



Calumet Biogas Risk Assessment

Board Study Session

MWRD

April 5, 2018



Background

- Resource recovery, energy neutrality, renewable fuel standard opportunities
- Potential cost savings/revenue generation
- Significant risk
- Understand opportunities and risks to define the path forward

Objectives/Purpose

Risk assessment for:

- HSLW market and HSLW receiving facility viability at Calumet WRP
- Potential biogas utilization options for Calumet WRP
- RNG utilization option at a large biogas volume high BTU facility (like Stickney WRP) based on Calumet risk model

Terminology

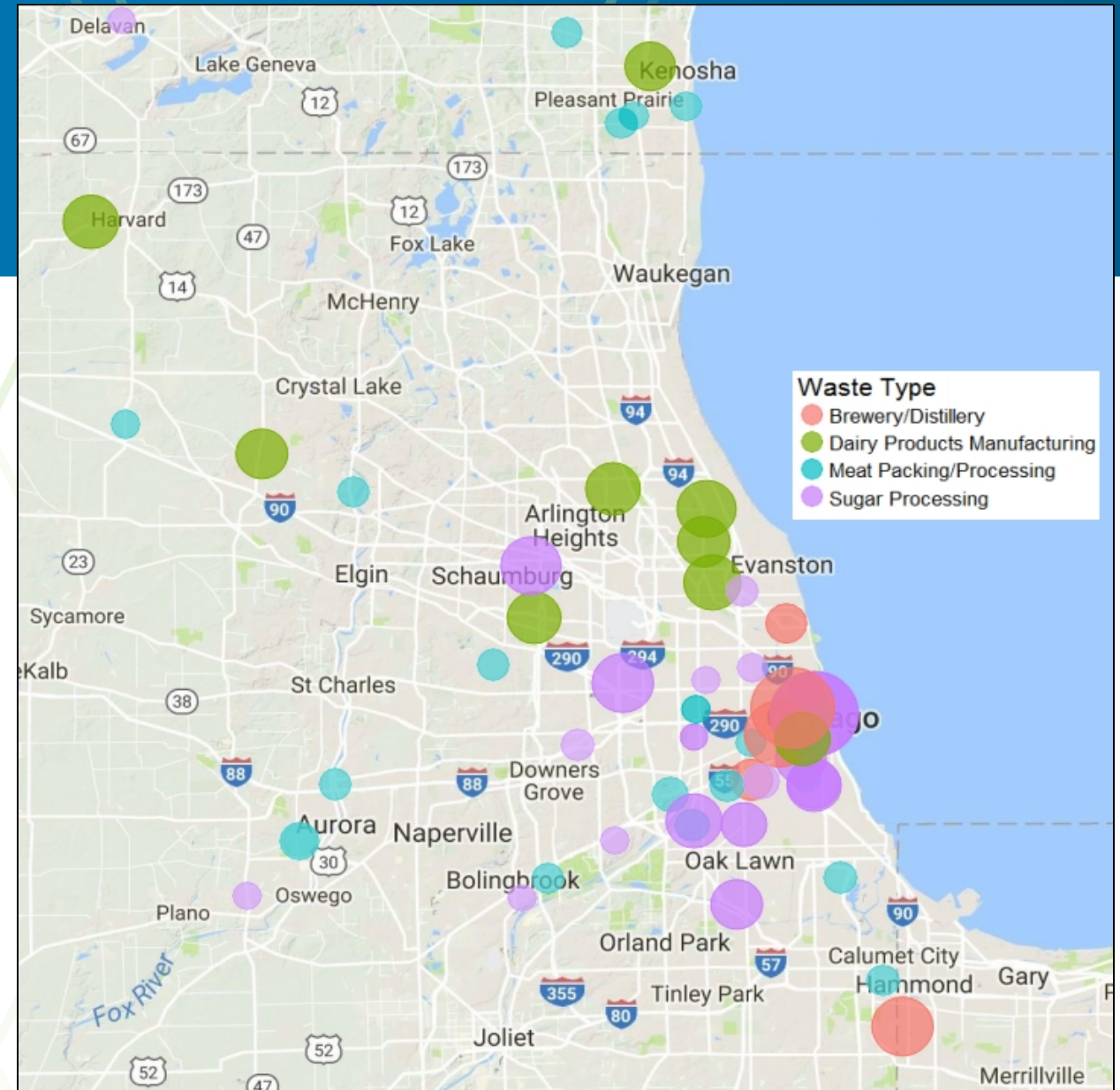
- Risk
- HSLW/Fermenters
- Supplemental carbon
- Gas utilization options – CHP, RNG, CNG
- RFS
- Transportation fuel (RNG or CNG)
- RIN

