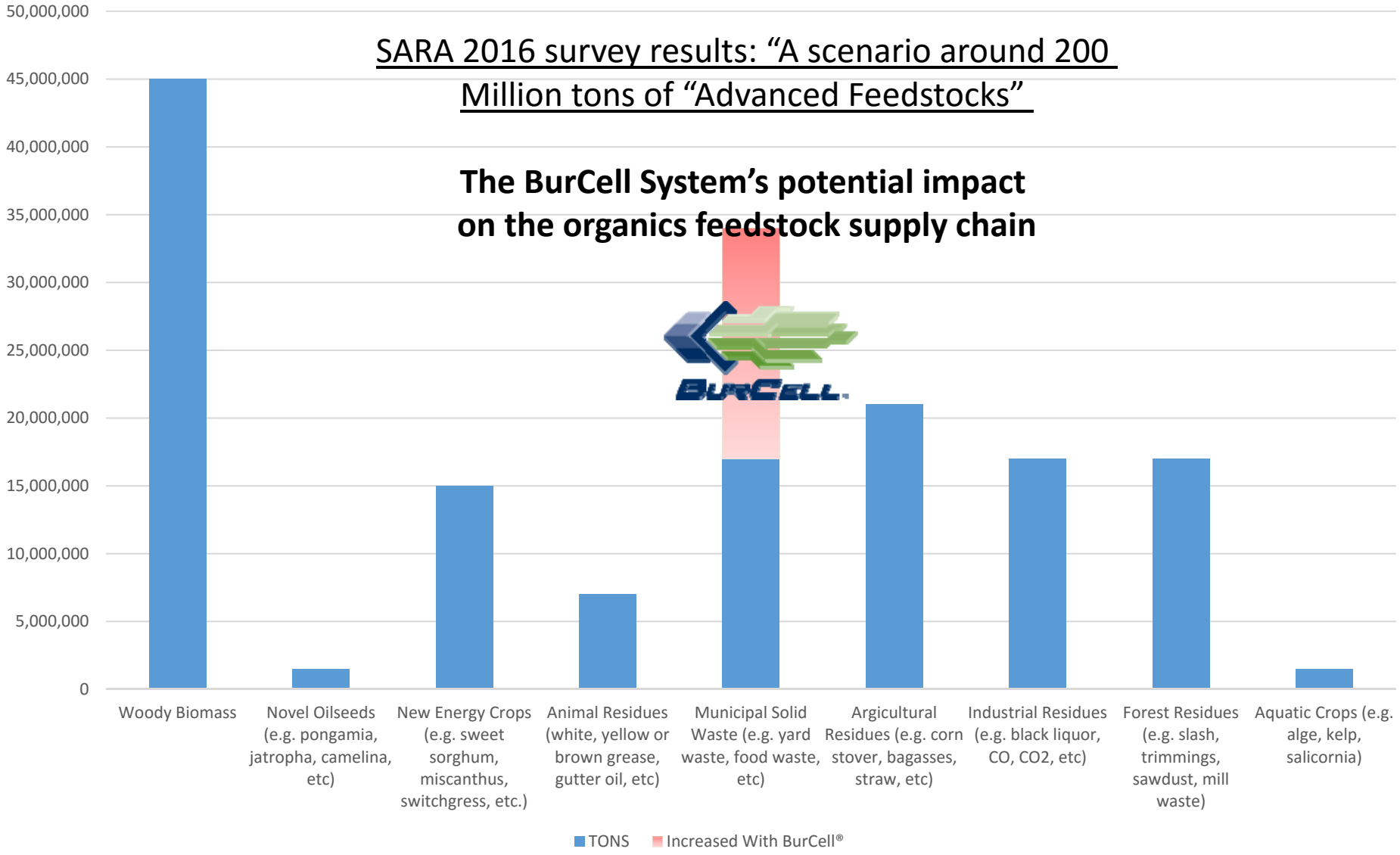


Improves the biogas yield
20% + for AD applications
and
produces a quality compost

Recovers all the remaining Organic material – 3 X improvement over mechanical systems

