



# City of Bethel

P.O. Box 1388 • Bethel, Alaska 99559-1388  
907-543-2047  
Fax # 543-4171  
Website: www.cityofbethel.org

## REGULAR MEETING AGENDA ENERGY COMMITTEE Monday, October 7, 2013 – 6:30 p.m. City Hall Council Chambers, Bethel, AK

### Members

Leif Albertson  
Chair

Mary Weiss  
Vice Chair

Greg McIntyre

Eric Whitney

Shari Neth

Martin Leonard

### Alternate Members

### Ex-Officio Member

Sharri Salyers

### I. Call to Order

### II. Roll Call

### III. People to be Heard

### IV. Approval of Agenda

-Agenda October 7, 2013

### V. Approval of Meeting Minutes

-Regular Meetings July 1, 2013 and August 5, 2013

### VI. Unfinished Business

**A.** Municipal Solid Waste Gasification- *Requested by Eric Whitney*

**B.** Update Renewable/ Alternative Energy Tracking Sheet-  
*Requested by Eric Whitney*

### VII. New Business

**A.** Presentation on Wind and Alternative Energy by Greg McIntyre- *Requested by Committee Members*

### VIII. Committee Member Comments

### IX. Adjournment

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# City of Bethel, Alaska

## Energy Committee

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July 1, 2013

Regular Meeting

Bethel, Alaska

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### I. CALL TO ORDER

A regular meeting of the Energy Committee held on July 1, 2013 at 6:30 pm in the City Hall Council Chambers, Bethel, Alaska.

Vice-Chair Mary Weiss called the meeting to order at 6:30pm.

### II. ROLL CALL

Comprising a quorum of the Commission, the following members were present for roll call:

*Members Present:*

*Leif Albertson*

*Mary Weiss*

*Shari Neth @6:35pm*

*Martin Leonard*

*Eric Whitney*

*Members Not Present:*

*Greg McIntyre*

Ex-Officio members present were the following:

Sharri Salyers

### III. PEOPLE TO BE HEARD

No People to be heard

### IV. APPROVAL OF AGENDA

#### MOTION TO APPROVE THE AGENDA

<b>MOVED:</b>	Eric Whitney	Motion to approve July 1, 2013 Agenda
<b>SECONDED:</b>	Leif Albertson	
<b>VOTE ON MAIN MOTION</b>	All in favor	

### VII. APPROVAL OF MINUTES

#### MOTION TO APPROVE THE MINUTES

<b>MOVED:</b>	Eric Whitney	Motion to approve the regular meeting minutes for April 1, 2013
<b>SECONDED:</b>	Martin Leonard	
<b>VOTE ON MAIN MOTION</b>	All in favor	

**MOTION TO APPROVE THE MINUTES**

<b>MOVED:</b>	Leif Albertson	Motion to approve the regular meeting minutes for May 6, 2013
<b>SECONDED:</b>	Eric Whitney	
<b>VOTE ON MAIN MOTION</b>		
All in favor		

**MOTION TO APPROVE THE MINUTES**

<b>MOVED:</b>	Eric Whitney	Motion to approve the regular meeting minutes for June 3, 2013
<b>SECONDED:</b>	Leif Albertson	
<b>VOTE ON MAIN MOTION</b>		
All in favor		

**VIII. UNFINISHED BUSINESS**

- a. **Municipal Solid Waste Gasification**- Requested by Eric Whitney

**MOTION**

<b>MOVED:</b>	Shari Neth	Motion to send a recommendation to the City Council for a feasibility study to be conducted in regard to municipal solid waste gasification plant.
<b>SECONDED:</b>	Eric Whitney	
<i>Discussion ensued and as to the wording of the recommendation to City Council.</i>		
<b>VOTE ON MAIN MOTION</b>		
All in favor		

**MOTION**

<b>MOVED:</b>	Eric Whitney	Motion to table the Municipal Solid Waste Gasification to the next committee meeting for the Drafted Recommendation for City Council.
<b>SECONDED:</b>	Shari Neth	
<b>VOTE ON MAIN MOTION</b>		
All in favor		

**IX. NEW BUSINESS**

- a. **Updated Renewable/Alternative Energy Tracking Sheet**- Discussion of tracking sheet this a continuing report of what is going on in our community and will continue on every agenda will be placed in Unfinished Business.

**b. Presentation of Wind and Alternative Energy-MOTION**

<b>MOVED:</b>	Shari Neth	Motion to table the August committee meeting due to Greg Malntyre not being present for meeting.
<b>SECONDED:</b>	Eric Whitney	
<b>VOTE ON MAIN MOTION</b>		
All in favor		

**c. Update on the Wind Energy Grant-** City of Bethel's Grant Manager updated the committee about the wind energy grants status.

**d. Status of the Bethel Landfill-** Discussion on the Landfill. Committee would like to have more information of the inspection of the landfill. Suggestion to bring this subject back up for further discussion at a later date.

**X. COMMISSION MEMBER'S COMENTS**

Shari Neth: Would like to thank everyone for coming.

Eric Whitney: Good to have a quorum.

Leif Albertson: looking for new members and good to have a quorum.

Martin Leonard: Thanks to the telephone link for the meeting.

Mary Wise: Thanks everyone.

**XI. ADJOURNMENT MOTION**

<b>MOVED:</b>	Shari Neth	Motion to Adjournment
<b>SECONDED:</b>	Eric Whitney	
<b>VOTE ON MAIN MOTION</b>		
All in favor		

Next meeting on August 5, 2013

\_\_\_\_\_, Chairperson

ATTEST:

\_\_\_\_\_  
Sharri Salyers, Recorder



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# City of Bethel, Alaska

## Energy Committee Minutes

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August 5, 2013

Regular Meeting

Bethel, Alaska

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### CALL TO ORDER

A meeting of the Energy Committee was held on August 5, 2013 at 6:30 pm in the City Council Chambers.

Meeting called to order by Chair Leif Albertson at 6:40 Pm

### ROLL CALL

A quorum was not established of the Committee, the following were present:

Albertson, Weiss, Neth

Excused absence(s): Whitney,

Unexcused absence(s): McIntyre, Leonard

Also in attendance were the following:

Sharri Salyers, Ex-Officio and Recorder

### ADJOURNMENT

APPROVED THIS \_\_\_\_\_ DAY OF \_\_\_\_\_, 2013.

\_\_\_\_\_  
Recorder,

\_\_\_\_\_  
Chair,



# City of Bethel

## Committees and Commissions

### Recommendation to City Council

Committees and Commissions that wish to make a recommendation to City Council should turn this form in to the City Clerk or to the City Council representative on the committee or commission.

<b>Committee/Commission:</b> Energy Committee	<b>Chairman:</b> Leif Albertson
<b>Date Submitted:</b>	<b>Council Rep:</b> Eric Whitney
<b>Issue:</b> To conduct a feasibility study on acquiring and operating a municipal solid waste gasification plant for the purpose of energy recovery and producing the amount of solid waste being added to the Bethel landfill.	
<b>Recommendation:</b>	
Whereas; approximately 15 tons of solid waste is added to the landfill daily.	
Whereas; there is a limited amount of space in our landfill	
Whereas; the cost to close our the existing landfill and start a new landfill is next amount	
Whereas; there is technology available proven to recover energy from solid waste that would otherwise never be utilized.	
Whereas; the purpose of the energy committee is to recommend and suggest projects that increase the sustain ability of our City, and reduce the volume of waste generated	

**Other:**

Therefore the energy committee recommends the city council that they direct the City manager to conduct a formal feasibility study for a municipal solid waste gasification system.

Received by: \_\_\_\_\_  
Date: \_\_\_\_\_



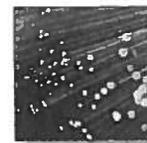
Strategic Solutions for Energy | Environment | Business

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 dburns@shearwaterllc.com

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 VP, Business Development  
 Old Harbor Native Corporation  
 907. 257. 1855  
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 hbissett@oldharbor.org

Shearwater Systems is a subsidiary of Three Saints Bay, which is owned by the Old Harbor Native Corporation, an Alaska Native Corporation formed in the early 1970s through the Alaska Native Claims Settlement Act. Through our subsidiary companies, Shearwater is able to offer implementation, construction, and maintenance support in a wide variety of systems and solutions.

