

TO:	CHAIR AND MEMBERS CIVIC WORKS COMMITTEE MEETING ON APRIL 16, 2019
FROM:	KELLY SCHERR, P.ENG., MBA, FEC MANAGING DIRECTOR - ENVIRONMENTAL & ENGINEERING SERVICES & CITY ENGINEER
SUBJECT	UPDATE AND NEXT STEPS FOR 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,

- a) the attached proposed by-law (Appendix A) **BE INTRODUCED** at the Municipal Council meeting to be held on April 23, 2019 to approve the Industrial Research Chair Agreement (in Thermochemical Conversion of Biomass and Waste to Bioindustrial Resources) with the University of Western Ontario attached as Schedule "A" to the by-law;
- b) the Mayor and the City Clerk **BE AUTHORIZED** to execute the Agreement authorized and approved in a), above;
- c) Civic Administration **BE AUTHORIZED** to undertake all administrative acts that are necessary in connection with executing this Agreement;
- d) Civic Administration **BE AUTHORIZED** to promote the role, contribution and opportunities to grow the London Waste to Resources Innovation Centre through its relationship with Western University; with existing businesses that have signed Memorandums of Understanding with the City of London; and with new businesses and organizations looking for opportunities in the broad field of resource recovery, creating resources from materials that would normally be discarded, and reducing materials that require disposal; and
- e) Civic Administration **BE DIRECTED** to report annually to the Civic Works Committee on the activities and actions taken through the London Waste to Resources Innovation Centre including a status on the operating structure and financial matters.

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 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)
- Preliminary Concept for a London Waste to Resources Innovation Centre (February 3, 2015 meeting of the CWC, Item #4)

STRATEGIC PLAN 2015-2019 AND DEVELOPMENT OF COUNCIL'S 2019-2023 STRATEGIC PLAN

Municipal Council has recognized the importance of solid waste management, climate change, other related environmental issues and innovation in its previous Strategic Plan (2015-2019) and to “Increase waste reduction, diversion, and resource recovery” and “Increase partnerships that promote collaboration, innovation, and investment” in the development of its 2019-2023 Strategic Plan for London. This work touches on three Areas of Focus:

- Building a Sustainable City
- Growing our Economy
- Leading in Public Service

BACKGROUND

PURPOSE

The purpose of this report is to:

- provide an update on the activities at the London Waste to Resources Innovation Centre and the next steps including operating and financial matters; and
- provide Civic Works Committee and Council with the details to recommend the execution of the Industrial Research Agreement (in Thermochemical Conversion of Biomass and Waste to Bioindustrial Resources) with the University of Western Ontario as part of the London Waste to Resources Innovation Centre.

CONTEXT

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;*
- c) *the Civic Administration BE DIRECTED to report back with a proposed scope of work and funding plan for the London Waste to Resources Innovation Centre.*

Municipal Council's Strategic Plan 2015-2019 (approved March 2015)

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.

Municipal Council Approval of 60% Waste Diversion Action Plan

The 60% Waste Diversion Action Plan containing programs and initiatives to be phased in between 2019 and 2022 to achieve 60% waste diversion was approved subject to further financing considerations. The Action Plan includes an update on the progress of the long-term Resource Recovery Strategy that will be completed in 2020.

Development of Municipal Council's Strategic Plan 2019-2023 (as of April 1, 2019, a report before the Strategic Priorities and Policies Committee)

The London Waste to Resources Innovation Centre is listed as a proposed component of London's Strategic Plan 2019-2023 under Growing Our Economy:

Outcome 2: London is a leader in Ontario for attracting new jobs and investments
 a) Increase partnerships that promote collaboration, innovation, and investment
 GOE-06 Expand opportunities and activities through the London Waste to Resources Innovation Centre.

DISCUSSION

This section contains three parts:

PART A: Overview of the London Waste to Resources Innovation Centre as of March 2019

PART B: Major Research and Development Program Awarded to Western University

PART C: Overview of Operations and Financial Considerations

PART A: Overview of the London Waste to Resources Innovation Centre as of March 2019



Primary Goals

The primary goals of the London Waste to Resources Innovation Centre 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.

Four Locations

The London Waste to Resources Innovation Centre currently operates using four existing locations:

1. Material Recovery Facility (MRF) on Manning Drive (beside the W12A Landfill) including the area just to the west of the facility which is approved for resources recovery/waste management demonstration projects (picture below).
2. 300 Dufferin Avenue City of London – City Hall. Most City of London staff involved in this project work out of City Hall.
3. The Institute for Chemicals and Fuels from Alternative Resources (ICFAR) is a research institute within the Faculty of Engineering at Western University. ICFAR has a 2,320 square metre (25,000 square foot) research centre and laboratory capable of conducting small and large scale pilot plants, undertaking advanced analytical facilities and prototypes. The aim of ICFAR is to be a leader in the development of technologies and processes for the production of chemicals and fuels from alternative resources (picture below).
4. Western University – access to facilities and professors working primarily on the main campus.



The City of London Regional Materials Recovery Facility (MRF) is located at 3438 Manning Drive. The blue star represents the area for proposed demonstration projects.



The Institute for Chemicals and Fuels from Alternative Resources (ICFAR) is located at 22312 Wonderland Rd N, Ilderton, a few minutes north of London, Ontario.

Main Activity Areas and Current Participants

The London Waste to Resources Innovation Centre currently has activities in five main areas with activities and accomplishments between 2015 and 2018 identified in Appendix B:

1. Research & Development
2. Training, Testing & Auditing
3. Resource & Waste Management Knowledge Exchange
4. Technology Demonstrations
5. Outreach & Engagement

The City has six Memorandums of Understanding (MoUs) approved by Council and one MoU that is pending that involve businesses working within the Innovation Centre with additional details found in Appendix B:

- Green Shields Energy – pending, April 16, 2019
- Canadian Plastic Industry of Canada (CPIA); approved March 2018
- Resource Energy Development of Canada (RediCan); approved March 2018
- Try Recycling; approved June 2017
- Bio-TechFar Inc; approved June 2017
- Tucker Engineering (via the former Hawthorne Green Key Group); approved June 2017; and
- University of Western Ontario (ICFAR); approved December 2016.

