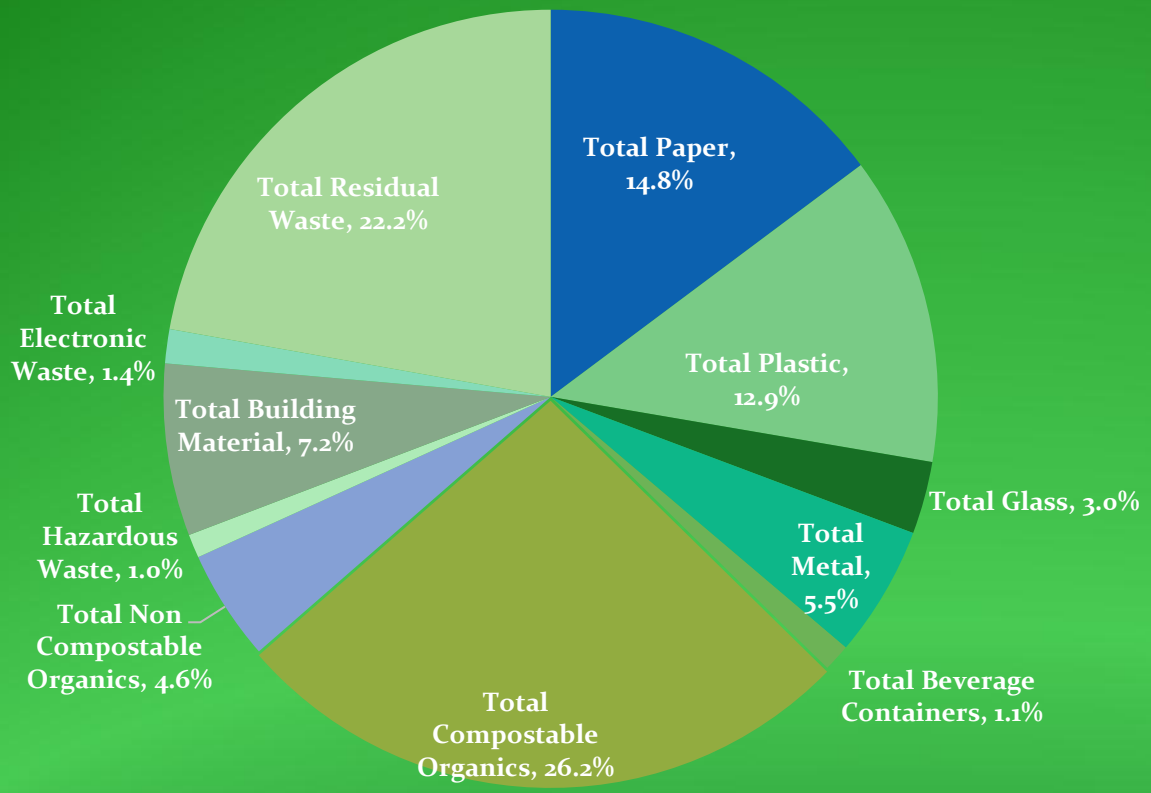
AUMA

November 2021

The SAEWA Project

Research and implementation of energy recovery from NON-RECYCLABLE WASTE MATERIALS to reduce long term reliance on landfills.