## Alaska Native Family of Companies



**Service Areas**  
 • In-Service Engineering Support  
 • Manufacturing & Fabrication  
 • Design & Engineering Services

**Customers**  
 Naval Sea Systems Command  
 Naval Surface Warfare Centers  
 Private and Public Shipyards  
 U.S. Army Corps of Engineers  
 U.S. Coast Guard  
 U.S. Navy SWRMC



**Service Areas**  
 • Systems Engineering  
 • Information Assurance (IA) & Security  
 • Research & Development  
 • Management & Administration

**Customers**  
 Bureau of Indian Affairs  
 Defense Information Systems Agency  
 Office of the Sec. of Defense  
 U.S. Air Force  
 U.S. DEA  
 U.S. DHS  
 U.S. DOC  
 U.S. Joint Forces Command  
 U.S. Navy



**Service Areas**  
 • Undersea Fiberoptic Infrastructure  
 • Microwave Tower Infrastructure  
 • Redundant Communications  
 • Construction (General Contracting)

**Customers**  
 Alaska Aerospace Dev. Corporation (AADC)  
 AT&T  
 GCI  
 Kodiak Launch Complex  
 Kodiak Island and Kenai Peninsula  
 U.S. Coast Guard  
 U.S. Forest Service



**Service Areas**  
 • Program Management  
 • Administrative Services  
 • Document Management  
 • Information R&A  
 • Cyber Security

**Customers**  
 ATF  
 NNSA  
 U.S. Coast Guard  
 U.S. DEA  
 U.S. Department of the Interior  
 U.S. DOE Office of Science  
 U.S. Navy



**Service Areas**  
 • Federal Consulting  
 • Systems Engineering & Technical Assistance  
 • Construction (General Contracting)

**Customers**  
 ATF  
 Missile Defense Agency  
 NASA  
 NNSA  
 U.S. Coast Guard  
 U.S. Department of the Interior  
 U.S. DOE  
 U.S. DOD  
 U.S. DOJ  
 U.S. Forest Service  
 U.S. Navy SPAWAR



**Service Areas**  
 • Consulting Services  
 • Environmental Services  
 • Civil Engineering  
 • Landscape Arch.  
 • Community Development  
*focus on renewable energy and natural resource management*

**Customers**  
 ATF  
 Chenaga Government Consulting  
 City of Old Harbor, AK  
 James River Water Development District  
 Scientific Certification Systems  
 STAR Distributed Energy  
 The ENSER Corporation  
 The Nature Conservancy

Shearwater identifies and submits grant applications on behalf of our Alaska Native village corporation, Old Harbor Native Corporation, on Kodiak Island to support energy efficiency and self reliance.

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Anchorage, AK 99503  
907. 278. 6100  
Fax: 907. 222. 2760

215B Main St.  
Milford, OH 45150  
513. 248. 9999  
Fax: 513. 248. 9111



**SHEARWATER**  
**SYSTEMS** LLC  
AN OLD HARBOR COMPANY

Strategic Solutions for Energy | Environment | Business

## 8(a) ANC-Owned Small Disadvantaged Business

*Shearwater Systems is an emerging specialty consulting firm focused on providing innovative strategic planning, project development, environmental services and civil engineering support to commercial, government, and non-profit clients with a strong focus in the renewable energy sector.*

**Energy Development** (biomass, waste-to-energy, solar, wind)

### Consulting Services

- Strategic Planning (Business & Technical)
- Project Management
- Preliminary Project Valuation Models
- Risk Assessment / Mitigation Planning
- GIS
- Green and Brownfield Development Plans
- Sustainability Support

### Environmental Services

- NEPA Environmental Assessments
- Wetlands Delineations & Watershed Analysis
- Biological Assessments
- Permitting, Sampling, and Analysis
- Phase I Site Assessments
- Watershed Analysis
- Environmental Compliance Monitoring
- Cultural Resources
- Avian Studies

### Civil Engineering (AK, HI, ND, SD, TX)

- Site Civil and Infrastructure
- Construction Management
- SWPPP (Storm Water Pollution Prevention Plans)

### Landscape Architecture (KS, MN, OH, SD, TX)

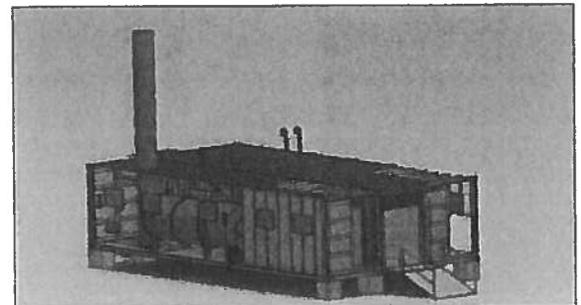
- Natural and Environmental Systems Analysis
- Viewshed Analysis
- Master Plan and Site Plan Design
- Park and Trail Planning and Design
- Planting Design and Irrigation Design
- Site Amenity and Site Furnishings Design
- Site Visualization Graphics and Imagery
- Water Conservation and Sustainable Design

### Our Mission

To develop high-quality, strategic solutions, focusing on the incorporation of sustainable development practices that support our clients' business objectives.



*Engineering, Construction Management and Environmental support for two Airport Projects in Old Harbor, AK. The existing runway side cuts/hills into usable embankment material for future use. This will enhance safety. Project 2 will extend the existing runway from 2,750 feet to 4,500 feet.*



*Shearwater is working with Waste to Energy Canada (WTEC) to deploy environmentally safe, sustainable modular waste-to-energy solutions throughout Alaska including modular systems like the one shown here that are highly suitable for rural village applications.*

**WTEC**

**Batch Gasifier System**

*Introduction*





## Batch Gasifier System

### PROFILE

Services & Products: WTEC offers an integrated suite of products and services to meet clients "Clean and Smart" infrastructure needs. We focus on using waste to create energy and solving environmental issues. Waste to energy is a beautiful methodology: it uses a lot of what we don't want (waste) to produce a lot of what we do need (power) thereby by solving two core issues.

### SERVICES

- Integrated Infrastructure planning using closed-loop approach for waste, renewable energy and water management;
- Sourcing, deployment, and long-term service and maintenance agreements,
- Project design and engineering

### PRODUCTS

- Waste to Energy: BGS™, MGS™, and CGS™ gasification/oxidation systems
- Wastewater Treatment & Recycling
- Water Purification: NF/RO and Desalination
- Soil and Water Remediation

### GOAL

WTEC's primary mission is to cleanly convert waste into energy, thereby mitigating environmental landfill issues, reducing global Greenhouse Gas (GHG) emissions, and creating thermal energy and/or electricity from an otherwise wasted source. Due to widely distributed waste streams with relatively low energy values and high transportation costs, WTEC's business model focuses on decentralized, community or industry based facilities that are well suited to our scalable gasification/oxidation technology.

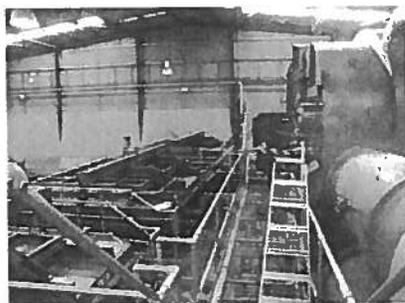
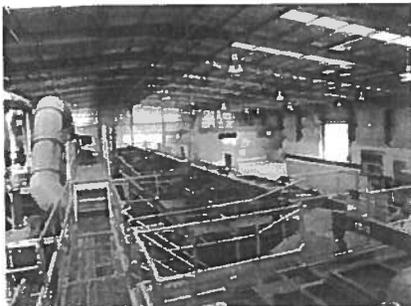
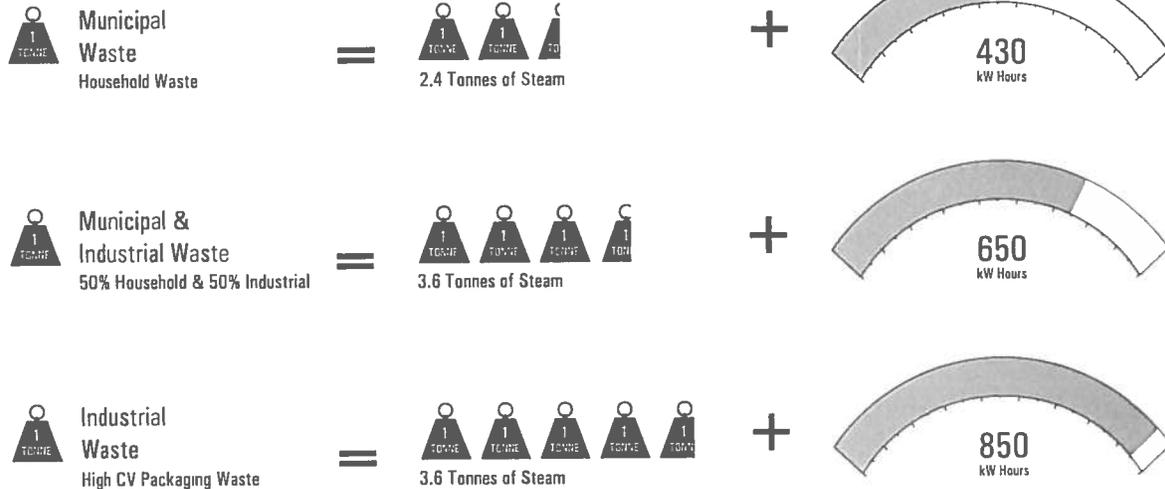
### APPROACH

WTEC unwavering dedication is to providing engineering services and technology for clients to bring their projects to fruition. While the team considers waste to energy as the core business, many clients choose to benefit from WTEC's integrated closed-loop approach to lead the provision of infrastructure and operational services to meet their needs. By providing a single-point source, WTEC appeals to private and public clientele. Each project commences with Discovery, followed by Commitment, Front End Engineering Design and then the full deployment to operation cycle.