HSLW Program at Calumet WRP

- Bio-P carbon demand: 193,000 lb COD/day
- HSLW market assessment
- Comparison to premium carbon and chemical P removal
- Risk assessment of HSLW receiving station/fermenters



Local HSLW Generators



Summary of HSLW Quantities, Strength and Tipping Fees/Costs

HSLW Category	Assessed Volume (gpd)	Assessed Soluble COD (lb/day)	Tipping Fee/(Cost) Range (\$/gal)
Premium - MicroC 2000™	NA	NA	(1.50)-(1.75)
Ethanol Waste - Thin Stillage	12,900,000	3,820,000	(0.00)-(1.00)
Biodiesel Waste - Crude Glycerol	68,200	586,000	(0.80)-(1.15)
Meat Packing/Processing Waste	422,000	17,700	0.01-0.03
Sugar Waste	700,000	222,000	0.00-0.03
Brewery/Distillery Waste	288,000	140,000	0.00-0.03
Dairy Waste	111,000	18,500	0.00-0.03
Total	14,500,000	4,800,000	NA

HSLW Program Financial Risk Assessment

Financial Scenarios	Annual Chemical Cost	Annual Revenue (Tipping Fees)	Annual O&M Costs	Capital Costs	20-Year Net Value
Chemical	(\$4,350,000)	\$0	\$96,000	\$5,215,000	(\$94,110,000)
Premium	(\$13,400,000)	\$0	\$106,000	\$3,245,000	(\$272,992,000)
HSLW Conservative	(\$1,410,000)	\$1,840,000	\$479,000	\$5,977,000	(\$9,010,000)
HSLW Moderate	(\$422,000)	\$2,479,000	\$479,000	\$5,977,000	\$23,531,000
HSLW Aggressive	\$0	\$4,480,000	\$479,000	\$5,977,000	\$71,994,000

HSLW Risk Assessment

Risk Factors

Quality: Variability of HSLW is a risk to handling, storage, and process control

Competition: Other municipal WRPs and animal feed operations

Market Disruption: Significant changes the flow of products in a particular market

Risk Mitigation Strategies

HSLW Receiving Facility: Flexibility to receive varying HSLW quality and ensure operational flexibility

Supply Agreements: Consistent quality, availability and secured tipping fees

HSLW Conclusions and Recommendation

- HSLW market is sufficient to meet Bio-P carbon demand
- HSLW facility delivers:
 - Annual revenue flow
 - Cost savings over chemical and premium scenarios
 - Favorable 20-year net value
- Quality, competition, and market disruption risks are easily mitigated
- HSLW facility is financially viable



Recommendation: Proceed with full implementation of the HSLW receiving facility to meet Bio-P carbon demand for Calumet WRP

Gas Utilization Options and Risk

- Calumet Options
 - CHP
 - RNG
 - CNG
- Large volume high BTU facility such as Stickney – RNG option
- Risks and their impacts on feasibility