PART B: Major Research and Development Program Awarded to Western University

Western University, a partner in the London Waste to Resources Innovation Centre, has recently been awarded an Industrial Research Chair Agreement by the Natural Sciences and Engineering Research Council (NSERC) Collaborative Research. The focus is on projects related to the thermochemical conversion of biomass and waste to bioindustrial resources. Details of the Research Chair include:

Item	Details
Lead organization	Western University (Dr. Franco Berruti)
Partners in the five year project (noting that the list of partners can be expanded at any time)	<ol style="list-style-type: none"> 1. Domtar Inc. 2. CHAR Technologies 3. TRY Recycling Inc. 4. Canadian Plastics Industry Association 5. Grain Farmers of Ontario 6. Ontario Greenhouse Vegetable Growers 7. Titan Clean Energy Projects Corporation 8. Ontario Federation of Agricultural 9. A&L Biologicals 10. City of London
Financial value contributed by the 10 partners	\$1,150,000
City financial value (included above)	\$150,000 (\$30,000 per year)
NSERC (matching funds)	\$1,150,000
Estimated in-kind value contributed by the 10 partners	\$723,000

Item	Details
Estimated City in-kind value (included above)	\$67,500 (\$13,500 per year)
Estimated total value over five years	\$3 million
Timeframe	July 1, 2018 to June 30, 2023

The full agreement and particulars are contained in Appendix A and Schedule A. Key projects that will be a focus of City of London staff and a number of the partners include:

- recycling and recovery of hard to recycle plastics such as flexible plastic packaging (including mechanical recycling, chemical recycling, conversion to fuels, creation of fuel sources);
- enhancing leaf and yard waste compost quality through the use of biochars;
- creating products from bulky items (e.g., furniture, mattresses, textiles);
- processing select biomass materials with individual streams of municipal solid waste to create value added inputs to other processes; and
- examining current and future end markets for source separated and/or facility separated organic materials beyond traditional aerobic composting.

PART C: Overview of Operations and Financial Considerations

The London Waste to Resources Innovation Centre is designed to operate based on the following operating principles:

- All project work performed or to be performed by the City of London is approved as part of existing Solid Waste Management programs or capital projects. At this time, there is no specific City of London budget assigned to the London Waste to Resources Innovation Centre.
- City staff time (in-kind) will be assigned to the London Waste to Resources Innovation Centre on a case-by-case basis in consideration of direction set by Council (e.g., 60% Waste Diversion Action Plan, preparation of a long-term Resource Recovery Strategy), obligations from an MoU approved by Council, or obligations from an agreement approved by Council.
- Any business or organization that would like to enter into a relationship with the City of London does so through a Memorandum of Understanding (MoU) presented to Civic Works Committee and approved by Council.
- All projects where City funds are used will follow the City's of London Procurement of Goods & Services Policy.
- Any program or budget that is not approved within the annual program budget (operating or capital) will require a submission to the Civic Works Committee and Council for approval.
- City staff will report annually to the Civic Works Committee on the activities and actions taken through the London Waste to Resources Innovation Centre including a status on the operating structure and financial matters.

In its current form, London to Waste Resources Innovation Centre is best described as being very opportunistic with respect to partners, funding and projects. It is set up as a collaborative network. There are no liabilities or assets assigned to it. Council can wind-

down participation at any time subject to the commitments noted in any MoUs and agreements.

The table on the next page provides an indication of how budgets are allocated to accomplish both City of London work and work that specifically aligns with the London to Waste Resources Innovation Centre including the new Industrial Research Chair. Investing in advancing waste diversion and resource recovery is a key part of the City's 60% Waste Diversion Action Plan and development of the long-term Resource Recovery Strategy.

Year	Past and Proposed Expenditures			Estimated Past and Proposed In-kind by City Staff		
	LWRIC	Research Chair	Total	LWRIC	Research Chair	Total
2015 – 2017	\$55,000 (about \$18,000 per year)	-	\$55,000	\$12,000 (about \$3,000 per year)	-	\$12,000
2018	\$3,000	\$15,000	\$18,000	\$4,000	\$6,750	\$10,750
2019	\$5,000	\$30,000	\$35,000	\$3,000	\$13,500	\$16,500
2020	\$10,000	\$30,000	\$40,000	\$4,000	\$13,500	\$17,500
2021	\$5,000	\$30,000	\$35,000	\$2,000	\$13,500	\$15,500
2022	\$5,000	\$30,000	\$35,000	\$2,000	\$13,500	\$15,500
2023	\$5,000	\$15,000	\$20,000	\$2,000	\$6,750	\$8,750

ACKNOWLEDGEMENTS

This report was prepared with assistance of Legal Services, Finance and Corporate Services (Financial Business Support) and Dr. Franco Berruti, ICFAR, Western University and Legal Services.

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

\\Shared\Administration\Committee Reports\CWC 2019 4 - LWRIC.docx

Appendix A A by-law to authorize and approve an Agreement between The University of Western Ontario, and The Corporation of the City of London and to authorize the Mayor and the City Clerk to execute the Agreement

Schedule A Industrial Research Chair Agreement

Appendix B Activities and Accomplishments at the London Waste to Resources Innovation Centre

- c Dr. Franco Berruti, ICFAR, Western University, 22312 Wonderland Road North, Ilderton, Ontario N0M 2A0

Appendix A

Bill No.
2019

By-law No. A.-

A by-law to authorize and approve an Agreement between The University of Western Ontario, and The Corporation of the City of London and to authorize the Mayor and the City Clerk to execute the Agreement.