### COMPETITIVE ADVANTAGE

Our primary focus is the waste to energy sector and the provision of integrated "clean & smart" waste, energy, and water infrastructure designed to meet each client's specific requirements.

## How much energy can be recovered from 1 tonne of waste?



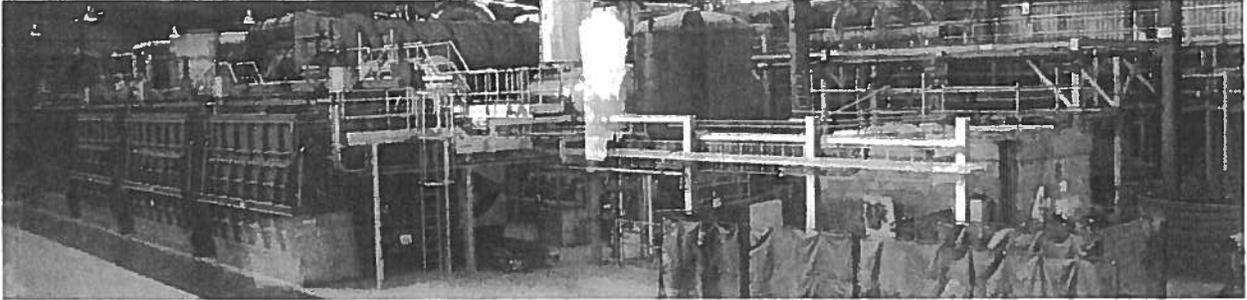
### ENERGY RECOVERY

Few people realise the enormous amount of energy, locked into municipal or industrial waste. Using the hot, exhaust gases from the Secondary Chamber, this energy can be converted into valuable steam, hot water, hot air or electricity.

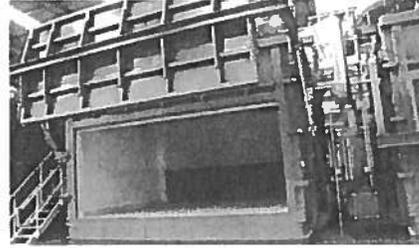
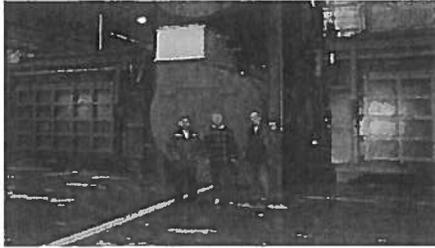
The BGS™ uses tried and tested technology to harness this energy. Super-efficient boilers and steam turbines convert the hot exhaust gases into electricity and this process also generates large quantities of hot water, ideal for space heating, drying or chilling i.e. air conditioning.

As with any energy recovery system, the recovered energy is related to the fuel processed by the system: wastes with high moisture content and low calorific value will produce far less energy than those low moisture content and higher calorific values.

The chart (above) provides an indication of the amount of energy recoverable from one tonne of waste, although a full waste stream analysis must be undertaken to provide a complete waste characterisation in order to determine the true potential of the waste.



The BGS™ two-stage gasification / oxidation technology system is not incineration

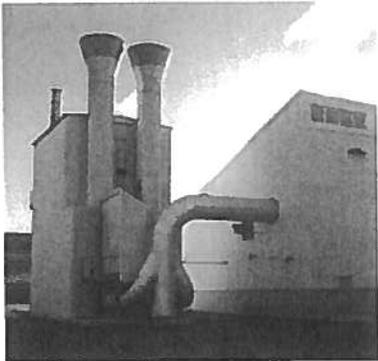
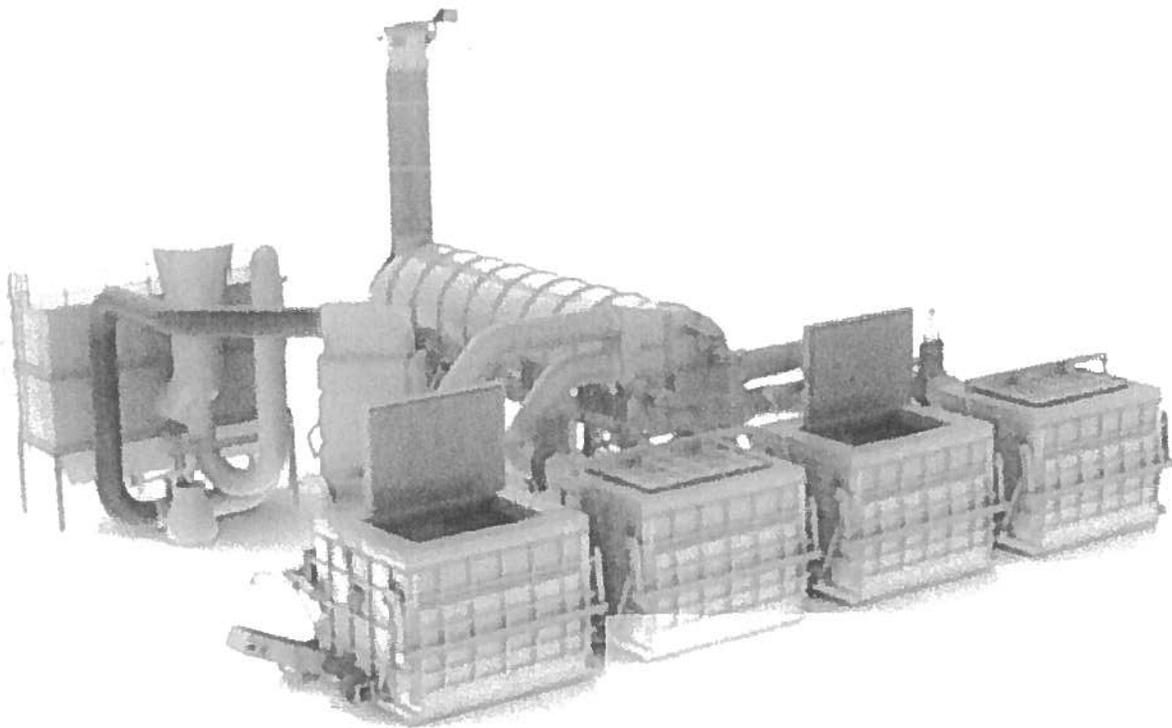


## BATCH GASIFIER SYSTEM (BGS)

- Two stage thermal gasifier converts both solid & semi-liquid waste
- Waste is loaded using conventional equipment into Primary Gasification Chamber/s
- Reduces waste by +95% volume to inert ash & recyclable metals, glass
- Once loaded, operation is fully automated & self sustaining
- Only requires a small amount of propellant (propane) to initiate
- Sizing designs from <1 to >1500 mt/day
- Extremely low O&M
- Finest ROI available
- Scalable & modular
- Allows for flexibility in processing capacity, so you may scale up with cash flow & need
- BGS™ has small footprint for versatile site location - ideal for remote camps or larger metro & industrial applications and decentralization.
- All systems may be SCADA monitored by our engineers
- Low capital & operating costs
- Safe and proven
- Lower temperatures of gasification process mean air emissions exceed all stringent EU & US regulations without add-on emission control devices
- We are proud of the successful 19-year history with communities, locations, industry, government, First Nations or remote camps around the globe.

## WHY GASIFICATION?

- ✓ Waste Gasification & Oxidation is preferred and proven methodology
- ✓ Proven & fully guaranteed technology
- ✓ Scalable & modular from <1-tonne to >1500 mt/day
- ✓ Thermal gasification and oxidation of waste stream, therefore not incineration
- ✓ Accepts all waste streams
- ✓ Robust efficiency
- ✓ Successfully deployed worldwide for 19 years

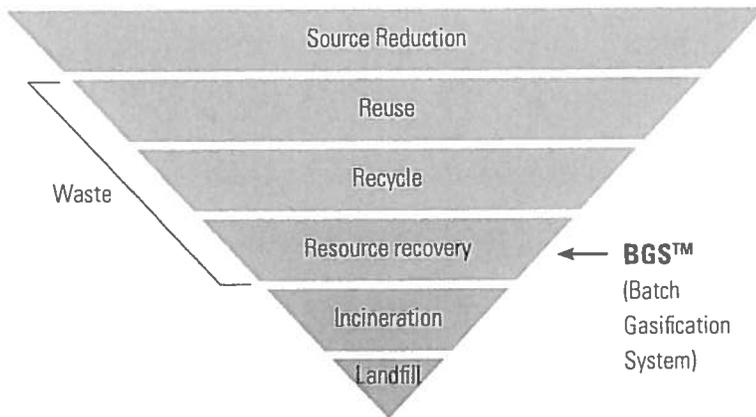


## OVERVIEW

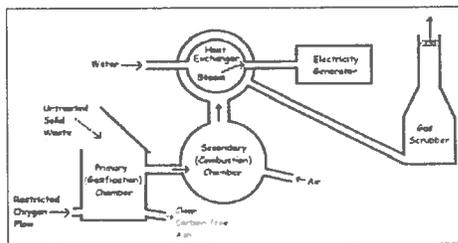
The BGS™ was designed as a low emission and low labour approach to small and medium-scale solid waste disposal. The BGS™ utilizes a gasification process that thermally converts waste products into a high value synthesis gas (syngas). This two-stage process provides the lowest possible emissions and is the most environmentally sound method for waste disposal. The unique modular BGS™ allows for flexibility of design, easy installation, and ease of operation. With capacities from 1 to 180 tonnes per day of waste processing, the BGS™ is ideal for small municipalities and private industries. By adding thermal recovery equipment, the hot effluent gas from the BGS™ can be used to produce steam, coolant and electricity.