Waste Characterization



Significant waste diversion opportunities still present

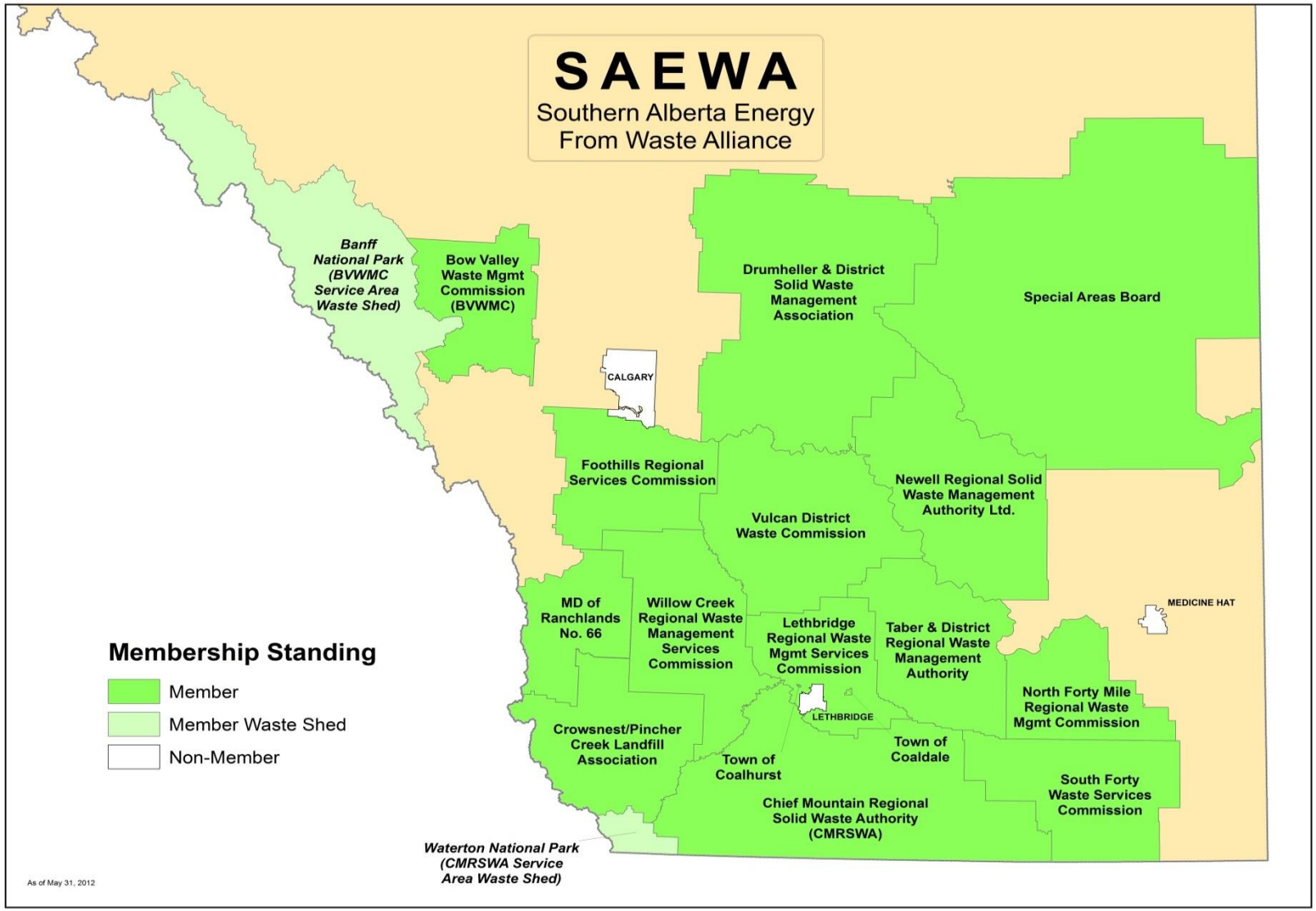
Used as input to:

- Volume of waste received at EFW
- Heat content of waste

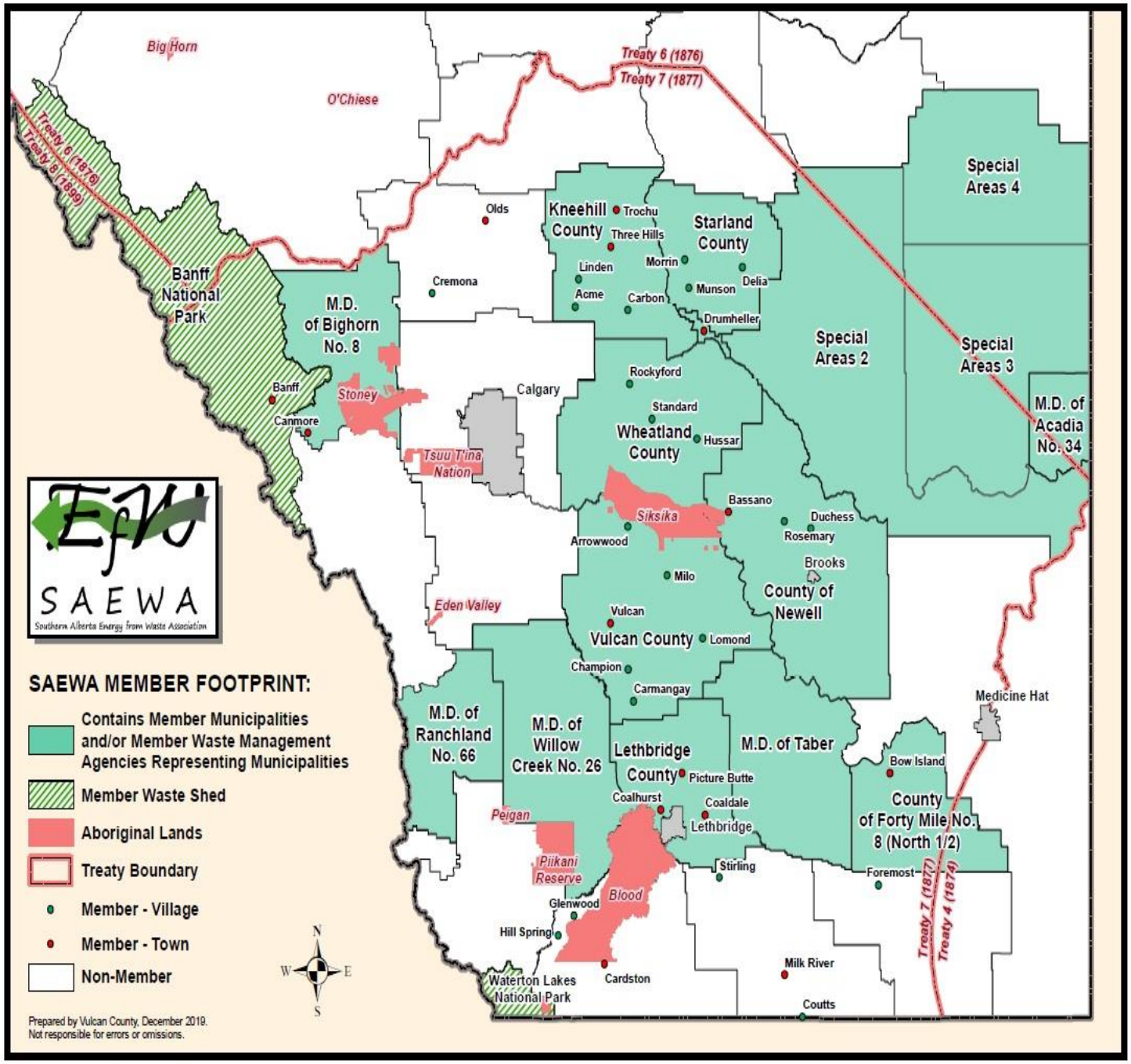

Balefill

City will now landfill clamshell plastics it paid $330K to store
BILL KAUFMANN Calgary Herald, Updated: August 20, 2019

Burying the material — which accounts for one to two per cent of all recyclables collected — will cost a total of $130,000, while continuing to store them at the Shepard landfill site for another year would be a $300,000 annual expense, said city officials. Total cost, $430,000.00 to manage 2000 tonnes of non-recyclable plastic: $215.00 per tonne



SAEWA Membership in 2012



SAEWA ACTIVE MEMBERS 2020

1. Vulcan & District Waste Commission:
   - Vulcan County
   - Town of Vulcan
   - Village of Arrowwood
   - Village of Mossleigh
   - Village of Carmangay
   - Village of Champion
   - Village of Milo
   - Village of Lomond
   - Village of Kircaldy