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 an Agreement with the University of Western Ontario to be a part of the Industrial Research Chair that has faculty members with research expertise in the area of thermochemical conversion of biomass and waste to bio-industrial resources; Western University wishes to further develop research expertise and train students in the area of thermochemical conversion of biomass and waste to bio-industrial resources and the City and other Sponsors are prepared to support the University in this endeavour, and in return will receive certain rights with respect to the results of such endeavour as set forth in the Industrial Research Chair Agreement and will be applied to the London Waste to Resources Innovation Centre program;

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

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

1. The Agreement between The Corporation of the City of London and the University of Western Ontario, 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 Agreement 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 April 23, 2019

Ed Holder
Mayor

Catharine Saunders
City Clerk

First Reading – April 23, 2019
Second Reading – April 23, 2019
Third Reading – April 23, 2019

Schedule A

INDUSTRIAL RESEARCH CHAIR AGREEMENT (hereinafter the “Agreement”)

THIS AGREEMENT is made as of July 1, 2018 (the “Effective Date”)

BETWEEN:

THE UNIVERSITY OF WESTERN ONTARIO
(hereafter the “University”)

- and -

**DOMTAR INC, CHAR TECHNOLOGIES, TRY RECYCLING INC., CANADIAN PLASTICS
INDUSTRY ASSOCIATION, GRAIN FARMERS OF ONTARIO, ONTARIO GREENHOUSE
VEGETABLE GROWERS, TITAN CLEAN ENERGY PROJECTS CORPORATION,
ONTARIO FEDERATION OF AGRICULTURE, A&L BIOLOGICALS -and- THE
CORPORATION OF THE CITY OF LONDON, ONTARIO**
(The “Sponsors” or individually a “Sponsor”)

WHEREAS:

- A. The University has faculty members with research expertise in the area of thermochemical conversion of biomass and waste to bio-industrial resources.
- B. The University wishes to further develop research expertise and train students in the area of thermochemical conversion of biomass and waste to bio-industrial resources.
- C. The Sponsors are prepared to support the University in this endeavour, and in return will receive certain rights with respect to the results of such endeavour as set forth in this Agreement.

NOW THEREFORE in consideration of the mutual covenants of the parties set forth in this Agreement and other good and valuable consideration, the University and the Sponsors agree as follows:

ARTICLE I - DEFINITIONS

As used in this Agreement:

1.1 “Chair Program” means the thermochemical conversion of biomass and waste to bio-industrial resources and development activities conducted under this Agreement including administrative support thereof, which is to be partially funded by the Natural Sciences and Engineering Research Council (“NSERC”) and other parties.

1.3 “Confidential Information” means all technical, scientific, business and marketing information of a party hereto or its affiliates which is disclosed to the other party hereto and which:

- a) if in written or other tangible form, is marked by the disclosing party as confidential at the time of disclosure; or
- b) if disclosed orally or visually, is identified by the disclosing party as confidential at the time of disclosure and is summarized in writing, marked as confidential and provided by the disclosing party to the receiving party within thirty (30) days of such oral or visual disclosure.

1.4 “Inventions” means all discoveries, creations, intellectual property (as such is broadly defined by the Canadian Intellectual Property Office), and improvements thereto made by any party/parties, in the performance of the Research Projects and which are capable of being protected by law.

1.5 “Incremental Faculty Position” means the person with expertise in the thermochemical conversion of biomass and waste to bio-industrial resources appointed or designated as such by the University who, in addition to being a Participant, may be assigned or delegated by the Chair

to direct certain research and development activities conducted by the University under this Agreement.

1.6 “Participant(s)” means the person(s) appointed or designated by the University from time to time to perform work on the Research Projects identified in Schedule A.

1.7 “Research Projects” means those Research Projects identified in Schedule A attached hereto, as may be amended from time to time.

1.8 “Research Results” means any and all findings and results made, developed or conceived in the performance of the Research Projects and includes, without limitation, all data and Inventions.

1.9 “Chair” means, Dr. Franco Berruti, who is the person with expertise in the thermochemical conversion of biomass and waste to bio-industrial resources appointed or designated as such by the University, who shall direct the research and development activities conducted by the University under this Agreement.

ARTICLE 2- NATURE AND SCOPE OF CHAIR PROGRAM

2.1 **Name of Chair Program.** The Chair Program shall be named the “NSERC Industrial Research Chair in thermochemical conversion of biomass and waste to bio-industrial resources.”

2.2 **Objectives.** The objectives of the Chair Program are to develop new, practical solutions for the thermochemical transformation of biomass, organic residues, co-products and wastes, into value-added products and resources that will be successfully commercialized, generating environmental and economic benefits, jobs and wealth.

2.3 **The Chair.** The Chair shall be responsible for carrying out the objectives of the Chair Program, ensuring that the Research Projects form a significant part of the overall research and development activities under this Agreement.

2.4 **No Representations or Warranties.** The University agrees to carry out the Research Projects in accordance with appropriate scientific and professional standards. However, the University does not promise success in achieving any desired result, given the exploratory nature of the research and development activities contemplated hereunder. The University makes no representations or warranties, express or implied, as to any matter including, without limitation, the condition, quality or freedom from error of the results of any of the work undertaken under the Research Projects, or that such results will be merchantable or fit for any particular purpose, and all warranties, including warranty against infringement, and conditions, express or implied, statutory or otherwise, are hereby disclaimed.

2.5 **Effect of Chair Program on Other University Activities.** Nothing contained in this Agreement shall be deemed to prevent or restrict other research agreements and/or activities between the University and the Sponsors (or any individual Sponsor) or third parties with respect to any area of research and/or any other matters outside the Chair Program; provided that such other matters outside the Chair Program shall not use, involve, or refer to Sponsor Confidential Information, Sponsor Background Intellectual Property, or Sponsor Inventions and to allow Sponsor to review and object to the inclusion of any Sponsor Confidential Information

2.6 **Legally Binding.** The Sponsors and the University agree that this Agreement shall be legally binding.

ARTICLE 3- Members of CHAIR PROGRAM

3.1 Qualifications of members. The members in the Chair Program shall consist of:

(a) a full-time tenured or tenure-track academic staff member of the University with rank, namely Professor Franco Berruti, as the Chair; and

(b) such other positions as are determined necessary by the University from time to time, which may include persons appointed to any of the following position(s):

(i) tenured or tenure-track academic faculty members, including the Incremental Faculty Position, and

(ii) technicians; graduate students, post-doctoral associates and project manager.

3.2 **Rank of members within the University.** The Chair and the Incremental Faculty Position shall each have the rights, duties, and responsibilities (including teaching responsibilities, which will be reduced for the Chair) of a full-time professor at the University determined by the University in accordance with its policies and procedures and/or as described under any collective agreement between the University and the University’s faculty association or similar body, with a

compensation commensurate with such position, and shall have tenure (for the Chair) or tenure-track status (for the Incremental Faculty Position). Such duties and responsibilities include teaching activities assigned by the University from time to time.

