

TO:	CHAIR AND MEMBERS CIVIC WORKS COMMITTEE MEETING ON JUNE 7, 2017
FROM:	KELLY SCHERR, P.ENG., MBA, FEC MANAGING DIRECTOR - ENVIRONMENTAL & ENGINEERING SERVICES & CITY ENGINEER
SUBJECT	MEMORANDUM OF UNDERSTANDING WITH BIO-TECHFAR INC. AS PART OF THE LONDON WASTE TO RESOURCES INNOVATION CENTRE

RECOMMENDATION

That, on the recommendation of the Managing Director, Environmental & Engineering Services and City Engineer, with the support of the Director, Environment, Fleet and Solid Waste, the attached proposed by-law (Appendix A) **BE INTRODUCED** at the Municipal Council meeting to be held on June 13, 2017 to:

- a) authorize and approve a Memorandum of Understanding with Bio-Techfar Inc., with respect to advancing our joint waste to resources (waste management, diversion and/or conversion into products with beneficial uses) objectives with the mutual understanding that the combined expertise, influence and commitment are better applied together to support common goals attached as Schedule "A" to the by-law; and
- b) authorize the Mayor and the City Clerk to execute the Memorandum of Understanding authorized and approved in a), above.

PREVIOUS REPORTS PERTINENT TO THIS MATTER

Relevant reports that can be found at www.london.ca under City Hall (Meetings) include:

- Memorandum of Understanding with the University of Western Ontario (Institute of Chemicals and Fuels from Alternative Resources) as Part of the London Waste to Resources Innovation Centre (December 12, 2016 meeting of the Civic Works Committee (CWC), Item #8)
- Update and Next Steps: London Waste to Resources Innovation Centre and Green Shields Energy (October 4, 2016 meeting of the CWC, Item #10)
- Memorandum of Understanding with Green Shields Energy (Examining to Role of a Waste Conversion Technology) (February 3, 2015 meeting of the CWC, Item #5)
- Preliminary Concept for a London Waste to Resources Innovation Centre (February 3, 2015 meeting of the CWC, Item #4)

STRATEGIC PLAN 2015-2019

Municipal Council has recognized the importance of solid waste management, climate change, other related environmental issues and innovation in its 2015-2019 - Strategic Plan for the City of London ([2015 – 2019 Strategic Plan](#)) as follows:

Building a Sustainable City

- Strong and healthy environment

Growing our Economy

- Local, regional, and global innovation

Leading in Public Service

- Proactive financial management
- Excellent service delivery

BACKGROUND

PURPOSE

The purpose of this report is to provide Civic Works Committee and Council with a non-binding Memorandum of Understanding (MoU) to be signed by the City of London and Bio-Techfar Inc. (Bio-Techfar).

In brief, the MoU sets out the mutual intentions of the City and Bio-Techfar to advance their joint waste to resources (waste management, diversion and/or conversion into products with beneficial uses) objectives. The MoU is based upon the mutual understanding that the combined expertise, influence and commitment of the parties are better applied together to support their common goals. This particular MoU is for a General Arrangement (Step 1) noting that any Formal Agreements (Step 2) would come back through Committee and Council.

CONTEXT

Municipal Council's Strategic Plan 2015-2019

The London Waste to Resources Innovation Centre is listed as a component of London's Strategic Plan 2015-2019 under local, regional and global innovation.

February 9, 2015 Council Direction - London Waste to Resources Innovation Centre

At its February 9, 2015 meeting, Council approved and adopted the following recommendation with respect to the London Waste to Resources Innovation Centre:

- a) *the concept of a London Waste to Resources Innovation Centre BE APPROVED IN PRINCIPLE; it being noted that the Centre would build upon the numerous innovative activities that have already occurred to date and are being planned for 2015 and 2016;*
- b) *the Civic Administration BE DIRECTED to:*
 - i) *identify potential partners, projects, resource requirements and funders;*
 - ii) *obtain initial feedback from potential partners; and,*
 - iii) *develop a scope of work for the London Waste to Resources Innovation Centre concept;*

London Waste to Resources Innovation Centre (LWRIC)

The primary goals of LWRIC are to:

- build on the existing foundation of traditional and innovative projects to divert waste from landfill and create value added products from residues and waste;
- create a focal point (location or locations) for the ongoing examination of innovative solutions for waste reduction, resource recovery, energy recovery and/or waste conversion into value-added materials, chemicals, heat and power;
- establish partnerships and collaborations between government, academia and businesses to synergistically build on existing strengths to create opportunities to prevent waste, to create products of value from waste, and to solve existing waste management challenges; and
- be known as an innovative centre of excellence with shared facilities and resources providing leadership, implementing best practices, undertaking leading edge research, providing knowledge and support to industry, while educating and training students, researchers and postdoctoral fellows in the various fields of resource and waste management.