## KEY FEATURES

- No expensive preparation of the waste; it goes into the BGS™ just as it comes off the waste collection vehicle.
- Gasification reduces waste to an inert ash with a weight reduction of up to 95%
- Low temperature gasification in sealed units produces syngas economically and minimises fly ash and NOx.
- Wide range of waste materials acceptable including tires.
- High temperature secondary oxidation ensures clean emissions in compliance with statutory legislation.



## CORPORATE SOCIAL RESPONSIBILITY TO SOLID WASTE MANAGEMENT



The UN internationally accepted Hierarchy of Waste Management, above, classifies gasification of waste as 'Resource Recovery' which is preferred over landfilling and incineration.

Our system - BGS™ (Batch Gasifier System), utilizes thermal gasification to destroy municipal, commercial, and industrial waste while reducing greenhouse gas emissions – to produce valuable energy.

Many remote communities, first nations, industrial sites, and camp locations strive to achieve a higher level of Corporate Social Responsibility (CSR) through mandated practices which are difficult to achieve, and be consistently incorporated in Best Management Practices BMP's. In many cases CSR calls for compliance with ISO registration, which calls for the continuous reduction of their Carbon Footprint.

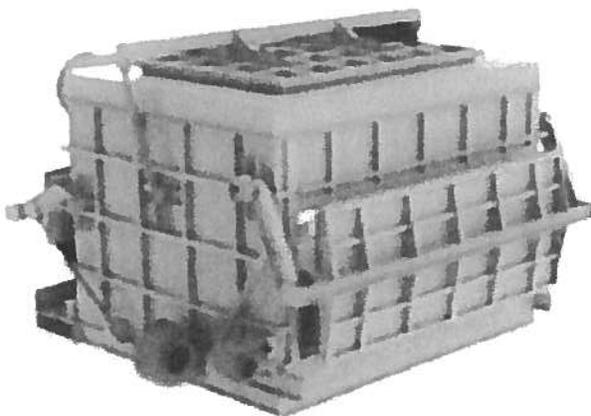
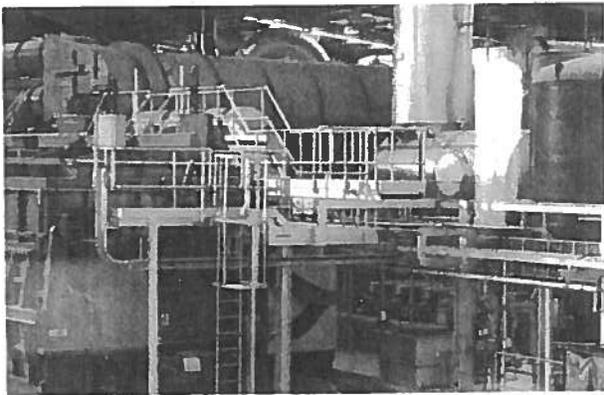
While attempting to adhere to CSR, BMP's and ISO mandates managers and leadership struggle with the economics and environmental impacts of their day-to-day waste stream. This waste stream is represented through household waste (organics, plastics, metals, cellulose, etc), commercial (wood, metals, plastics, oils, etc) and Industrial (oils, sludge, etc), logging and mines. This is where BGS™ comes in as a proven solution for you.

Energy recovery and reuse - Heat can be recovered in the boiler, Organic Rankine Cycle (ORC) engine, absorption chiller, or heat exchanger. Recovered energy can be used for industrial processes, heating and cooling, and generating electricity – providing excellent return on investment and long term viability.

Simple BGS™ process diagram – the system accepts most waste streams & produces valuable heat & / or coolant + optional electricity (seen as steam turbine here). The process is deemed Carbon neutral by the IPCC with emissions scrubbing standards that exceed all EPA, EU and SEPA regulations.

## BGS BENEFITS

- ✓ Reduce Greenhouse Gas Emissions: For every one tonne of municipal waste sent to landfill, more than 20 tonnes of greenhouse gases are created. BGS™ eliminates this.
- ✓ Create Valuable Energy from Waste: Shortest ROI available, ask us how for heat, cooling & electricity.
- ✓ Prevent Leachate: Every tonne of waste gasified by BGS™ eliminates harmful landfill leachate from the environment
- ✓ Safe Disposal of Waste: Without presorting BGS safely treats municipal, medical, tires, hazardous, commercial & industrial waste streams including dried wastewater sludge, oils, unrecyclable plastics etc
- ✓ BGS is not Incineration: Incineration releases toxins & pollutants into the atmosphere. BGS™ prevents this & meets all emission standards. BGS™ is the UN acceptable method of destructing & converting waste.
- ✓ We export from Canada and fabricate locally. WTEC is Canadian owned & operated using guaranteed equipment built in Canada and/or fabricated close to deployment to reduce shipping costs. Ask us about



## SEQUENTIAL BATCH PROCESS

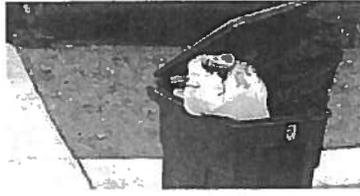
While the BGS™ uses a “batch” process, rather than the continuous feeding of waste material, the system is able to generate consistent and reliable amounts of syngas and heat, enabling it to generate electrical power continuously, 24/7.

As illustrated above, each BGS™ module is capable of processing 60-tonnes of waste per day, and consists of 4 Primary Gasification Chambers (PGC's), each holding approximately 15 tonnes of waste. After being filled with waste, the chamber doors are sealed, and each chamber moves through its cycle of ignition, gasification, carbon reduction, and cool-down, completing this cycle in 24 hours.

By staggering the ignition of each of the 4 PGC's, this ensures that the module is at all times producing a rich flow of syngas, which is combusted in order to generate steam and electricity continuously. Where greater throughput or energy recovery is required, we simply build and ‘train-on’ additional modules, each comprising of 4 PGC's. Each of these modules has its own Secondary Combustion Chamber (SCC), its own boiler and Flue Gas Treatment System, providing incredible flexibility in terms of both operation and maintenance.



Baled waste



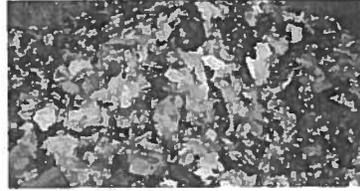
Municipal waste



Plastics & rubber



Clinical waste



Industrial waste



Animal remains



Oil wastes



Chemical waste



Wood & paper wastes

## ACCEPTED WASTE

No other system is as flexible as the BGS™. Most combustible wastes can be accommodated, and there is rarely any requirement to pre-process the waste.

The BGS™ has a beneficial track record with a wide range of non-hazardous and hazardous wastes, allowing the system to adapt easily to future changes in waste types and governing legislation.

## HOW IT WORKS

1. Untreated waste is loaded into the Primary Gasification Chamber.
2. A controlled slow undisturbed gasification process is initiated at 450c, where the waste is converted into a synthetic gas (syngas).
3. The syngas is drawn off the primary chamber into the secondary oxidation chamber where the temperature is increased to 1200c (thermal cracking of dioxins and furans).
4. Waste is reduced to 95-97% of its original volume; the balance is a mix of inert ash and recyclable metal and glass.
5. BGS™ is self-sustaining requiring a tiny amount of propellant, typically for 7 to 9 minutes, no fuel is required.