2. Bow Valley Waste Management Commission:
   - MD of Bighorn No. 8
   - Town of Banff
   - Town of Canmore

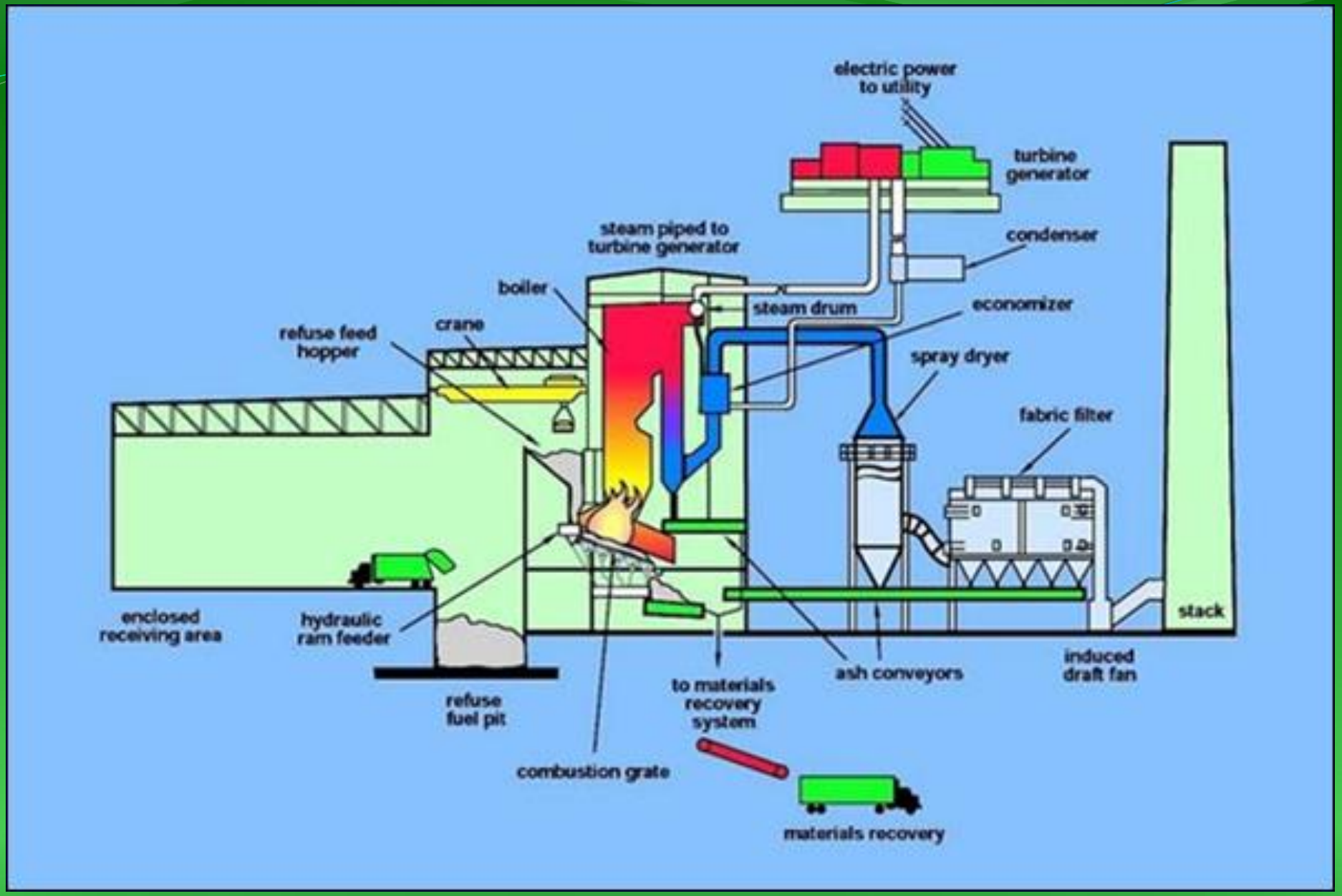
3. Big Country Waste Management Commission:
   - Town of Hanna
   - Town of Oyen
   - Village of Cereal
   - Village of Empress
   - Village of Youngstown
   - Village of Veteran
   - Village of Consort
   - MD of Acadia No. 34
   - Special Area No. 2
   - Special Area No. 3
   - Special Area No. 4