Current MoUs

The City has two signed MoUs as follows:

- Green Shields Energy (GSE) - a working relationship to explore the viability of a Gas Phase Reduction (GPR) technology for managing solid waste. This technology has already been proven to manage a range of material including pesticides, soil, sediment, sludge, high-strength oils, tar, watery wastes, wood wastes, brominated fire retardants, CFC refrigerants. It has not been thoroughly tested to handle mixed solid waste (household garbage), source separated organics (Green Bin) materials, mixed plastic waste, etc. GPR is a process for the conversion of organic material to methane rich gas also known as synthetic gas or syngas. The process comprises heating vaporized organic material in the presence of an excess amount of hydrogen gas and superheated steam to produce a methane rich fuel syngas. The syngas can be converted to various fuels or burned directly to create energy. The expiry date of this MoU is December 31, 2017.
- University of Western Ontario (Institute of Chemicals and Fuels from Alternative Resources - ICFAR) – a working relationship covering the broad sectors of solid waste management, biomass management and related sectors that produce waste materials. ICFAR is a research facility with proprietary technologies and expertise that have contributed to the successful conversion of a range of materials into energy, chemicals and inert materials. Western has identified Environmental Sustainability and Green Energy as an area of research strength and ICFAR/Western has various research interests in the field of biomass conversion technologies and management and wishes to coordinate R&D activities, including multi-disciplinary, multi-institutional waste-to-resource initiatives, for the purpose of using the broad expertise to valorize biomass and organic wastes into marketable products at the local, regional, Canada-wide and international levels. The expiry date of this MoU is December 31, 2019.

Direction of the Provincial Government

Waste Free Ontario Act, 2016

In November 2015, the Minister of the Environment and Climate Change (MOECC) introduced a new legislative framework for managing waste in Ontario under Bill 151, *Waste Free Ontario Act (WFOA)*. Bill 151 received Royal Assent in June 2016 and was proclaimed November 30, 2016.

Strategy for a Waste-Free Ontario: Building the Circular Economy

MOECC published the final Strategy for a Waste-Free Ontario: Building the Circular Economy in February 2017, a requirement of the WFOA, which outlines a road map for resource recovery and waste reduction for Ontario. It also:

- sets a vision and goals including interim waste diversion goals for 2020, 2030 and 2050;
- articulates key government actions to support implementation of the vision and goals; and
- identifies performance measures to measure progress towards achieving the vision and goals.

The Strategy focuses on moving Ontario towards a circular economy described as “a system where nothing is wasted and valuable materials destined for landfill are put back into the economy without negative effects on the environment.” This approach – a circular economy – has the potential to reduce greenhouse gas emissions, save and better utilize scarce resources, create jobs and create financial opportunities. To fulfil the vision, the Strategy has two visionary goals:

- a zero waste Ontario; and
- zero greenhouse gas emissions from the waste sector.

DISCUSSION

Bio-Techfar have developed a proprietary pyrolysis technology, referred to as the BT-100/500, that has successfully converted a range of biomass materials into pyrolysis-oil and pyrolysis-char for both energy and non-energy applications. The technology utilizes a mechanically fluidized reactor (MFR). Bio-Techfar now wants to increase the technology throughput for biomass materials such as forestry residuals, agricultural residuals, yard waste and other industrial or municipal biomass materials/waste streams.

Step 1 – Memorandum of Understanding – General Arrangement

The first step in formalizing a working relationship with Bio-Techfar is to enter into a non-binding MoU. The MoU sets out the short-term objective of collaboration between the City and Bio-Techfar which would be to undertake testing and research; write and present reports; develop data/information including a feedstock inventory; and work with industry, government and academic partners on the viability of its proprietary pyrolysis technology and processes to create higher value resources from biomass waste that would normally be sent to recycling and/or disposal facilities. The proposed MoU is provided in Schedule A of Appendix A.