## BGS ACCEPTS MOST WASTE INCLUDING:

- Municipal Solid Waste
- Tires
- RDF or similar
- Fish/Animal
- Industrial/Commercial
- Bio-Solids
- Construction/Demolition
- Pallets
- Medical / Hospital
- Biomass
- Treated timber
- Railway ties
- Confidential Records Furniture
- Non-Recyclables
- Shingles
- Hazardous Materials Organics

## For consideration when comparing other waste to energy technologies

<b>Type of Waste Stream Treated</b>	<b>Energy Efficiency from System</b>	
Municipal	Operational Requirements	+/- 9%
Industrial & Commercial	Conversion to Energy (Heat)	95%
Construction & Demolition	Conversion to Electricity	Option
Medical & Pharmaceutical	<b>Energy conversion (electricity option)</b>	
Tires.	Steam	80% Efficient to boiler
Fish & animal remains	Heat / Coolant – Process, grid	Yes
Wastewater bio-solids	<b>Operational Manpower Requirements</b>	Low 4 to 6 personnel
Biomass crops	(based on 60MT/day)	
Tree stumps / bio-mass	<i>Scalable &amp; Modular Design</i>	Yes
Liquid Waste - oils, solvents	<i>Uses Best Available Technology</i>	Yes
<b>Waste By-Products – residuals</b>		
Inert Ash	<i>Machine maintenance costs</i>	Low
<b>Recyclable Materials</b>		
Inert Ash, Glass, Metals	<i>SCADA – background security</i>	Yes
<b>Eliminates Incineration</b>		
<b>Reduces CO2 Emissions</b>		
<b>Stops Leachate</b>		
<b>Proven worldwide</b>		
	<i>Reduction of waste mass</i>	97%
	<i>Eliminates the need for landfill,</i>	Yes
	<i>Decentralized</i>	Yes
	<i>Visual Impact</i>	Very Low
	<i>Low Odour</i>	Yes
	<i>Low Noise</i>	Yes

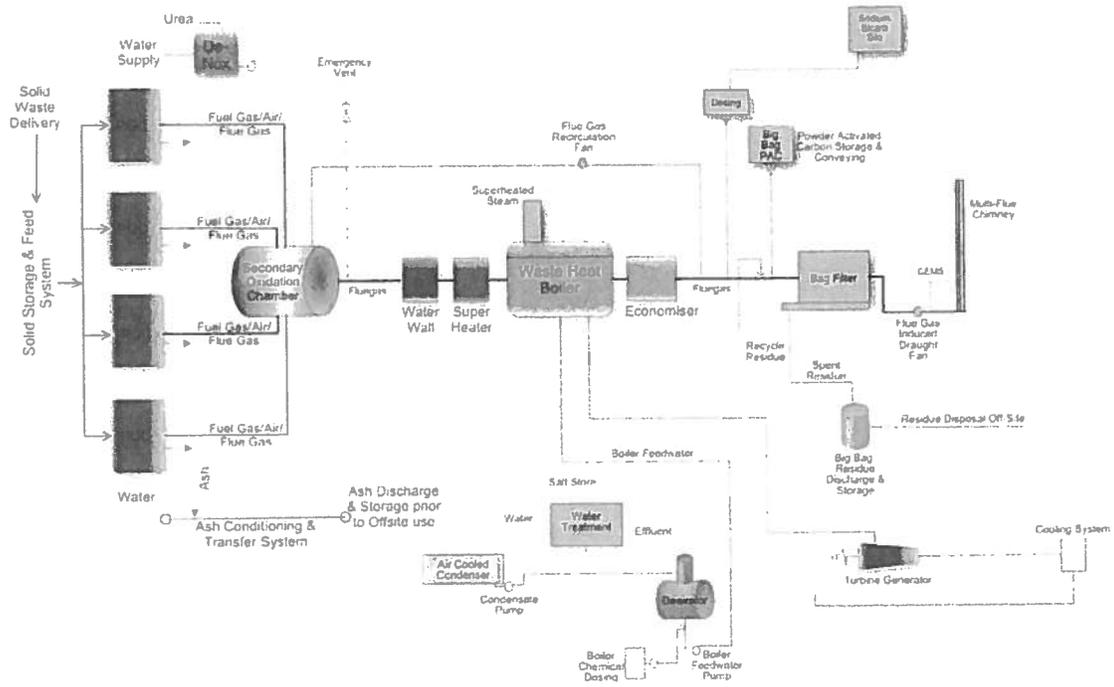
WTEC works with each client from conception, commissioning and long term operation

## ADVANTAGES OF BGS™

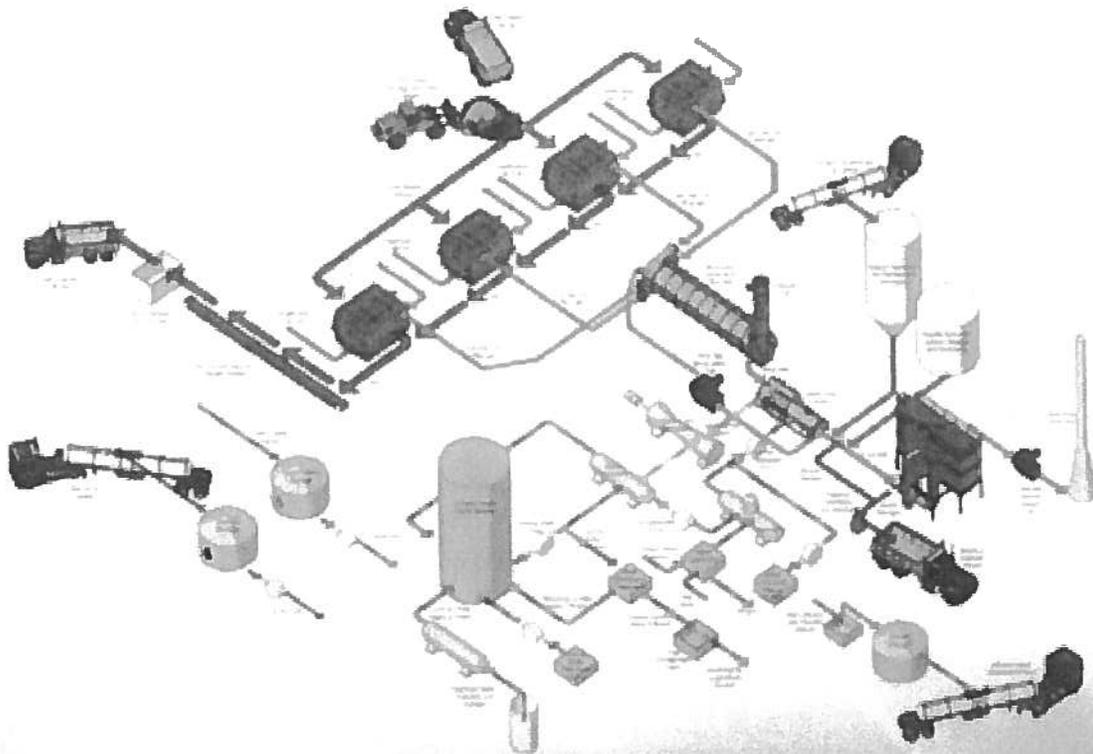
1. Proven technology with large-scale commercial plants built, permitted, & operating.
2. Technically & environmentally superior, cheaper, & politically more acceptable than mass burn incineration.
3. Self-sustaining, exothermic reaction does not burn wastes directly as with incineration but converts wastes first into hot, synthetic gas, which is then burned cleanly & efficiently.
4. Technically simpler than other advanced thermal treatment technologies.
5. Can process virtually all types of solid, semi-solid & liquid waste fuels including medical and other hazardous wastes.
6. No sorting or pre-processing of wastes required.
7. Loose, baled & densified wastes can all be loaded directly into the BGS™.
8. Processes wider range of wastes more efficiently with greater net energy recovery than other thermal or non-thermal conversion technologies.
9. Avoids costs & technical complexity of processing & storing syngas or Refuse Derived Fuel.
10. Simple, robust design with very few moving parts.
11. High facility availability factor.
12. Easy batch loading by boom loader or automatic conveyor—15 minutes to load 15 metric tons of waste and no more labor required for 23 hours.
13. Self-sustaining, exothermic reaction requires very little auxiliary fuel.
14. Thermal reaction turns waste into hot gases and clean, non-toxic, carbon-free ash.
15. High efficiency of energy conversion—approximately 95% to boiler or other heat recovery equipment.
16. Reduces waste volume up to 97%.
17. BGS™ achieves complete destruction in regulatory terms of medical & other types of hazardous waste.
18. Produces no slag or clinkers.
19. Bottom ash is sterile, non-toxic, & friable, contains virtually no carbon, and passes EPA's "Toxicity Characteristics Leaching Procedure" test.
20. Bottom ash need not be landfilled & can be sold as aggregate for concrete & asphalt road surfacing, pipe bedding or drainage fill.
21. Metal & glass can be recovered easily and safely from bottom ash for recycling.
22. Cuts landfill waste to zero or near zero.
23. Provides renewable energy for electricity, steam, heating, cooling & purifying water.
24. Lower air emissions than central power plants.
25. Cuts Greenhouse Gases by eliminating landfill gases; off setting power produced by burning fossil fuels; cutting waste transport to landfills or incinerators & increasing recycling of metals & glass.
26. Moderate temperature & slow, undisturbed gasification produces very low particulates, CO, heavy metals, NOx & other pollutants.
27. Syngas is combusted in Secondary Chamber at temperatures up to 1300° C with retention time  $\geq$  2 seconds.
28. Inherently low BGS™ emissions can be further reduced by advanced treatment of flue gases to pass all EPA tests and permit requirements in US & European Union.
29. Low air emissions allows low stack as required by local regulations.