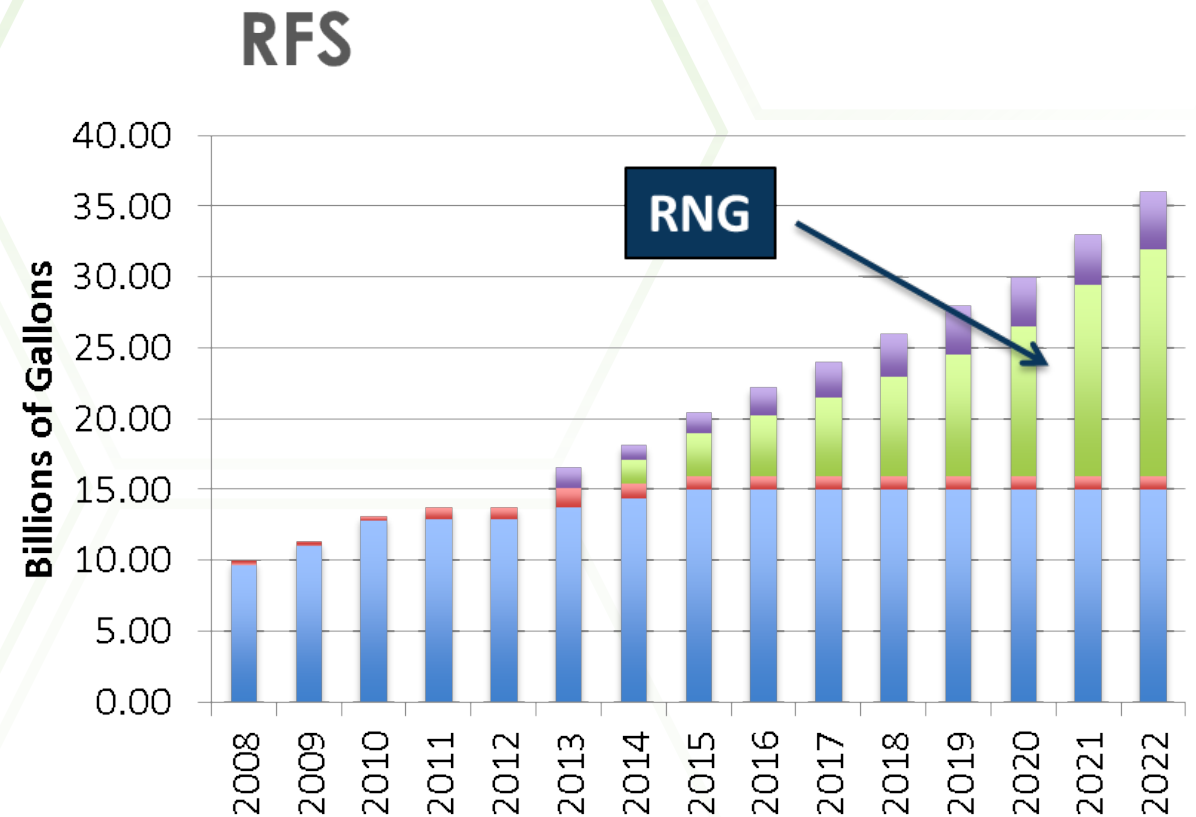
Risk Overview/Introduction

- Construction costs
- Regulatory changes
- Political changes
- RIN value variability
- Market forces
- Importance of RINs and other credits on project feasibility

Commodity	Current Value	Unit	per MMBtu	Regulatory Risk
Natural Gas Price	\$3.00	\$/MMBTu	\$ 3.00	Low-None
D3 RIN Price	\$2.50	\$/RIN	\$ 29.31	Low - Medium
LCFS Credit Value	\$125	\$/Metric Ton	\$8.30	Low
Total			\$40.61	

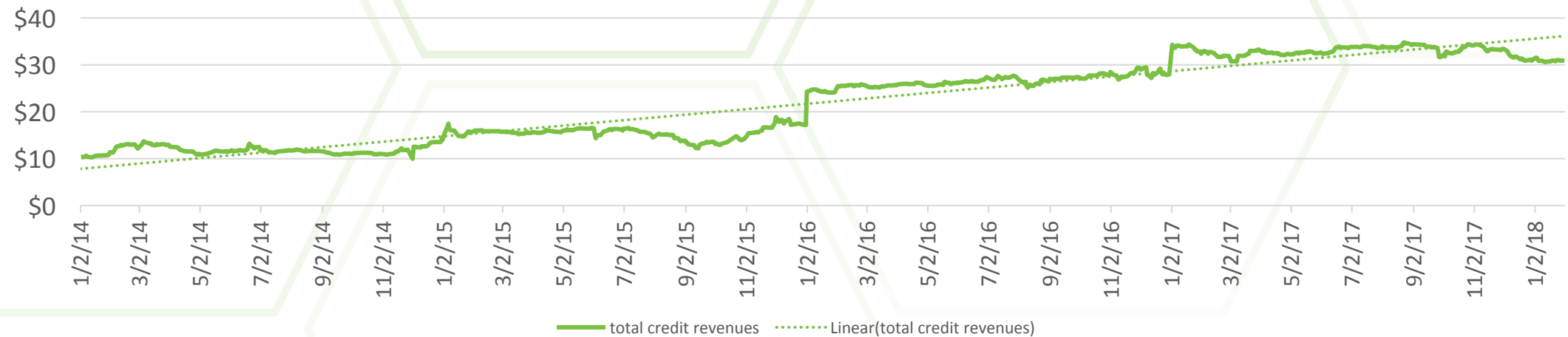
RFS Program Opportunities

- Renewable Fuel Standards (RFS) program
- Renewable transportation fuels
- Renewable Identification Numbers (RINs)
- Low Carbon Fuel Standard (LCFS) credits



RINs

Average basket of credit values (D3 RINS + LCFS) since 2014 per MMBtu



- RINs and renewable fuel credits
- RIN classifications by fuel type (“D”-codes)
- D3 RINs (municipal wastewater)= High Value
- D5 RINs (organic waste) = Low Value