The responsibilities of the City are to include:

- Assist with all approvals (e.g., Ministry of the Environment & Climate Change MOECC, City of London zoning, etc.);
- Provide land in the special policy area (Waste Management Resource Recovery Area) as a host site for 5 years with an option to renew for additional years subject to Council approval as part of the Formal Agreement;
- Bring services (water, sanitary and hydro) to the location of the of the pilot scale facility subject to Council approval as part of the Formal Agreement;
- Provide access to the boardroom room and education room in the Material Recovery Facility (MRF);
- Participate, when available, in discussions, tours and related activities;
- Assist Bio-Techfar in inventorying and sourcing feedstocks;
- Subject to the completion of a feedstock inventory, materials handling specifications and financial requirements, provide reasonable quantities of non-hazardous feedstock for conversion;
- Assist with reporting, being available for media interviews and related matters; and
- Keep London Municipal Council informed.

The responsibilities of Bio-Techfar are to include:

- Design and lead the feedstock inventory project;
- Obtain all necessary Environmental Compliance Approvals and Operating Licenses
- Construct and operate the commercial scale pilot facility and all associated costs including building, utilities, air emission controls, etc.
- Evaluate and report the results of the research and development work; and

- Provide overview reports quarterly to the City of London highlighting activities undertaken, key non-proprietary results and related matters noting that such reports are subject to the requirements of the *Municipal Freedom of Information and Protection of Privacy Act*.

Step 2 – Formal Agreement for Demonstration Pilot Projects

The City and Bio-Techfar will work together to develop a Formal Agreement(s) to undertake activities that involve capital works, contracts with funding agencies, contracts with secondary educational institutions, private companies and investors. Any Formal Agreement will follow the same approval processes as this General Arrangement and require Council approval.

ACKNOWLEDGEMENTS

This report was prepared with assistance from Mike Losee, Division Manager, Solid Waste Management. This report has followed the template for by-law approval and MoU signing approved by the City Clerk and Legal Services.

PREPARED AND SUBMITTED BY:	RECOMMENDED BY:
JAY STANFORD, M.A., M.P.A. DIRECTOR, ENVIRONMENT, FLEET & SOLID WASTE	KELLY SCHERR, P.ENG., MBA, FEC MANAGING DIRECTOR, ENVIRONMENTAL & ENGINEERING SERVICES & CITY ENGINEER

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Appendix A A by-law to authorize and approve a Memorandum of Understanding between Bio-Techfar Inc., and The Corporation of the City of London and to authorize the Mayor and the City Clerk to execute the Memorandum of Understanding

Schedule A Memorandum of Understanding

Attachment A Overview of City of London Solid Waste Management Facilities

Attachment B Overview Bio-Techfar (BTF) Inc. and BTF Pyrolysis System

Attachment C Feedstock Categories and Specifications

c Paul Franch, President and CEO, Bio-Techfar Inc. 112 Coons Road Richmond Hill, Ontario L4E 2K6

Appendix A

Bill No.
2017

By-law No. A.-

A by-law to authorize and approve a Memorandum of Understanding between Bio-Techfar Inc., and The Corporation of the City of London and to authorize the Mayor and the City Clerk to execute the Memorandum of Understanding.

WHEREAS section 5(3) of the *Municipal Act, 2001*, S.O. 2001, c. 25, as amended, provides that a municipal power shall be exercised by by-law;

AND WHEREAS section 9 of the *Municipal Act, 2001*, S.O. 2001, c. 25, as amended, provides that a municipality has the capacity, rights, powers and privileges of a natural person for the purpose of exercising its authority under this or any other Act;

AND WHEREAS it is deemed appropriate for The Corporation of the City of London (the "City") to enter into a Memorandum of Understanding with the Bio-Techfar Inc., to undertake testing and research; write and present reports; develop data/information including a feedstock inventory; and work with industry, government and academic partners on the viability of a proprietary pyrolysis technology and processes to create resources from waste that would normally be sent to recycling and/or disposal facilities;

AND WHEREAS it is deemed appropriate to authorize the Mayor and the City Clerk to execute the Memorandum of Understanding on behalf of the City;

NOW THEREFORE the Municipal Council of The Corporation of the City of London enacts as follows:

1. The Memorandum of Understanding between The Corporation of the City of London and Bio-Techfar Inc., attached as Schedule A to this by-law, is hereby authorized and approved.
2. The Mayor and the City Clerk are hereby authorized to execute the Memorandum of Understanding authorized and approved under section 1 of this by-law.
3. This by-law shall come into force and effect on the day it is passed.