30. WTEC's Best Available Technology includes: injection of sodium bicarbonate to neutralize acids; activated carbon to remove trace dioxins, furans & heavy metals; flue gas recirculation & selective non-catalytic reduction (SNCR) to control NOx & filter baghouse to collect scrubber consumables.
31. Process trains with modular & scalable components can provide optimum processing capacities of virtually any size.
32. Functionally independent process trains & their modular components reduce down time as maintenance & repair on one does not affect operation of others.
33. One or more functionally independent process trains can be paired with a functionally independent power train to provide full redundancy in power generation.
34. BGS™ modules are pre-fabricated & tested, which cuts costs, ensures quality, & speeds installation on site.
35. Modules can be added or taken off line as needed, which cuts risk of incorrectly forecasting waste generation volumes & recycling success.
36. Modular design cuts initial and life-cycle capital costs because plants can be built for near-term rather than long-term capacity needs.
37. Typically deployed from 0.5 mtpd to plus 500 mtpd (or 'trained' for larger capacity)
38. Low cost & modular design facilitates de-centralized waste processing and distributed power generation.
39. Heat can be recovered in boiler, Organic Rankine Cycle turbine generator, absorption chiller, or other exchanger.
40. Recovered energy can be used for industry, heating & cooling, electricity or mechanical power & desalination.
41. Low-profile plant exterior looks much like an ordinary warehouse for low visual impact.
42. Small site footprint.
43. Mobile BGS™ at 1.5 metric tonnes per day capacity are containerised for easy delivery & installation.
44. Automated process controls with manual override provide operator interface by touch-screen.
45. Digital control system can provide SCADA (Supervisory Control & Data Acquisition) data logging capability.
46. Digital control system can allow the WTEC team to provide real-time remote monitoring and technical support for local plant operators and management.
47. Long list of potential revenue streams: gate or "tipping" fees; electricity; process heat and/or steam to industry; low-pressure steam for district heating; chilled water or air for central cooling; desalinated water; bottom ash for concrete aggregate; scrap metal and glass recovered from bottom ash; carbon credits and renewable energy credits.
48. Qualifies for renewable energy grants, subsidies and tax credits.
49. Modular design and low capital and operating costs allow cost-effective waste processing and renewable energy generation even at small capacities.
50. Highly experienced international team for ongoing support, refinement and management.
51. De-centralized waste processing & distributed power generation cuts costs & environment effects of waste hauling or transfer stations and allows communities to take responsibility for their waste where it's generated for power where it is needed.
52. Via complimentary technology such as Materials Recycling, Anaerobic Digestion or Carbon Capture we can provide a full suite of solutions – we look forward to working with you.

## TYPICAL 60MTPD BGS PROCESS FLOW



## TYPICAL 60MTPD BGS LAYOUT



# WTEC

Providing clean and smart technology for worldwide clients for over nineteen years

Waste to Energy Canada Inc. (WTEC) is a limited liability diversified waste-to-energy company headquartered in Vancouver, BC, Canada.

Waste-to-Energy Canada Inc

Clean & Smart solutions.

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## Case Study: Mobile Gasifier System into the High North

### THE CHALLENGE

The Canadian arctic community of Old Crow is located in northern Yukon at the confluence of the Porcupine and Crow Rivers (approximately 800 km north of Whitehorse) by the Arctic National Wildlife Refuge - home range of the Porcupine Caribou herd and home to the Vuntut Gwitchin First Nation.



The only means of access is by air, with an occasional winter road. The daily temperature reaches above freezing for only 5 months of the year varying between -31.1 degrees and 25.0 degrees Celsius.

Old Crow required a waste destruction system in accordance with the Yukon Solid Waste Management Plan that prohibits burning and burying waste. Ensuring ecological integrity was a critical element as the community relies on the Porcupine Caribou herd for their livelihood - tourism and subsistence hunting.

A Working Group consisting of the community of Old Crow together with Yukon's Infrastructure Development Branch and Yukon Energy invested two years of rigorous due diligence before an RFP was developed attracting 12 proponents from North America and Europe.

**WTEC was the successful proponent with the agreed plan of a modular Mobile Gasifier System to be transported via Hercules aircraft to Old Crow.**

### OUR TECHNOLOGY - YOUR SOLUTION

WTEC technology cleanly destroys waste with options for producing renewable energy.

The modular 1.5 tonne per day Mobile Gasifier Systems are ideally suited for remote locations, communities, camps, extraction industry sites, institutions, ports, airports, hospitals, military deployments, emergency relief and ships - in fact any situation where a mobile system would solve a waste problem.

At a medium scale - from 60 tonnes per day - the clean conversion of unprocessed or sorted waste for the production of renewable energy becomes cost effective - ask us for details.

Each fully enclosed WTEC systems use a long, slow, low temperature gasification process that uses the fuel value of the waste so that once the process has commenced it becomes a self-sustained conversion from solid waste to gas. A simple low temperature conversion is the preferred cleaner and energy efficient method. The gas is then completely oxidized in a second stage for 3 or 4 seconds at very high temperature providing thermal energy. This means few moving parts, and low operating costs. The small amount of inert bottom ash is clean and can be used for land remediation. Each system is modular and scalable.

WTEC technology has evolved from a widely deployed system with proven benefits.

### CLEAN & SMART SOLUTIONS

Designed for communities, industries and organizations in Canada and overseas that require no landfilling or incineration, our Mobile Gasifier System is a technology and management solution that provides a clean, smart and affordable solution to deal with +/- 1.5 tonnes of waste per day.

Unlike other small-scale technologies our MGS systems use gasification/oxidation and have evolved via a long track record, require little input energy, are simple, efficient, effective and self contained for rapid deployment.

Our MGS systems take any feedstock and cleanly convert it into inert bottom ash and enhance recycling where feasible.

**Leasing options can lower capital requirements.**

**Our mobile systems mean reduced deployment bureaucracy for our clients.**

**The dual-module containerized design means ease of deployment in any location.**



## Mobile Gasifier System

### DEPLOYMENT

Each WTEC pre-configured and pre-tested MGS system is permanently housed in 2-customized 40' shipping containers, a Service Module and a Process Module.

The "plug-and-play" design allows the system to be setup and operational in hours with minimal assembly.

Once the Process Module and Recycling units in the Service Module are married to the common access-way and the stack assembly are complete, the MGS is ready for operation.

The MGS can include a fully containerized Emissions Control Systems module to meet any global air emission standard. Features such as loading devices, Continuous Emission Monitoring Systems (CEMS) and Supervisory Control And Data Acquisition system (SCADA) are options.

Each self-contained MGS allows for easy disassembly and transportation to another location.

### HOW IT WORKS

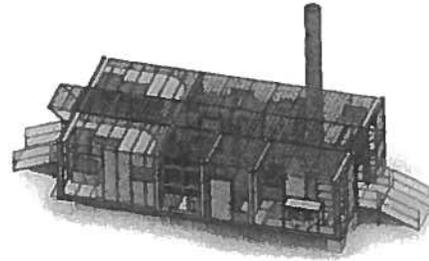
WTEC's 1.5 tonne per day gasification facility cleanly destroys waste and can provide a recycling centre – providing the convenience of a complete facility in a sturdy, compact and highly reliable format.

Robustly built for harsh environments and based within standard shipping containers the Mobile Gasifier System is air, truck, rail or sea transportable for rapid deployment worldwide.

Being safe and easy to operate the system can be monitored, controlled and serviced remotely.

The secure system is raised to avoid any ground or wildlife interference and is completely self-contained with its own generator.

Each MGS is equipped with a high pressure wash-down system that incorporates a drain system and return tank to avoid ground pollution.

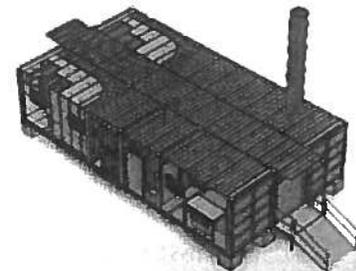
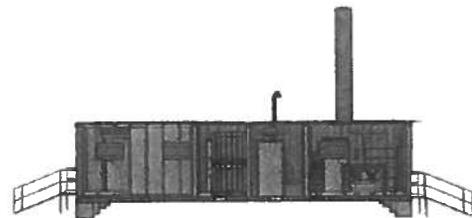


#### ▲ ABOVE: Service Module and a Process:

Module For ease of deployment the two modules are joined to a common enclosed walkway accessed from all sections. All components and materials for assembly are shipped in the service module.

#### ▼ BELOW: Mobile Gasifier System:

Adaptable for varied climates and conditions and Canadian built to withstand the world's harshest environments.