ARTICLE 4- FUNDING

4.1 **Sponsors' Funding Commitment.** The Sponsors shall fund an amount of at least \$ 1,150,000 Canadian Dollars during the period beginning on July 1, 2018 and ending on June 30, 2023, as detailed in the payment terms and budget attached here to as "Schedule B". Such funding will be utilized by the University in paying costs and expenses of the Chair Program (including the purchase of equipment). The Sponsors shall also honour all of their respective in-kind commitments detailed in the Proposal as further indicated in Schedule B, attached hereto.

4.2 **Total Limit of Sponsor's Commitment.** The total financial obligation of the Sponsors under this Agreement is set out in Schedule B as of the Effective Date of this Agreement. Should the Sponsors and the University wish to add Sponsor(s) in the future they will ensure that all necessary letters of support, appropriate NSERC forms, budget and project justification documentation and all applicable NSERC policies and procedures are followed. The Industrial Advisory Board will review requests for the addition of new Sponsor(s) and voice their support or concerns to the Chair who will then make recommendation to the University and to NSERC. Prior to remittance of annual payment, a partner may opt to discontinue as a Sponsor. The University, through the Chair, shall notify NSERC and provide all necessary documentation.

4.3 **Acknowledgement of Additional Committed Funding.** The Sponsors acknowledge that funds will also be provided to the University by NSERC for the purpose of paying costs and expenses of the Chair Program. Furthermore, the Sponsors each individually covenant to ensure that their respective in-kind commitments (such as but not necessarily limited to, the supply of feedstock, student internship sponsorship, meeting hosting, etc.), as applicable, anticipated in the Chair proposal will be honoured and reported upon (as required). The University will collaborate in good faith with the Sponsors on ensuring the in-kind commitments will be properly accounted for throughout the Chair Program.

ARTICLE 5- INDUSTRIAL ADVISORY BOARD

5.1 **Composition.** There shall be an industrial advisory board (the "Advisory Board") composed of one (1) representative from each of the Sponsors and the University, the Chair, and such other persons as may be designated from time to time by University in consultation with the Chair.

5.2 **Role.** The Advisory Board shall convene every six months at a mutually agreeable time in order to advise the Chair regarding the general objectives of the Chair Program, but shall not have any responsibilities or rights regarding the operation or affairs of the University or the Chair Program.

ARTICLE 6- REVIEWS OF CHAIR PROGRAM

6.1 **Annual Assessment.** The University and the Advisory Board shall jointly conduct an annual assessment of the Chair Program. The purpose of such assessment shall be to review the quality of the Research Projects as well as the nature of the activities with respect to the objectives set out above and herein. Furthermore, individual Sponsors shall receive quarterly summaries of the progress of all agreed upon Research Projects (as envisaged in Schedule "A" attached).

6.2 **NSERC Review.** The parties shall make commercially-reasonable efforts to participate in any of NSERC's program review/s of the Research Projects.

ARTICLE 7 - RESEARCH RESULTS

7.1 **General Reporting.** The University, in addition to the reporting requirements of Article 8, shall report Research Results and all Inventions to NSERC, in the form of written reports as part of the NSERC performance review process; provided, however, that a Sponsor or the University may delay any such report by up to a maximum of 60 days to allow for an owning Sponsor of any pertinent Invention under Article 8.2 to determine whether it will seek, and if elected to seek, statutory protection of the pertinent Invention. Such reporting shall be of a general nature and summarize the Inventions, Research Results and activities undertaken in the Research Projects.

7.2 **Further Detailed Reporting.** The University shall provide detailed reporting to the Sponsors through the Advisory Board as envisaged in Article 8 below. The Sponsors will ensure

that they each respectively make commercially-reasonable efforts to provide all reports requested of, or required by, NSERC, including financial reporting and research reporting, at NSERC's sole discretion, as such pertains to the Sponsors' activities.

ARTICLE 8 - INTELLECTUAL PROPERTY

8.1 Ownership of Original Documents and Materials. For the purposes of Articles 8.1, 8.2, 8.3 and 8.4, the "Sponsor" shall be defined as "Sponsor and its affiliates" and "Sponsors" shall be defined as "Sponsors and their affiliates. The University shall retain possession of, ownership of and copyright to all original documents and materials used and developed during the course of this Agreement, including but not limited to notes, reports and data, unless such notes, reports, and data include Sponsor Confidential Information.

8.2 Ownership of Inventions. All Inventions (including but not limited to all intellectual property rights therein) developed or generated during any individual Research Project under this Agreement shall be solely owned by the particular Sponsor who collaborated with the University during the pertinent Research Project. If any non-owning Sponsor expresses interest in commercializing any Invention that is owned by another Sponsor, then it will need to negotiate in good faith with the owning Sponsor toward a pertinent contract between themselves. The University will make no ownership claims to any Inventions (except as qualified in Article 8.4 below). Therefore, in recognition of the University foregoing its usual ownership rights, the owning Sponsor of any Inventions expressly agrees to pay to the University 2% of any and all Net Revenue, generated by the owning Sponsor (or any of its licensees, sublicenses or assignees) which is directly attributable to commercialization of the Invention, net of (a) discounts, in amounts customary in the trade, for quantity purchases, cash payments, wholesalers, and distributors; (b) amounts repaid or credited by reason of rejection or returns; (c) any freight or other transportation costs, insurance, duties, tariffs and sales and excise taxes based directly on sales or turnover or delivery of material produced under this Agreement; and (d) patent expenses incurred by the respective Sponsor in connection with such Invention(s). The University does not guarantee that any Inventions will be generated during the Research Projects. Commercialization, if any, of Inventions must be carried out with "**Benefit to Canada**" to the extent required by NSERC's policies. Other than the deduction permitted for Net Revenue, the University will not be responsible for any commercialization costs associated with any invention, including, but not necessarily limited to, patenting or other costs, but the owning Sponsor of a pertinent Invention will be responsible solely for said costs.

8.3 Publication and Student Rights. Notwithstanding any other condition of this Agreement, nothing herein shall be construed in such a manner as to interfere with the ability and right of a student to complete his/her academic program at the University or to graduate. Nothing will interfere with the ability of any student to defend his/her thesis. Students shall own the copyright in any paper of publication of their creation, along with the professors and/or co-authors, including postdoctoral fellows, who may have assisted. For greater certainty, no Sponsor shall own any copyright in any student papers. A student thesis defence cannot be prevented or delayed for any reason by the Sponsors. Nevertheless, a student publication or any other University publication, such as a Chair publication, may be delayed up to a maximum of 60 days to allow for an owning Sponsor of any pertinent Invention under Article 8.2 to determine whether it will seek, and if elected to seek, statutory protection of the pertinent Invention and to allow Sponsor to review and object to the inclusion of any Sponsor Confidential Information..