PASSED in Open Council June 13, 2017

Matt Brown
Mayor

Catharine Saunders
City Clerk

First Reading – June 13, 2017
Second Reading – June 13, 2017
Third Reading – June 13, 2017

Schedule A

Memorandum of Understanding

Between

The Corporation of the City of London (“City”)

And

Bio-Techfar Inc. (“Bio-Techfar”)

Whereas the City has established a special policy area in the City’s Official Plan, referred to as the Waste Management and Resource Recovery Area, that plans for the continued evolution of the W12A Landfill and nearby lands into an “Integrated Waste Management Centre” that utilizes environmentally responsible and sustainable operations and practices and achieves a high standard of compatibility with its environs and neighbours;

Whereas the remaining life expectancy of the W12A Landfill as of January 1, 2017 is approximately eight and half years or less;

Whereas the City wishes to examine, support, conduct research and/or implement projects under the broad classification(s) of resource recovery, energy recovery and/or waste conversion within the special policy area, in other locations in London, or in collaboration with others outside of London as part of its continuous improvement system for solid waste management. The continuous improvement system is described in several public documents including City of London Continuous Improvement System for Waste Management (1997), A Road Map to Maximize Waste Diversion in London (2007) and Road Map 2.0 The Road to Increased Resource Recovery and Zero Waste (2013);

Whereas the City wishes to pursue projects, relationships and partnerships for the purposes of innovation, creativity, best practices and excellence in solid waste management and is proposing to operate, subject to final Municipal Council approval, under a banner known as the London Waste to Resources Innovation Centre (LWRIC);

Whereas Bio-Techfar has a broad range of operational expertise in the area of waste to resource management;

Whereas Bio-Techfar Inc. have developed a proprietary pyrolysis technology, referred to as the BT-100/500, that has successfully converted a range of biomass materials into pyrolysis-oil and pyrolysis-char for both energy and non-energy applications. Bio-Techfar Inc. now wants to increase the technology throughput for biomass materials such as forestry residuals, agricultural residuals, yard waste and other industrial or municipal biomass materials/waste streams;

Whereas Bio-Techfar Inc. is also interested in conducting research towards a project to utilize the landfill gas from the W12A Landfill to produce renewable Combined Heat & Power for internal processes, provide power to the City of London’s Material Recovery Facility (MRF) and provide other potential leaseholders of the London Waste to Resources Innovation Centre with the same options; and

Whereas the City and Bio-Techfar recognize that the framework direction for waste management and waste diversion in Ontario has been set through the *Waste Free Ontario Act, 2016* and the Strategy for a Waste-Free Ontario: Building the Circular Economy (February 2017).

1.0 Purpose of the Memorandum

This Memorandum of Understanding (“MoU”) is intended to set out the mutual intentions of the City and Bio-Techfar to advance their joint waste conversion, resource and energy recovery objectives. The MoU is based upon the mutual understanding that the

combined expertise, influence and commitment of the parties are better applied together to support their common goals. The MoU establishes the non-legally binding framework and set of principles for enhanced and focused coordination and collaboration to support their shared interests in waste conversion and resource and energy recovery.

The parties to this MoU acknowledge that if they wish to jointly carry out specific initiatives that may arise out of this MoU, they will have to engage in further discussion and prepare necessary agreements to define, authorize and execute, among other things, each party's roles and responsibilities, resource allocation and other details.

The MoU is not an exclusive arrangement and does not restrict either party from pursuing their mandates either on their own or in collaboration with any other party.

2.0 Short Term Objective

The short-term objective of the collaboration between the City (Attachment A) and Bio-Techfar is to:

- Build on the existing foundation of traditional and innovative projects to divert waste from the landfill and create value added products from residues and waste;
- Create a focal point (location or locations) for the ongoing examination of innovative solutions for waste reduction, resource recovery, energy recovery and/or waste conversion into value-added materials;
- Establish partnerships and collaborations between government and businesses to synergistically build on existing strengths to create opportunities to prevent waste, to create products of value from waste, and to solve existing waste management challenges; and
- Be known as an centre of excellence with shared facilities and resources providing leadership, implementing best practices, undertaking research, providing knowledge and support to industry in the various fields of resource and waste management.