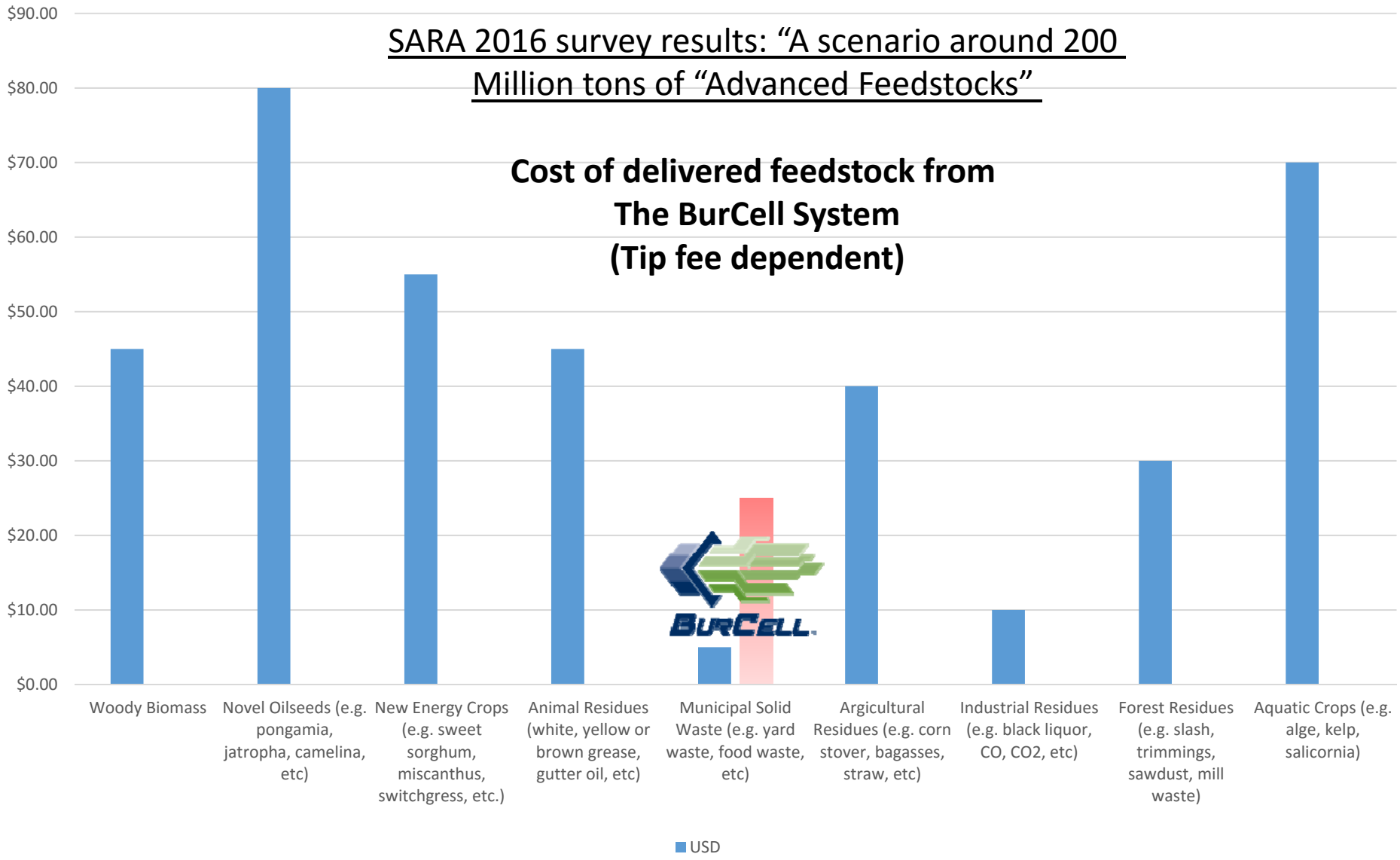


* Projected results, subject to waste characterization and other project specific variables



http://survey.constantcontact.com/survey/a07eclj0lc4inhg78h6/results. The Digest. "SARA 2016 – Sustainable, Affordable, Reliable, Available feedstocks".

SARA 2016 survey results: "A scenario around 200 Million tons of "Advanced Feedstocks"



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Questions

--Ron Barmore--

ron@cornerstone-resources.com