8.4 Background IP. No license or other right is implied or given under this Article 8 with respect to any intellectual property which is not a part of any Invention. For greater certainty, the Sponsors and the University acknowledge that the Chair Program might involve the use of existing, separate intellectual property of each party. An initial comprehensive description and declaration of pertinent background intellectual property ("Background Intellectual Property"), which for purposes of a definition means and includes the valid intellectual property and proprietary rights in the descriptions provided in Schedule "C" below, along with any other industrial, proprietary and intellectual property rights of a party to this Agreement that existed before, or was created outside, the Chair Program and is brought into the Chair Program for further research and development. *No party shall obtain any rights, except for the right of use merely for academic participation in the Chair Program, and the University's right to use such for academic participation in the Chair Program, in any other party's Background Intellectual Property, unless the interested parties negotiate a separate contract specifying commercial rights to same.* For purposes of the Chair Program and this Agreement, the parties do hereby each expressly agree that in the event any improvements to any Background Intellectual Property are made during the Chair Program, *those particular improvements, even if same rise to the level of an Invention, shall be jointly owned by the party who owns said Background Intellectual Property (the "Owning Party") and, if applicable, the other Party by or with whom the improvement is developed or conceived.* Notwithstanding Article 8.2 above, the University will own any

improvements that it solely makes to its Background Intellectual Property. In the event that any Sponsor is interested in commercializing said improvements and/or licensing the University's Background Intellectual Property, it will need to negotiate the pertinent contract, utilizing the University's standard agreement template, at said time, taking into account standard business terms. The University is not obliged to, and does not guarantee that it will ever be able to, finalize a contract with any Sponsor with respect to the University's Background Intellectual Property and/or any improvements to same.

ARTICLE 9- EQUIPMENT

9.1 **Ownership of Equipment.** The University could purchase equipment as it deems necessary for use under this Agreement, using funds from the Sponsors, NSERC or other third parties. The University shall own any equipment purchased by the University.

ARTICLE 10 - FACILITIES AND TECHNICAL COOPERATION

10.1 **Required Space or Facilities.** The University shall arrange for any space or facilities on premises owned by the University which it considers required for the purposes of carrying out research and development activities under this Agreement.

10.2 **Co-Operation by Sponsors.** The Sponsors shall in their sole discretion and at their own expense provide the Chair Program with technical assistance, consultation and use of their facilities, as applicable, for the purpose of conducting the Research Project activities under this Agreement.

ARTICLE 11 — CONFIDENTIALITY

11.1 **Confidentiality and Non-Disclosure.** The parties may disclose information that they consider confidential one to the other to facilitate work on the Research Projects. The receiving party shall exercise reasonable efforts to treat and keep confidential, and cause its officers and employees to treat and keep confidential, and not to disclose to any other party, or use for any purpose other than the Research Projects, any Confidential Information. Such reasonable efforts shall be no less than the efforts as each normally takes with its own proprietary information to prevent disclosure to third parties. Confidential Information will be disclosed within the receiving party only on a "need to know" basis.

11.2 **Designated Representatives.** The disclosing party shall disclose any Confidential Information to the Designated Representative of the receiving party. The Designated Representatives are as follows Shabnam Sanaei for DOMTAR INC., Rick Vandersluis for TRY, Joseph Hruska for CPIA, Nicole Mackellar for GFO, Justine Taylor for OGVG, Andrew White for Char, George Lazarovits for A&L, Jamie Bakos for Titan, Don McCabe for OFA, Jay Stanford for the City of London and the Designated Representative of the University shall be Franco Berruti. Any party may change its Designated Representative for this purpose by notice in writing to the other parties.

11.3 **Exclusions from Confidentiality.** The obligations regarding confidentiality shall not apply to information which:

- (a) is already known to the receiving party as evidenced by written records; or
- (b) is or becomes a matter of public knowledge without breach of this Agreement by the receiving party; or
- (c) is received by the receiving party from a third party which had no duty of confidentiality with respect to such information; or
- (d) is developed independently of and without reference to the information received from the disclosing party, as evidenced by written records kept in the ordinary course of the receiving party's business ; or
- (e) is made subject to an order by judicial or administrative process requiring the receiving party to disclose any or all of the information, provided receiving party shall promptly notify the disclosing party allowing some reasonable time to oppose such process, before disclosure occurs; or
- (f) is disclosed by the receiving party with the disclosing party's prior written approval, but solely to the extent of such written approval by the disclosing party.

11.4 **Duration of Confidentiality.** The obligations of confidentiality with respect to Confidential Information shall survive termination of this Agreement and shall terminate two (2) years from

the date of termination of this Agreement or completion of all Research Projects hereunder, whichever first occurs.

11.5 Right to Publish and Graduate Not Affected. By its nature and policies, the University requires that Research Results be published. Nothing, but for the provisions of Article 8 above, in this Agreement shall affect the right of the University and its students, staff, faculty, post docs and researchers to publish the Research Results during or after the term of this Agreement.

ARTICLE 12- PUBLICITY

12.1 Public Statements and Media Releases. Any party may make public statements, issue publicity or media releases or make other disclosures revealing the existence of this Agreement and the general relationship of the parties hereunder without the prior approval of the other party; provided, however, that no such public statement, release, or disclosure may name another party without such party's consent. All such communications shall acknowledge the support of the Research Projects by NSERC and the Sponsors and shall, where appropriate, state the name of the Chair Program. Notwithstanding, no party may issue any press releases regarding the Chair Program or this Agreement until NSERC approves such press release.

12.2 Restriction on Use of University's Name. Trademarks. The Sponsors shall not use the University's name or trademark or name of any member of University staff in any advertising or promotional material or publicity release relating to the Research Results or other activities undertaken hereunder or upon any products, materials or designs arising from this Agreement, without the prior written consent of the University.

12.3 Restriction of Use of Sponsors' Names, Trademarks. The University shall not use any of the Sponsors' names or trademarks in any advertising or promotional material or publicity release relating to the Research Results or other activities undertaken hereunder or upon any products, materials or designs arising from this Agreement, without the prior written consent of the affected party/ies.