Pyrolysis Technology

A specific short term objective of the collaboration between the City and Bio-Techfar Inc. is to determine the requirements and costs to construct and operate of a pilot commercial scale facility that utilizes the BT-100/500 pyrolysis technology to manage various biomass materials, specifically non-hazardous landfill bound waste products, such as; brush and clean wood waste, leaf and yard material, forestry residuals, agricultural residuals, and other industrial or municipal biomass materials/waste streams. Agriculture residues including, but not limited to; switch grass, Miscanthus and corn husks can potentially be blended with municipal biomass wastes to create value added products through processing (Attachment B).

Complementing the technical processes is the ongoing development of the potential role for this technology to handle various materials from the residential, institutional, commercial, industrial and agriculture sectors and to contribute towards policies and programs established by the various levels of government (Municipal Provincial and Federal) as well as and other Governmental agencies outside of Canada.

Bio-Techfar envisions a pilot project facility that has the potential to process about 40 tonnes/day (about 12,500 tonnes per year). The proposed facility would operate 24 hours a day, 7 days a week (340 days per year) with consideration for noise limitations, emissions and the impact on local neighbours.

Landfill Gas for Combined Heat & Power

A secondary short term objective of the collaboration between the City and Bio-Techfar is to undertake the study and research for the development, construction and operation of a landfill gas to energy project that will utilize the existing landfill gas being flared at the W12A Landfill throughout the London Waste to Resources Innovation Centre, internally at Bio-Techfar Inc. and at the City of London's MRF.

This will be done by studying landfill gas samples, conducting a landfill gas study on its ability to produce landfill gas over its lifetime and the construction of upgrades to the landfill gas management system, air emission controls, pipelines and infrastructure to produce combined heat and power for use throughout the site. The W12A Landfill has the potential to produce up to 2.5 megawatts (MW) of power.

There is an opportunity to have the London Waste to Resources Innovation Centre benefit from utilizing this existing renewable resources available onsite. Combined Heat & Power generated onsite for the MRF and other tenants of the innovation center would contribute towards policies and programs established by the various levels of government (Municipal Provincial and Federal) as well as other Governmental agencies outside of Canada.

Bio-Techfar acknowledges that the completed research would provide background details to any request for proposals and/or other type of business offering as per the City of London Procurement of Goods & Services Policy.

3.0 General Arrangement

The responsibilities of the City are to include:

- Assist with all approvals (e.g., Ministry of the Environment & Climate Change MOECC, City of London zoning, etc.);
- Provide land in the special policy area (Waste Management Resource Recovery Area) as a host site for 5 years with an option to renew for additional years subject to Council approval as part of the Formal Agreement (Section 4.0);
- Bring services (water, sanitary and hydro) to the location of the of the pilot scale facility subject to Council approval as part of the Formal Agreement (Section 4.0);
- Provide access to the boardroom room and education room in the Material Recovery Facility (MRF);
- Participate, when available, in discussions, tours and related activities;
- Assist Bio-Techfar in inventorying and sourcing feedstocks;
- Subject to the completion of a feedstock inventory, materials handling specifications and financial requirements, provide reasonable quantities of non-hazardous feedstock for conversion (Attachment C);
- Assist with reporting, being available for media interviews and related matters; and
- Keep London Municipal Council informed.

The responsibilities of Bio-Techfar are to include:

- Design and lead the feedstock inventory project;
- Obtain all necessary Environmental Compliance Approvals and Operating Licenses
- Construct and operate the commercial scale pilot facility and all associated costs including building, utilities, air emission controls, etc.;
- Evaluate and report the results of the research and development work; and
- Provide overview reports quarterly to the City of London highlighting activities undertaken, key non-proprietary results and related matters noting that such reports are subject to the requirements of the *Municipal Freedom of Information and Protection of Privacy Act*

4.0 Formal Agreement

The parties agree to work together to develop a Formal Agreement to undertake activities that involve capital works, contracts with funding agencies, contracts with private companies and investors. The Formal Agreement will follow the same approval processes as this General Arrangement.

5.0 Effective Date and Duration

This MoU will come into effect upon the date it has been signed by all signatories and will remain in effect until December 31, 2019. This MoU will be reviewed two months prior to the anniversary date and any agreed to changes added to the MoU. Substantive

changes will trigger the approval process for the MoU and this determination is at the discretion of the City and of Bio-Techfar.