## Mobile Gasifier System

### Dynamic/Flexible

- Handle all waste types cleanly – (*see separate item for accepted waste types*).
- Adaptable to all human-occupied altitudes, latitudes & climates.
- System is pre-configured to accept glass and metal crusher to enhance recycling where suitable.
- Unique and proprietary HVAC system accommodates all environmental conditions e.g. desert, jungle, polar, shipboard etc.
- All components are marine grade for durability, first in class from proven recognized industry leaders with warranties.
- Readily redeployed as required, ability to marry multiple units.
- For sale or lease.

### Easy Operation

- Set up within one day, operational next day.
- Operator training included by WTEC (allow one week to adequately train operator).
- Mid-level operator skill level i.e. heavy equipment operator.
- One staff member required 1 hour per day.
- Easy loading of mixed waste – internal between modules for small/moderate sized waste.
- Systems pre-heat and check prior to operator arrival, monitored via phone or mobile device.
- SCADA remote monitored operation (Supervisory Control and Data Acquisition).
- Proprietary control software background monitored by WTEC technicians for troubleshooting, software upgrades etc.
- SCADA Satellite uplink option for remote locations.
- Enclosed wash down detention system (heated in freeze zones).
- Self-contained control/service module.
- Allows for recycling, transparency, can be overlaid with ISO 14001.

### Design

- Widest most variable possible waste stream profile accepted i.e. any gasified waste that thermally destructs within 1200°C.
- Allows for special protocol loads e.g. medical.

- Mounted on location-specific blocks to avoid adverse effects on site.
- Adjustable jacking allows for leveling.
- Closed cell R8, polyurethane coated foam lining (food grade, non-porous) sheeted in 20 gauge closed seam sheet metal for durability and contamination avoidance.
- Proprietary technology and software
- Completely self-contained standalone concept including, environmental fuel containment systems, generator, 24volt system with 1-week battery backup, heat/moisture sensors in each zone, fire warning systems, auto shutdown, level warnings, spare FQD in control PLC, tools, workbench, lighting etc.
- Unique venting/heat management system for +45° to -40°C.
- System pre-heat and auto-shutdown.
- Extra hydraulic, air and power hook ups as required allows for future upgrades without extra install costs.
- One-year warranty, extended warranty available.
- Service support (24/7) including upgrades as required on demand.
- With average EU or North American MSW feedstock input, emissions will be within acceptable EPA, EU, and SEPA compliance.
- Optional Continuous Emissions Management Systems can be added for waste streams of higher contamination levels.

## Dimensions/Capacities

- Based on average N/American MSW input, 1.5mtpd MGS produces 0.6 MWt.
- 1.5mtpd (6m3 @ 95% full) Primary Gasification Chamber capacity.
- Gross Weight = Service Module 30T, Process Module 44T.
- Transport dimensions = Two x 12.2m long containers, 2.4m wide, 2.6m high.
- Primary aperture dimension = 3.3 x 1m.
- Enclosed 1.2m wide access walkway between modules.
- Small footprint 6 x 12.2m.
- Cool down period = 3 hours
- Stack height = 5.5m from grade, or to local code.
- External fuel (the match) is introduced for 3-7 minutes at start of process then shut-off, as balance of process is self-sustaining.
- Consumables = varies according to location, feedstock and other factors: Allow \$45 per day for initial budgeting - discuss your needs with us.

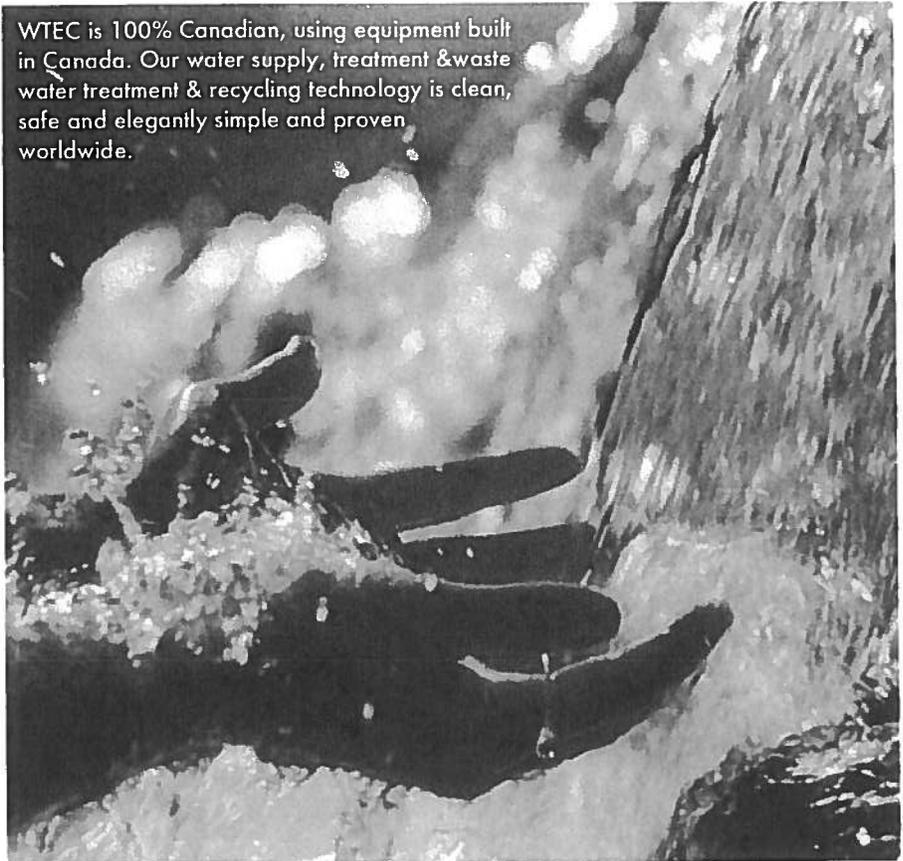


## Deployment

- Road, Rail, Ship or Air transportable.
- Modular – MGS can be ‘trained’ together.
- Standard equipment, fixtures and systems for ease of replacement (rail on rail of Military field design) with spares in inventory.
- Sanitizing operation - waste receiving and holding areas are sealed and washed down via pressure hose using bio-degradable wash liquid or similar.
- Financing/leasing option - WTEC have favourable terms with a number of financial partners offering variable rates and terms to potential clients with suitable credit history, globally.
- Multiple applications e.g. mining or oil & gas sites, remote communities, military, industrial sites, ports, islands, resorts, medical facilities, prisons, remediation sites – discuss your need with us.

# Water & Waste Water Treatment / Recycling & Reuse

WTEC is 100% Canadian, using equipment built in Canada. Our water supply, treatment & waste water treatment & recycling technology is clean, safe and elegantly simple and proven worldwide.



## Environmentally Safe, Clean & Efficient, Cost Effective, Proven & Accepted Technology

### Bio-Brane + Bio-Wheel Waste Water Treatment

- ▶ High Process efficiency
- ▶ Combines the stability of fixed-film & compact activated sludge in a single treatment system
- ▶ Proven worldwide since 1990
- ▶ Simple control system
- ▶ Sturdy and simple construction
- ▶ Reliability of operations
- ▶ Compact footprint
- ▶ Scalable, modular to grow for changing needs or cash flow
- ▶ Operation is fully automated
- ▶ No annoying odours
- ▶ Extremely low noise levels
- ▶ Unobtrusive for good site aesthetics
- ▶ Low power consumption
- ▶ Reduced total community raw water use
- ▶ Low capital and operating costs allow for system to be decentralized
- ▶ Better system = better chance of federal or provincial funding

### Our approach:

- ✓ Assess needs
- ✓ Use proven technology
- ✓ Incorporate waste water recycling
- ✓ Process design
- ✓ System engineering
- ✓ Commissioning
- ✓ Inspections & Compliance
- ✓ Management
- ✓ WtEC's service excellence

**WTEC**  
waste to energy canada

### H2O Innovations Bio-Brane & Bio-Wheel system advantages:

- ✓ High quality effluent that surpasses the most stringent regulations.
- ✓ Proven & durable with very low maintenance & operating costs.
- ✓ Low capital requirement (ask about lease or finance).

## Bio-Brane & Bio-Wheel benefits

### 1. Best of both

Combines the stability of fixed-film and compact activated sludge in a single treatment system using proprietary & patented technology.

### 2. Mitigates leaching

Every gallon of waste water treated eliminates harmful leachate from entering the environment.

### 3. Award winning technology



### 4. Simple to install

Easy to manage & very cost effective to run using 20% less energy compared to other systems



### 5. We export

Ask us about Export and Development Canada eligibility

### 6. Scalable and Modular

Provides options from portable 'camp models' to complete municipal or regional applications

Contact us at WTEC for clean and smart sustainable system sourcing, design, install and management.

Toll Free: 1 877 441 7377  
www.wtecanada.com

**WTEC**  
waste to energy canada

H2O installs and manages the Bio-Brane and Bio-Wheel system to have a very small footprint, extremely low noise and odour. SCADA background monitored and our service & support excellence.