ARTICLE 13 - TERM, EXTENSION OF TERM AND TERMINATION

13.1 Term. This Agreement is effective from the Effective Date, as defined above, and will terminate on June 30, 2023, unless extended under Section 13.2.

13.2 Extension of Term. The parties may by mutual agreement in writing, extend the term of this Agreement, upon such terms and conditions as they may mutually agree, subject to NSERC's approval, as applicable.

13.3 Termination. This Agreement may only be earlier terminated by mutual agreement of the parties.

13.4 Rights Prior to Termination Survive. Termination under any provision herein shall not affect the rights of the parties which have accrued prior to the date of termination.

ARTICLE 14- LIABILITY AND EXCUSABLE DELAYS

14.1 Delays Beyond University's Reasonable Control. No liability shall be incurred by the University for delay in progress of the Research Projects unless such delay arises from the gross negligence or willful misconduct of the University. Furthermore, under no circumstances whatsoever, will the University's liability to any Sponsor exceed the amount of cash received from that Sponsor under this Agreement in the calendar year in which any cause of action arises.

ARTICLE 15— GENERAL PROVISIONS

15.1 Notices. All notices, reports, invoices and other written communications which any party may desire to give to any other may be delivered or sent to the address/coordinates below. If to:

DOMTAR INC.:

Shabnam Sanaei
Domtar
395, boul. de Maisonneuve Ouest
Montreal, QC H3A 1L6
Email: Shabnam.sanaei@domtar.com

TRY RECYCLING:

Rick Vandersluis
TRY Recycling Inc.

11110 Longwoods Rd.
Delaware, ON N0L 1E0
Email: rick.vandersluis@tryrecycling.com

CPIA:

Joseph P. Hruska
Canadian Plastics Industry Association
5955 Airport Rd., Suite 125
Mississauga, ON L4V 1R9
Email: jhruska@plastics.ca

GFO:

Nicole Mackellar
Grain Farmers of Ontario
679 Southgate Drive
Guelph, ON N1G 4S2
Email: nmackellar@gfo.ca

OGVG:

Nathan Warkentin
Ontario Greenhouse Vegetable Growers
32 Seneca Rd.
Leamington, ON N8H 5H7
Email: n.warkentin@ontariogreenhouse.com

CHAR:

Andrew White
CHAR Technologies Ltd.
2425 Matheson Blvd E., Suite 816
Mississauga, ON L4W 5K4
Email: andrew.white@chartechnologies.com

A&L:

George Lazarovits
A&L Biologicals
Agroecology Research Service Ctr
2136 Jetstream Rd.
London, ON N5V 3P5
Email: lazarovitsg@alcanada.com

CITY OF LONDON:

Jay Stanford
City of London
300 Dufferin Ave.
P.O. Box 5035
London, ON N6A 4L9
Email: jstanfor@london.ca

TITAN CLEAN ENERGY PROJECTS CORPORATION:

Jamie Bakos
Titan Clean Energy Projects Corporation
P.O. Box 296, 501 Crossford Avenue
Crail, SK S0G 0V0
Email: jbakos@titan-projects.com

ONTARIO FEDERATION OF AGRICULTURE:

Neil Currie
 Ontario Federation of Agriculture
 Ontario AgriCentre
 100 Stone Road West, Suite 206
 Guelph, ON N1G 5L3
 Email: neil.currie@ofa.on.ca

ONTARIO FEDERATION OF AGRICULTURE (for invoicing):

Jon Lazarus
 Ontario Federation of Agriculture
 Ontario AgriCentre
 100 Stone Road West, Suite 206
 Guelph, ON N1G 5L3 jon.lazarus@ofa.on.ca
 Email: jon.lazarus@ofa.on.ca

If to the University:

Respecting industry liaison, project management, interpretation, amendment or termination of this Agreement:

Chantal Gloor
 Institute for Chemicals and Fuels from Alternative Resources (ICFAR)
 The University of Western Ontario
 22312 Wonderland Rd. N.
 Ilderton, Ontario N0M 2A0
 E-mail: cmgloor@uwo.ca

Respecting scientific and technical (research) aspects of this Agreement:

Franco Berruti
 Institute for Chemicals and Fuels from Alternative Resources (ICFAR)
 The University of Western Ontario
 22312 Wonderland Rd. N.
 Ilderton, Ontario N0M 2A0
 E-mail: fberruti@uwo.ca

Respecting financial reporting, invoicing and financial communications with NSERC:

Svetlana Berdnik
 Financial Services
sberdnik@uwo.ca
 Tel: 519-661-2111 ext 85458

In order for any notices, requests, directions, or other communications to be effective, they will be delivered in person, or sent by mail or e-mail addressed to the party for whom it is intended at the above-mentioned address/coordinates and will be deemed to have been received on the date of delivery. The address/coordinates of either party may be changed by notice in the manner set out in this provision.

15.2 Enurement. This Agreement shall be binding upon and enure to the benefit of the parties hereto and their respective successors and permitted assigns.

15.3 Assignment. No party shall assign this Agreement or any part thereof or any rights or obligations under this Agreement or with respect to the Research Results or Inventions without the prior written approval of the other party.

15.4 Amendments. No amendment, or variation of this Agreement shall be effective unless set forth in writing signed by a duly authorized representative of each party.

15.5 Entire Agreement. This Agreement contains the entire agreement between the parties and supersedes all prior agreements, negotiations, representations and proposals, written and oral.

15.6 **Headings.** All headings in this Agreement are inserted solely for convenience, are not part of this Agreement and do not in any way limit or amplify the terms hereof. Any reference to “days in this Agreement means calendar days, unless otherwise specified.

15.7 **Schedules.** The Schedules, including the Proposal, as incorporated by reference, form part of this Agreement.

15.8 **Further Assurances.** Each of the parties shall sign such documentation and deliver such information as may be reasonably required by the other in order to confirm and give effect to the provisions set forth in this Agreement.

15.9 **Governing Law.** This Agreement shall be interpreted and governed by the laws of the Province of Ontario and the laws of Canada applicable in such Province. Any action taken relating to this Agreement shall be commenced in the courts of the Province of Ontario.