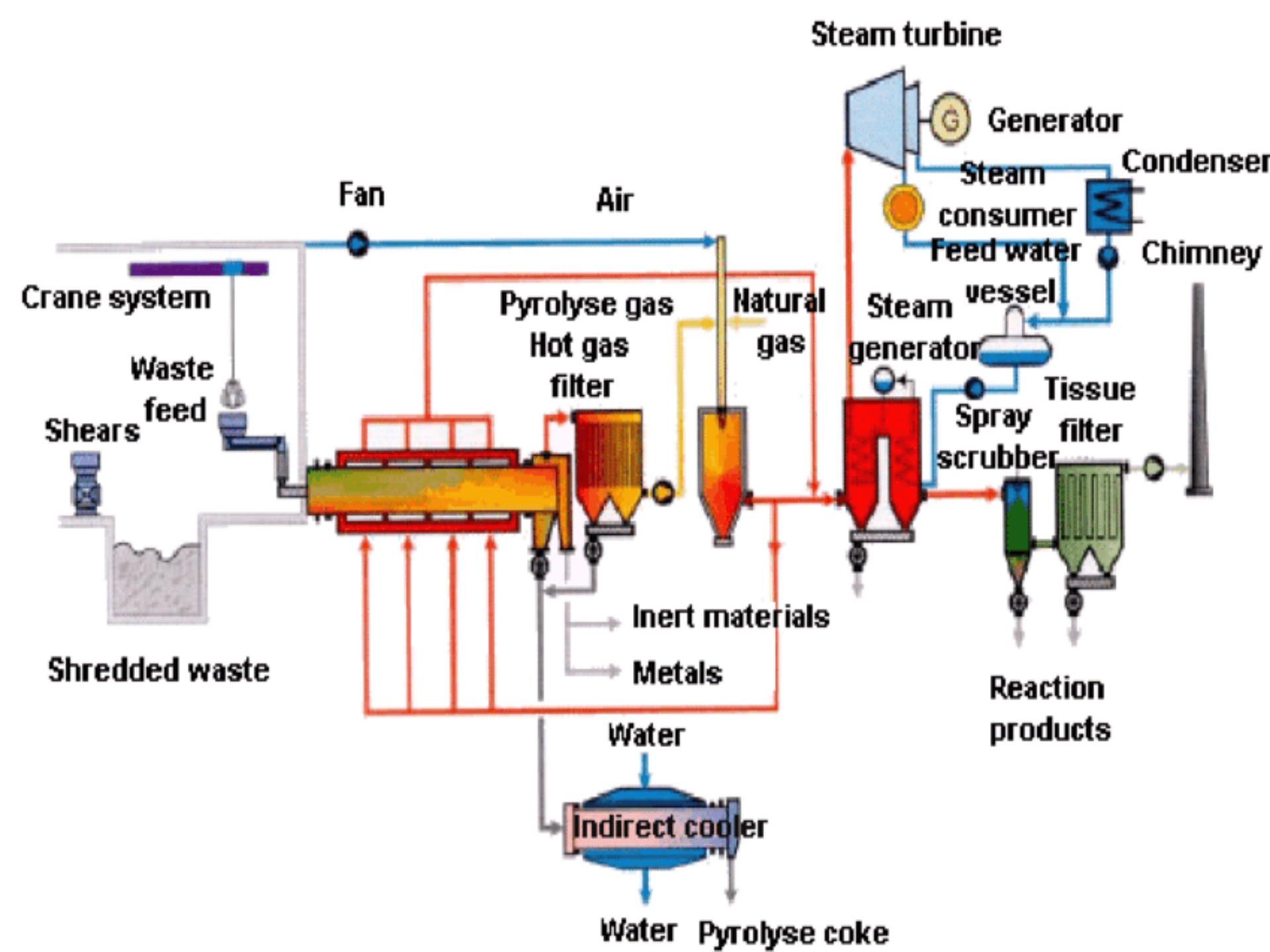
4. Drumheller & District Waste Solid Waste Management Association:
   - Kneehill County
   - Starland County
   - Town of Drumheller
   - Town of Trochu
   - Village of Acme
   - Village of Beiseker
   - Village of Carbon
   - Village of Delia
   - Village of Hussar
   - Village of Linden
   - Village of Morin
   - Village of Munson
   - Village of Rockyford
   - Village of Standard

5. North 40 Mile Regional Waste Management Commission:
   - County of 40 Mile No. 8 (North ½)
   - Bow Island

6. Newell Regional Solid Waste Management Authority:
   - County of Newell
   - City of Brooks
   - Town of Bassano
   - Village of Duchess
   - Village of Rosemary

7. Independent Members:
   - MD of Willow Creek
   - MD of Taber
   - MD of Ranchlands No. 66
   - Lethbridge County
   - Wheatland County
   - Town of Olds
   - Town of Coaldale
   - Town of Three Hills
   - Town of Picture Butte
   - Village of Cremona


electric power to utility
turbine generator
condenser
steam piped to turbine generator
boiler
steam drum
economizer
crane
refuse feed hopper
spray dryer
fabric filter
enclosed receiving area
hydraulic ram feeder
stack
induced draft fan
ash conveyors
to materials recovery system
refuse fuel pit
combustion grate
materials recovery


Steam turbine
G
Generator
Condenser
Steam consumer
Feed water vessel
Chimney
Fan
Air
Crane system
Pyrolyse gas
Hot gas filter
Natural gas
Steam generator
Waste feed
Shears
Tissue filter
Spray scrubber
Inert materials
Metals
Shredded waste
Reaction products
Water
Indirect cooler
Water
Pyrolyse coke

Feasibility Study

Task 1	Waste Generation and Sizing
Task 2	Combustion Technology Evaluation
Task 3	Waste Collection, Transportation & Handling
Task 4	Heat Recovery & Cogeneration Options
Task 5	Air Emissions GHG & Control Options
Task 6	Permitting Requirements
Task 7	Capital and Operating Costs

Work Completed ($1.5m)

- Project Development Plan
- Regulatory Requirements Plan
- Siting Process Plan
- Communications Plan
- Procurement Process Plan
- Initial Business Plan
- Detailed Business Plan
- Waste Stream Characterization
- Member Waste Stream Current Costs
- Governance Model: Brownlee LLP/Municipal Affairs
- Siting Analysis: U of A
- LCA: HDR with 3rd Party Review with O&G Sustainability and Pembina Institute