RIN Related Risks

- Low annual RVOs (renewable volume obligation)
- D3/D5 requirements
- RIN pricing (with waiver credit)
- Changes to RFS (regulatory or post-2022)
- Other risks

Biogas Risk Assessment Methodology

- Conservative, Moderate and Aggressive risk scenarios
- Risk analysis and sensitivity to changes in RIN value

	Conservative	Moderate	Aggressive	Current Conditions
D3 RIN Value, \$/RIN	\$0.50	\$2.50	\$3.20	\$2.60
D5 RIN Value, \$/RIN	\$0.25	\$0.70	\$1.25	\$0.75
LCFS – Carbon Trading Price, \$/MT	\$0	\$75	\$175	\$125

Benefits, Risk and Risk Mitigation for RINs and Carbon Credits

BENEFITS	RISKS	RISK MITIGATION STRATEGIES
<ul style="list-style-type: none">• Municipal bio-solids to clean transportation fuel• Relatively low breakeven requirements• Displace millions of gallons of diesel each year• Reduce NOx emissions• MWRD model for sustainable urban development	<ul style="list-style-type: none">• Majority of revenues come from clean carbon premium• Regulatory risk related to federal clean fuel policies• Market impacts on RIN value	<ul style="list-style-type: none">• Diversify revenues into other carbon markets not correlated with federal policy• Secure long-term fixed-price contracts• Transfer risk to third-party• Quantify and monetize other environmental services provided

Calumet Biogas Utilization Options and Financial Analysis

- Objective for Calumet
- Utilization options
- Bioenergy model
- Financial risk analysis

Calumet WRP Financial Risk

		CHP SYSTEM COSTS		
CHP Option	Capital Costs	\$14,710,000 - \$18,770,000		
	Net Annual Value	\$1,172,000 - \$1,511,000		
	Payback Period, yrs	14.8 – 15.0		
		Conservative	Moderate	Aggressive
RNG Pipeline Injection Option	Capital Costs	\$33,670,000	\$33,670,000	\$33,670,000
	Net Annual Value	(\$799,000)	\$2,585,000	\$6,682,000
	Payback Period, yrs	NA ⁽¹⁾	13.0	5.0
		Conservative	Moderate	Aggressive
CNG Production & Fueling Station Option	Capital Costs	\$38,820,000	\$38,820,000	\$38,820,000
	Net Annual Value	(\$35,000)	\$3,349,000	\$7,446,000
	Payback Period, yrs	NA ⁽¹⁾	11.6	5.2

Calumet WRP Conclusions and Recommendation

- Potential RFS revenue can be significant, but is high risk
- RNG/CNG options do not have short payback periods
- Paybacks beyond 2022 have increased risk
- CHP payback times are reasonable and low risk



Recommendation: Proceed with a CHP option for biogas utilization at the Calumet WRP

**Large Volume
High BTU Facility
Biogas RNG
Utilization
Option**



Stickney Financial Risk Results

	Flow A	Flow B	Flow C	Flow D
DG from Sludge, Mcf/d	6,040	6,040	6,040	6,040
DG from OW & Food Waste, Mcf/d	0	4,300	6,690	9,070
Total DG, Mcf/d	6,040	10,340	12,730	15,110
Product Gas, MMBtu/day	3,072	5,260	6,475	7,686
% D3 RIN	100%	0%	0%	0%
% D5 RIN	0%	100%	100%	100%

Annual RIN Values	Flow A	Flow B	Flow C	Flow D
Net Annual Value				
Conservative	\$4,567,000	\$6,063,000	\$8,447,000	\$10,822,000
Moderate	\$30,021,000	\$19,999,000	\$25,611,000	\$31,200,000
Aggressive	\$49,088,000	\$49,770,000	\$62,264,000	\$74,706,000
Payback Period, years				
Conservative	14.7	11.1	8.0	6.2
Moderate	2.2	3.4	2.6	2.2
Aggressive	1.4	1.4	1.1	0.9

Conclusions and Recommendation for a Large Facility like Stickney

- RNG solution revenues can be very attractive
- RNG solution paybacks are very short, substantially reducing risk
- Early implementation further reduces risk
- RNG solution is financially attractive even with RIN variability



Recommendation: Proceed with a RNG pipeline injection solution for a large volume high BTU facility such as the Stickney WRP

Summary Recommendations

- *Proceed with full implementation of the HSLW receiving facility to meet Bio-P carbon demand for Calumet WRP*
- *Proceed with a CHP option for biogas utilization at the Calumet WRP*
- *Proceed with a RNG pipeline injection solution for a large volume high BTU facility such as the Stickney WRP*



Questions and Answers