15.10 **Counterparts and Facsimile Signatures.** This Agreement may be executed in one or more counterparts, each of which, when so executed, shall be deemed to be an original, and all of which together shall constitute one and the same agreement. This Agreement may be executed and delivered by facsimile, e-mail or other electronic means or by physical means.

IN WITNESS WHEREOF, the parties have executed this Agreement as of the date first written above.

THE UNIVERSITY OF WESTERN ONTARIO

By: _____

Name: _____

Title: _____

DOMTAR INC.

By:

Name:

Title:

TRY RECYCLING

By:

Name:

Title:

GFO

By:

Name:

Title:

CPIA

By:

Name:

Title:

OGVG

By:

Name:

Title:

CHAR

By:

Name:

Title:

TITAN

By:

Name:

Title:

CITY OF LONDON

By:

Name:

Title:

A&L

By:

Name:

Title:

ONTARIO FEDERATION OF AGRICULTURE

By:

Name:

Title:

SCHEDULE "A"

- **Description of Research Projects.** The NSERC Industrial Research Chair Proposal itself, in its entirety, as applicable, is hereby incorporated into this Agreement by reference. Furthermore, one Research Project will be designed to address the interest of each Sponsor, developed by the Chair in consultation with the pertinent Sponsor. Resources allocated will be proportional to the Sponsor's contribution and leverage.

SCHEDULE "B"

Sponsors' Funding and In-kind Commitments

Payment terms:

The University will invoice the Sponsors for the annual amount listed below upon execution of this Agreement and annually thereafter on the anniversary of the Project start date (July 1, 2018). Invoices shall be sent to the accounts payable and/or Purchase Order contacts below. Payment will be due within 30 days of receipt of the University's invoice.

Funding Commitments:

SPONSOR	ANNUAL CASH COMMITMENT (\$, CDN)	TOTAL (5 YR) CASH COMMITMENT (\$, CDN)	TOTAL (5 YR) IN- KIND COMMITMENT, CASH EQUIVALENT & OTHER (as taken from proposal) (\$, CDN)
DOMTAR			
TRY			
CPIA			
GFO			
OGVG			
A&L			
London	\$ 30,000	\$ 150,000	\$ 67,500
TITAN			
OFA			
CHAR			
TOTAL FOR 5 YEARS:		\$ 1,150,000	

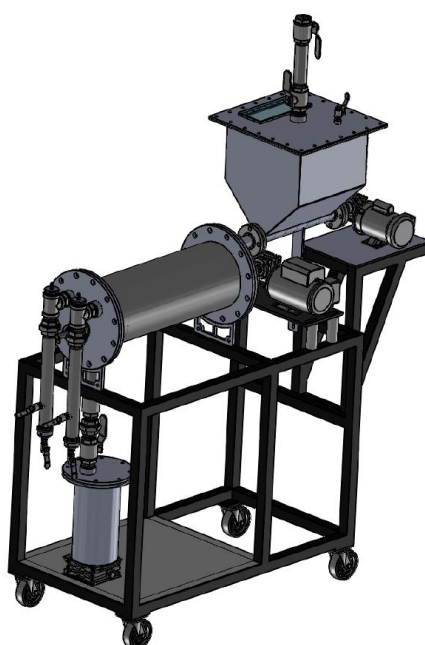
Invoicing contacts per Sponsor: Refer to ARTICLE 15 – General Provision

SCHEDULE "C"
Background Intellectual Property

University:

A new and novel continuous horizontal pyrolysis pilot plant technology, able to process between 3 to 20 kg/h of biomass and other organic feedstocks, consisting of an air-locked hopper, a screw feeder, a horizontal reactor vessel, a biochar collection system and a condensation train.

The horizontal reactor vessel is heated by induction and equipped with specially designed mixing paddles driven by an electric motor with adjustable alternate rotating motion, able to mix the feedstock with a bed of reacting/reacted material (biochar) retained within the horizontal reactor body by a specially designed weir over which the reacted biochar will eventually overflow and fall into a biochar cooling chamber and air locked collection vessel after having travelled the entire length of the reactor. The vapors produced exit the reactor body immediately as they are generated through two parallel filter chambers covered with a fine metallic mesh, located horizontally in the freeboard above the reactor chamber. Such parallel filters are directly connected with two downstream condensers equipped with water sprays to achieve the first level of fractional condensation of a dry bio-oil phase. Such condensers are also equipped with a backflush system able to clear independently each filter with pulses of nitrogen. The primary condensation system is followed by a secondary one, consisting of condensers cooled with chilled water. The flowrate of non-condensable gaseous effluents is monitored, samples can be withdrawn, and the main gas effluent can be flared or used for heat recovery. The entire system is flushed with nitrogen. The feeding auger and all the seals are water cooled. Temperatures are measured in several locations and the system is equipped with a pressure release safety valve. A Report of Invention has been filed.



DOMTAR CORP.: N/A

TRY RECYCLING: N/A

CPIA: N/A

GFO: N/A

OGVG: N/A

CHAR TECHNOLOGIES: N/A

A&L: N/A

City of London: N/A

TITAN: N/A

OFA: N/A

APPENDIX B

Activities and Accomplishments at the London Waste to Resources Innovation Centre

This Appendix contains details in three areas:

- Progress made in the five key Activity Areas of the London Waste to Resources Innovation Centre
- Overview of existing Memorandums of Understanding (MoUs)
- Overview of Direction of the Provincial Government (2016 to 2019)

Progress Made in the Five Key Activity Areas of the London Waste to Resources Innovation Centre

Area of Activity	#	Details
1. Research & Development Academic Research Projects and Presentations	Over 30	Students from the Faculties of: <ul style="list-style-type: none"> • Engineering • Science • Social Sciences • 2 PhD projects – food waste avoidance and landfill technology • 1 PostDoc – resource recovery/WCT/disposal • Maximizing Resource Recovery from Waste Through Biogas and RNG Production, a project partially funded by the Federation of Canadian Municipalities (FCM) Green Municipal Fund with support from the Canadian Biogas Association • Request for Information for Resource Recovery Technologies; 26 responses received (2018)
2. Training, Testing & Auditing Projects/initiatives completed or in progress	7+	<ul style="list-style-type: none"> • Two audits/assessments of packaging materials at the City's Material Recovery Facility (MRF) (2015) • Establishment of an internal network of 19 internationally recognized experts from Western's Faculties of Engineering, Science, Social Science, and the Schulich School of Medicine & Dentistry, coordinated by Dr. Berruti • Establishment of a Municipal Working Group for Mixed Waste Processing (7 Ontario municipalities) • Avoiding food waste, an emerging collaboration with Western University and input for the Middlesex London Food Policy Council (2016-2018)
3. Resource & Waste Management Knowledge Exchange Memorandums of Understanding approved	7	Further MoU details are provided after the table <ul style="list-style-type: none"> • Canadian Plastic Industry of Canada (CPIA) • Resource Energy Development of Canada (RediCan) • Try Recycling • Bio-TechFar Inc • Tucker Engineering through the Hawthorne Green Key Group • University of Western Ontario (Institute of Chemicals and Fuels from Alternative Resources) • Green Shields Energy (GSE)