Overview

- Processing Capacity: Up to 300k tonnes per year.
- Potential Outputs: +/- 50 MW electricity +/- 1 million tonnes process steam
- Estimated tipping fees: $50 per tonne with higher level (non granted) government support. $90 per tonne with debt financing.
- Green House Gas Reductions (peer reviewed): 230k tonnes per year 7m tonnes over the life of the project
- Engineers of Record: HDR Inc.
- Funds Expended:
  - Higher level of Governments $1.5m
  - Municipal support estimated $2.0m

LCA January 2018

Emissions Over the Study Period	tCO_{2e}	tCO_{2e}/tMSW
Landfilled MSW	7,418,135	0.824
Transportation of MSW to Landfills	56,473	0.006
Total Landfill Alternative Emissions	**7,474,607**	**0.831**
Waste Combustion at EfW Facility	2,880,568	0.320
Transportation of Waste to EfW Facility	99,484	0.011
Emissions Displaced from Generated Electricity	(2,435,132)	(0.271)
Emissions Displaced from Metals Recovery	(168,480)	(0.019)
Total EfW Facility Alternative Emissions	**376,441**	**0.042**
Reduction in GHG Emissions from EfW Facility	**7,098,166**	**0.789**
Relative to Landfilling	**95.0%**	**95.0%**

How do we Pay for it?

Municipal infrastructure routinely amortised 20 yrs. WTEs have a 30 to 50 year lifespan with no post closure costs like landfills.

Could be considered similar to Regional water/wastewater infrastructure for funding

Utility model shares cost over many Municipalities

Public/Private is often used

Private sector Design/Build/Operate is often used

Summary of Financials – Base Case

Cost ($M)	NPV	2021	2050
Principal repayment	($260.15)	($10.12)	($25.48)
Interest payments	($178.62)	($15.98)	($0.62)
O&M costs	($487.79)	($22.48)	($39.91)
Total facility costs	**($926.56)**	**($48.57)**	**($66.01)**

Operating Revenue ($M)	NPV	2021	2050
Electricity sales	$290.24	$14.70	$21.18
Recovered metal sales	$75.68	$2.45	$7.83
Carbon offset credit sales	$32.10	$3.47	$0.00
Bottom ash sales	$6.94	$0.41	$0.41
Total operating revenue	**$404.96**	**$21.04**	**$29.42**

Net Cost per Tonne	Levelized (NPV)	2021	2050
Total cost per tonne	($183.69)	($161.91)	($220.03)
Total revenue per tonne	$80.28	$70.13	$98.06
Net cost per tonne	**($103.41)**	**($91.78)**	**($121.98)**

Variable	Units	Values
Debt financing ratio	%	100%
Interest rate	%	3.21%
Term (years)	years	30
Annual debt service	$M	$26.10
Bond issuance year	year	2020

Tipping fee of **$91.78** (2021) required to subsidize facility operating costs

Summary of Financials – Interest-free Loan

Cost ($M)	NPV	2021	2050
Principal repayment	($476.53)	($15.88)	($15.88)
Interest payments	$0.00	$0.00	$0.00
O&M costs	($911.82)	($22.48)	($39.91)
Total facility costs	**($1,388.35)**	**($38.36)**	**($55.80)**

Operating Revenue ($M)	NPV	2021	2050
Electricity sales	$533.42	$14.70	$21.18
Recovered metal sales	$147.15	$2.45	$7.83
Carbon offset credit sales	$45.13	$3.47	$0.00
Bottom ash sales	$12.38	$0.41	$0.41
Total operating revenue	**$738.07**	**$21.04**	**$29.42**

Net Cost per Tonne	Levelized (NPV)	2021	2050
Total cost per tonne	($154.26)	($127.87)	($186.00)
Total revenue per tonne	$82.01	$70.13	$98.06
Net cost per tonne	**($72.25)**	**($57.74)**	**($87.94)**

Variable	Units	Values
Debt financing ratio	%	100%
Interest rate	%	0%
Term (years)	years	30
Annual debt service	$M	$15.88
Bond issuance year	year	2020

Tipping fee of **$57.74** (2021) required to subsidize facility operating costs

Summary of Financials – Grant / Utility Model

Cost ($M)	NPV	2021	2050
Principal repayment	$0.00	$0.00	$0.00
Interest payments	$0.00	$0.00	$0.00
O&M costs	($487.79)	($22.48)	($39.91)
Total facility costs	**($487.79)**	**($22.48)**	**($39.91)**