Proven worldwide since 1990 the compact combined system ensures effective use of space, achieving 100% water reuse to EU, EPA and Canada standards. Matches criteria for LEED and Built Green.



"This wastewater treatment facility combines modern biotechnology, energy saving design concepts and practical engineering know-how into a high performance, high efficiency environmental protection." The American Council for Engineering Company (ACEC)

## Geo-Cube treated wastewater & storm water detention for reuse:

- \* Flexibility in design & deployment, in line with Bio Brane & Bio-Wheel unaffected by frost
- \* Cost effective:
  - No cranes or concrete
  - 1/3 of the labour to install
  - No revetment required, just back fill over
- \* Less space required over traditional holding tanks
- \* Water is captured off roof spaces & impermeable surfaces (roads etc),
  - All debris & sediment is pre filtered before entering storage
  - All oils & contaminants are separated
- \* Excellent use of space rather than ponds = no bugs
- \* Service life is +90 years
- \* System design incorporates 100-year storm event
- \* Systems are easily designed in 3-ways:
  - Total retention, no water escapes
  - Retention with slow dispersal to ground
  - Total retention with slow release to watercourse
- \* Captured water held & used for: Green spaces or reused in lavatories.

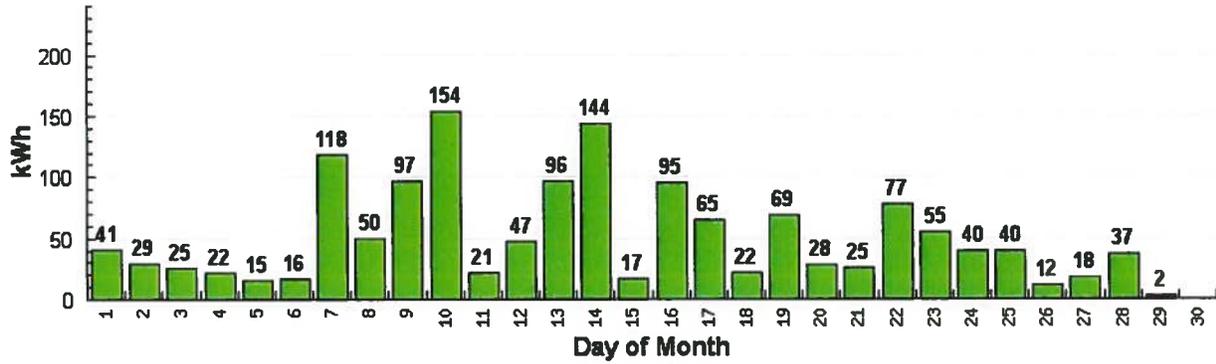


We provide financing or lease options for water, waste and energy systems. We are proud of our long and successful history of working with many communities and corporations. Call us to discover more...



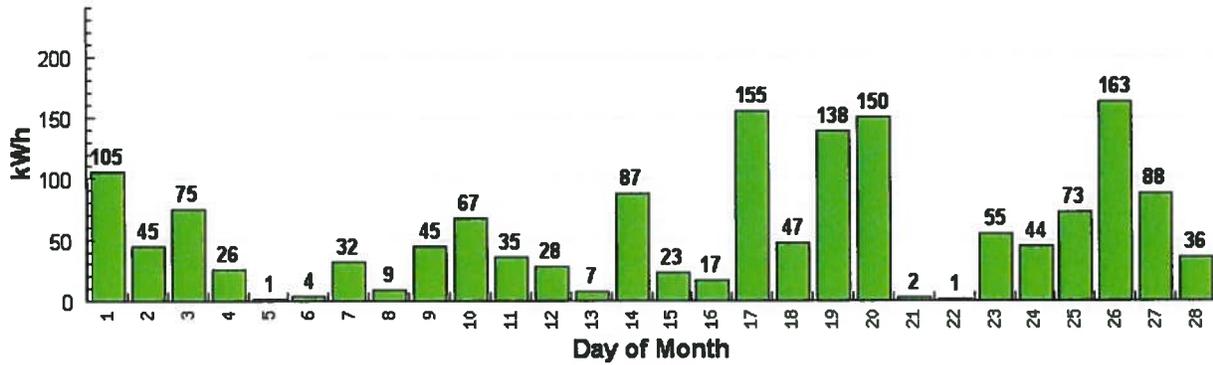
## March 2013 Energy Produced

1,477 kWh total



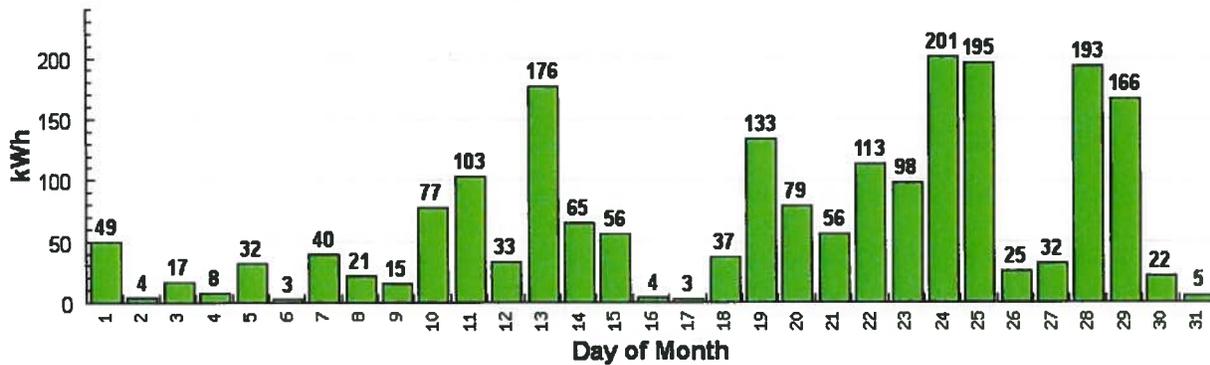
## February 2013 Energy Produced

1,558 kWh total



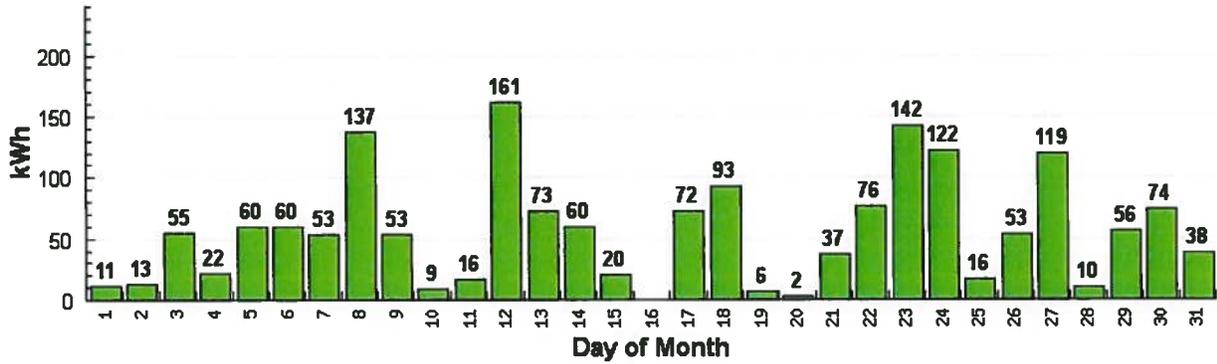
## January 2013 Energy Produced

2,061 kWh total



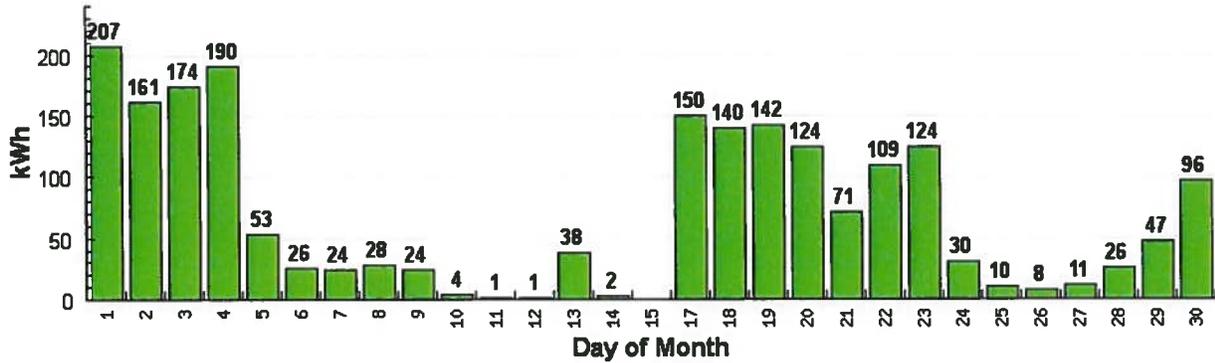
## December 2012 Energy Produced

1,719 kWh total



## November 2012 Energy Produced

2,021 kWh total



## October 2012 Energy Produced

2,465 kWh total