Area of Activity	#	Details
Memorandums of Understanding in discussion	3	
Businesses and Associations expressing interest in the LWRIC	10+	Includes several local business, Ontario based businesses and 1 European company
4. Technology Demonstrations	5+	<ul style="list-style-type: none"> • Mixed waste processing at the Canada Fibres (Dongara) Advanced Waste Diversion Facility (August 2017) • Numerous site visits to see working resource recovery technologies
5. Outreach & Engagement	10+	<ul style="list-style-type: none"> • FCM Sustainable Communities Conference (February 2015) • Several internal presentations by ICFAR staff to other faculties at Western University (2015-2018) and at various conferences around the world • Several City of London presentations (e.g., Advisory Committee on the Environment) and Open Houses for 60% Waste Diversion and the Environmental Assessment to expand the W12A Landfill (2017-2018) • Converting Wastes to Resources Through Sustainable Engineering Workshop, Western University (April 2016) • Resource Recovery Partnership Workshop, University of Waterloo (June 2016 & 2017) • Ministry of the Environment & Climate Change and Ministry of Economic Development, October 2017 • Resource Recovery Partnership Workshop, University of Waterloo – International 2 Day event (June 2018) • Establishment of the Resource Recovery Partnership, a Canada-wide collaboration to promote and advance resource recovery and zero waste to landfill solutions (2018)
LWRIC Administration Funding opportunities being examined	7+	<ul style="list-style-type: none"> • Natural Sciences and Engineering Research Council (NSERC) Collaborative Research • Mitacs • Sustainable Development Technology Canada • Federation of Canadian Municipalities • Ontario Research Fund Research Excellence Program • Ontario Centres of Excellence • Industrial Contracts

Overview of Existing Memorandums of Understanding

The City has six Memorandums of Understanding (MoUs) approved by Council:

- Canadian Plastics Industry Association (CPIA) – a working relationship to carry out research and development projects supported by grants, contracts which generate knowledge, expertise and trained personnel with a focus on valorization of waste plastic resources residues. Share waste plastic resources management expertise (policy, technology, education, sustainability frameworks) with the City, with the industry partners and Western/ICFAR. Act as a window of access to plastic industry

expertise and networking opportunities for the City, government agencies, Western/ICFAR and potential industry partners to maximize synergies of expertise, infrastructure and resources. Also, to proactively engage in conversations with the City, industry partners, government(s) and Western/ICFAR to ensure continuous review and improvement of current initiatives and development of new projects. The expiry date of this MoU is March 31, 2020.

- Resource Energy Development of Canada (RediCan) – a working relationship to undertake testing and develop data/information on the viability of the Concord Blue Reformer® advanced thermal conversion technology to be delivered and constructed by Lockheed Martin Canada to manage various types of organic feedstocks, including biomass, bio-solids, solid waste materials, including mixed solid waste, commonly known as household garbage. This will be done through research at an off-site location housing a demonstration facility or by constructing and operating a pilot-scale facility containing an advanced thermal conversion system that is designed for demonstrating the effectiveness of the process for the conversion of various organic feedstocks and waste streams. It is currently proposed that a demonstration facility would process between 50 and 75 tonnes of material per day while generating the following products: a hydrogen-rich synthetic (syn) gas that can be used as a renewable natural gas (RNG) and/or blended with natural gas, or be used to produce a variety of other forms of renewable energy and bio-products. The expiry date of this MoU is March 31, 2021.
- Bio-TechFar Inc. – a working relationship 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. 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. 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. The expiry date of this MoU is December 31, 2019.
- Tucker Engineering (via the former Hawthorne Green Key Group) – a working relationship designed to undertake testing and research; write and present reports; develop data/information; and work with industry, government and academic partners on the viability of its proprietary pyrolysis technology and processes to create higher value resources from waste that would normally be sent to recycling and/or disposal facilities. Hawthorne has the Canadian rights to a proprietary pyrolysis technology that has successfully converted a range of biomass materials into energy, chemicals and/or fuels, now wants to determine the viability of this technology on solid waste materials, including mixed solid waste, commonly known as household garbage. The expiry date of this MoU is June 30, 2020.
- Try Recycling Inc. – a working relationship to undertake testing and research; write and present reports; develop data/information; and work with industry, government and academic partners on the viability of a range of technologies and processes to create resources from waste that would normally be sent to disposal facilities. Try has proprietary and other expertise related to the successful conversion of a range of waste materials into products with beneficial uses, in particular, the conversion of organic wastes into compost and various construction, renovation and demolition (CR&D) wastes into beneficial products. The expiry date of this MoU is December 31, 2019.
- 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.

Overview of Direction of the Provincial Government (2016 to 2019)

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.

Preserving and Protecting our Environment for Future Generations: A Made-in-Ontario Environment Plan

The proposed Made-in-Ontario Environment Plan is the Provincial Government’s holistic approach to managing all the environmental aspects that it is now responsible for including “Reducing Litter and Waste in Our Communities & Keeping Our Land and Soil Clean”. Specifically on page 43, it proposes to:

- “Investigate options to recover resources from waste, such as chemical recycling or thermal treatment, which have an important role – along with reduction, reuse and recycling – in ensuring that the valuable resources in waste do not end up in landfills.
- Encourage increased recycling and new projects or technologies that recover the value of waste (such as hard to recycle materials)”.

This theme and direction has been carried into the most recent release from the province, *Reducing Litter and Waste in Our Communities: Discussion Paper* (March 2019) and the section titled *Recover the Value of Resources*.