Operating Revenue ($M)	NPV	2021	2050
Electricity sales	$290.24	$14.70	$21.18
Recovered metal sales	$75.68	$2.45	$7.83
Carbon offset credit sales	$32.10	$3.47	$0.00
Bottom ash sales	$6.94	$0.41	$0.41
Total operating revenue	**$404.96**	**$21.04**	**$29.42**

Net Cost per Tonne	Levelized (NPV)	2021	2050
Total cost per tonne	($96.70)	($74.92)	($133.05)
Total revenue per tonne	$80.28	$70.13	$98.06
Net cost per tonne	**($16.42)**	**($4.79)**	**($34.99)**

Variable	Units	Values
Debt financing ratio	%	n/a
Interest rate	%	n/a
Term (years)	years	n/a
Annual debt service	$M	n/a
Bond issuance year	year	n/a

Tipping fee of **$4.79** (2021) required to subsidize facility operating costs

Site Selection

Request for expressions of interest

- 11 sites submitted for analysis and comparative evaluation (Long List of EFW Sites):
  - Wheatland County (1 Site)
  - Vulcan County (2 Sites)
  - County of Newell (1 Site)
  - Town of Coaldale (3 Sites)
  - Special Areas Board (3 Sites)
  - Town of Claresholm (1 Site)

Preferred Site – Why County of Newell (cont'd)

- **Highest Ranking for Social and Cultural**
  - Furthest from nearest Park
  - Furthest from Residential Areas
  - Furthest from Historic Resources
  - Furthest from Sensitive Receptors
- **Highest Ranking for Land Use**
  - Compatible with existing zoning; "Public Service" already approved for waste management.
  - Part of the Newell Regional Landfill, the site area is used for storing concrete, asphalt, and shredded tires
- **3rd Highest Ranking for Technical**
  - Good design flexibility, although the site is smaller than others (note adjacent property is available is required.)
  - Proximity to major power transmission lines and major highways

Preferred Site – Why County of Newell

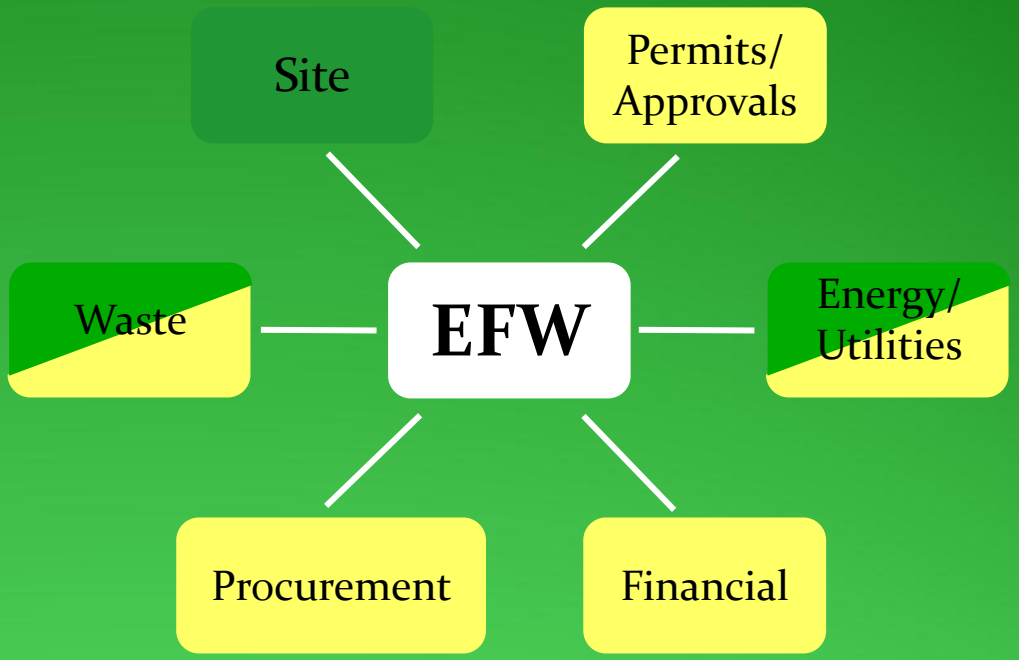
- **Highest Ranking for Cost and Constructability**
  - Limited/No Upgrades required to existing roadway infrastructure
  - Publicly Owned
  - Permitting/Approvals likely easier given it is a brownfield site and already an existing waste management facility
  - High potential for district energy users which could have a significant effect on overall business case for facility
- **Highest Ranking for Environmental**
  - Furthest from nearest water body
  - Fewest number of wetlands in proximity
  - 0 at-risk species were identified within a 1 km radius
  - Already an existing waste management facility

What about Vulcan 2?