A participant may withdraw from this MoU by providing a sixty (60) written notice to the other parties.

This MoU is subject to approval processes required by each of the parties.

DATED this _____ day of _____.

IN WITNESS WHEREOF:

THE CORPORATION OF THE CITY OF LONDON

By:

Name: Matt Brown
Title: Mayor

By:

Name: Catharine Saunders
Title: City Clerk

I/We have authority to bind the City.

BIO-TECHFAR INC.

By:

Name: Paul Franch
Title: President & CEO

I/We have authority to bind the corporation.

Attachment A

Overview of City of London Solid Waste Management Facilities (www.london.ca)

The City contributes to the health of the environment and its citizens through appropriate collection and management of garbage, recyclables, yard materials, household special waste, and other designated waste materials. This involves providing pick-up and drop-off services within London, processing and creating products of value from compostable/recyclable/reusable materials; and disposing of garbage in an environmentally responsible manner, including the ongoing monitoring and management of closed landfills and other sites producing methane.

To support these services the City owns and operates an array of Solid Waste diversion and disposal assets valued at over \$64 Million. These range from public waste and recycling bins, to drop off depots and one active landfill (W12A) and many closed landfill sites.

The City also owns a centralized Material Recovery Facility (MRF) which provides recycling services to London and several neighbouring communities. The MRF was newly constructed in 2011 and is operated and maintained by an outside contractor.

Drop off locations (Community EnviroDepots) are provided for special wastes including household special waste, yard materials, electronics, scrap metal, tires, roofing, etc. Solid Waste is responsible for maintaining these assets in serviceable condition between replacement cycles, ensuring compliance with Provincial regulations and maintaining the continuity of solid waste services to the citizens of London and other customers.

General household waste is primarily collected by the City while recycling pick-up and processing services are contracted out. The City owns and operates a fleet of garbage truck.

The W12A Landfill consists of a number of assets including landfill cells, buildings, leachate and gas collection systems and stormwater management ponds. This facility operates within its Operation Plan, with additional disposal cells being brought online to accommodate waste in accordance with its Environmental Compliance Approval. Based on projected use, the current landfill will reach capacity in about 2023, at which point it will require an expansion (or other long term disposal solution) to provide the city with the space needed to meet its future needs.

The W12A buildings (Incl. Site Works & Equipment) includes the roads, curbs and landscaping as well as the administration, maintenance and scale house buildings. The W12A Leachate Collection System collects and conveys leachate for treatment. This system is capable of meeting the current City's needs and is expanded as new disposal cells are constructed. The Landfill Gas Collection System collects and conveys landfill gas to the on-site landfill gas flare for destruction. This system is capable of meeting current City's needs and is expanded as new disposal cells are constructed.

On-site W12A Stormwater Management Ponds and site drainage infrastructure collect and treat surface runoff from snow and rain that impact the site. Maintenance occurs on a planned basis, with investments identified through regular inspections.

Any expansion or examination of alternatives will be undertaken as per the requirements of the Environmental Assessment Act.

Buffer land is comprised of City owned land adjacent or near the W12A Landfill that has been acquired to provide an appropriate buffer from existing operations and to provide buffering for possible future landfill expansion and resource recovery facilities. It is expected that additional land will be acquired for these purposes over the next several years.

Attachment B

Overview of Bio-Techfar Inc. (BTF) and the BTF Pyrolysis System

Bio-Techfar is a bio refinery technology and services provider for the conversion of biomass and other solid feedstock into energy and non-energy products through an innovative mechanically fluidized reactor, the BTF Pyrolysis System.

The BTF pyrolysis system converts the feedstock into pyrolytic oil (a mixture of oxygen rich hydrocarbons), pyrolytic char (mainly carbon and minerals), pyrolytic gas (light hydrocarbons CO and CO₂), and pyrolytic water. Ideal feedstock includes 2nd generation non-food biomass, such as ligno-cellulosic materials and organic wastes or by-products from forestry, agriculture, industry and municipalities.

Unlike other thermochemical biomass conversion processes with a “single product output”, the MFR pyrolysis system enables the production of all three main products (oil, char and gas) with both energy and non-energy value potential.

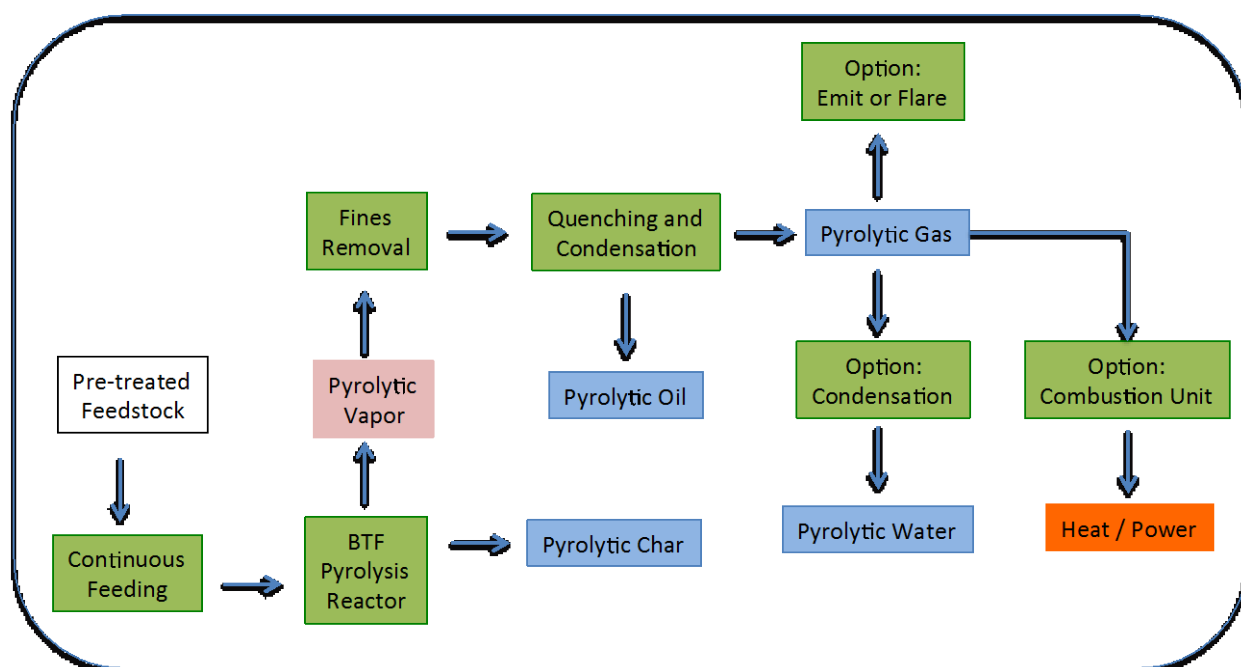


Figure 1 – BTF Pyrolysis System Schematic

The overall process is illustrated in Figure 1. Here is a brief description of the main process steps:

- The feedstock must be pre-treated for processing, typically reduction in size and moisture content, to meet the specifications for the production of specific outputs.
- The pre-treated feedstock is fed into the pyrolysis reactor, where it is converted into pyrolytic vapor and pyrolytic char. Reactor processing conditions can be tuned to favor any of the three main products (pyrolytic oil, char, gas).
- Pyrolytic char is removed directly from the pyrolysis reactor.
- Fine char and ash particles may exit with the pyrolysis gas stream from the reactor and will be removed by the fines removal system.
- Pyrolytic oil is then condensed and collected from the pure vapor stream.
- The remaining pyrolytic gas contains water vapor, CO₂ and lighter hydrocarbons.

Attachment C

Feedstock Categories and Specifications

Feedstock & Material Categories of Interest

1. Stumps & brush delivered to W12A EnviroDepot located at the landfill.
2. Oversized yard waste that has entered the composting stream but is difficult to compost (e.g., most often becomes a residual waste).
3. Wood chips from London Forestry Division.
4. Wood chips from City contracted services.
5. Clean wood from construction sites including processed skids sourced from local organizations and waste management companies.
6. Clean wood from institutional, commercial and industrial operations.
7. Agriculture wastes that are consistent in quality and composition and could include, but not limited to corn husks, switch grass, Miscanthus and other residues left to decay in fields.

Feedstock & Material Specifications

Feedstock is ideally to be 10 to 15% or less moisture level, chipped and passed through a ¼" minus screen. There is no tolerance for contaminants including, but not limited to; sand, metal, plastics, inert material, chemicals, nylons, creosote or pressure treated wood.