- Carrying two (2) sites forward as the EFW facility development process progresses, has a number of significant advantages, including:
  - Redundancy to manage risks, including (but not limited to):
  - Risk that overtime, one site may no longer be available;
  - Potential unforeseen risks (e.g. permitting issues);
  - Risk related to SAEWA reaching an agreement with the municipality and/or landowner to secure the site; and,
  - Risk related to SAEWA reaching an agreement related to utilities, energy users, rail access, etc.
- An opportunity to further explore potential energy end-users (and in the case of Newell, potential water supply alternatives) and build these opportunities into the business case analysis.

Next Steps

- The next steps for the development process overall include:
  - confirmation of potential energy users;
  - development of a more detailed business case;
  - economic analysis and review of financing options;
  - examination of securing waste supply;
  - consideration of rail access options; and,
  - initiation of the facility/technology procurement process.



Request for Expressions of Interest

- Posted on MERX Canada site.
- Closing date extended by 1 month to September 20, 2021 at the request of Technology Vendors.
- Technology not restricted but must be commercially demonstrated.
- 29 Companies have downloaded documents.
- Expect submissions to be at the last minute.
- Strategy was to have REOI's in hand before Municipal Elections and evaluate following.

Who Responded

- /
- https://www.covanta.com
- https://www.hz-inova.com & https://www.acciona.com
- https://www.suez-na.com/

Snapshot – Covanta

(Note: Unverified information summarized from EOI submission.)

	Covanta Energy LLC
Primary business	Owner & operator of waste to energy facilities. Head office in New Jersey
Proposed roles	Developer, designer, technology provider, constructor & operator
Corporate Background	• Established 1939. Formerly Ogden Corporation. • Founded as Covanta in 1983. • Prior to 2018 acquired several other firms. • Owned by Covanta Holding Corporation. Listed on the New York Stock Exchange: CVA
Key Facts	• 41 operating waste to energy facilities (39 in North America) • Annual capacity to process 21 million tons of waste • Annual capacity to produce 10 million megawatt hours of electricity and 9 billion pounds of steam • 500+ employees

Snapshot – HZI & Acciona Partners

(Note: Unverified information summarized from EOI submission.)

	Hitachi Zosen INOVA (HZI)	Acciona Concesiones, SL (Acciona)
Primary business	Engineering, procurement, construction and operation of energy from waste plants	Developer and operator of renewable energy and infrastructure
Proposed roles	Developer, technology provider, constructor & operator	Developer, constructor & operator
Corporate Background	• Established 1933 as L von Roll Aktiengesellscghaft • 1960 became Von Roll in Germany and Japan • 1975 entered North American market • 2003 Von Roll INOVA acquired by AE&E • 2010 acquired by Hitachi Zosen	• Based in Madrid, Spain, operates worldwide • Listed on the Madrid stock exchange • Corporate history goes back 100+ years • 2019 partnered with HZI on 300,000 tons/year energy from waste plant in Australia
Key Facts	• 700+ energy from waste projects since 1933 • 15 operating waste to energy plants in North America • 2 operating anaerobic digestion plants in US	• 40 public-private partnerships (6 in Alberta) • 2019 involved in energy from waste project in Scotland • Owns/operates 10,100 megawatts of wind power generation

Snapshot – Suez

(Note: Unverified information summarized from EOI submission.)

	SUEZ
Primary business	Waste management, water and wastewater treatment
Proposed roles	Developer, operations & maintenance. Will sub-contract other services such as engineering, technology provision and construction
Corporate Background	• SUEZ Group global parent company active in waste management since 1919 • Suez Canada established as an Alberta corporation in 2010
Key Facts	• Operator of Edmonton High Solids Anaerobic Digester, EPCOR Biosolids Dewatering Facilities, Swan Hills Treatment Centre • Constructing compost plant and organic waste biomethanization plant in Montreal • Operates over 60 energy from waste plants around the world processing 9 million tons of waste

Next Steps

- Continue to seek Higher level of Government support
- Evaluate Submissions to REOI
- Recommend preferred partner to SAEWA membership

UK

Durham / York Ontario

Metro Vancouver

Germany with Ski Hill

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