



Sarnia-Lambton
Biohybrid Chemistry
CLUSTER

Sarnia-Lambton Ontario Canada

Powering a sustainable world[®]

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Sarnia-Lambton's bioindustrial advantages

- Location of Canada's Bioindustrial Innovation Centre
- Ontario's largest cluster of refineries and petrochemical plants
- Unique industrial infrastructure suited to bioindustrial industries
- Excellent selection of private and municipal industrial parks
- Headquarters of Sustainable Chemistry Alliance
- State-of-the-art training facilities for chemical workers at Lambton College
- Situated on multi-modal transportation routes, including Great Lakes deep water port
- Abundant agricultural land with biomass potential
- World-class university and college R&D
- Ability to move from bench scale, to pilot plant, to full-scale commercialization within a few city blocks
- Highly supportive community with vision and purpose



Sarnia-Lambton, Ontario, Canada, is a significant North American petrochemical and refining complex known for the production of petroleum and petrochemical products, plastics, synthetic rubber, and chemicals. It is home to many well known multinational companies, including BP Energy, CF Industries, LANXESS, DuPont, Exxon-Mobil (through its Canadian affiliate Imperil Oil), NOVA Chemicals, Royal Dutch Shell, Styrolution, and Suncor.

This concentration of chemical and refining companies comprises Sarnia-Lambton's largest economic sector, followed by agriculture. The area's miles of sandy Lake Huron beaches help to make tourism its number three economic sector.

Strong community direction and support Recognizing the area's natural fit for ongoing developments in the fields of industrial biotechnology and bioprocessing, an effective regional initiative was established and is continuing to develop and grow the **Sarnia-Lambton Biohybrid Chemistry Cluster**; merging hydrocarbon-based and industrial bio-based economies. The community's economic growth strategy is focused on further enhancing the traditional hydrocarbon-based sector while developing new opportunities in the emerging renewable energy sector.

Collaborative partners include leading industries and organizations such as: **LANXESS**; **TransAlta**; the **Sarnia-Lambton Economic Partnership**; the **Sustainable Chemistry Alliance**; the **Bioindustrial Innovation Centre**; **Western University Research Park, Sarnia-Lambton Campus**; and **Lambton College**.

BioAmber and Sarnia-Lambton In August 2011, renewable chemical company **BioAmber Inc.** announced it would build its first global-scale manufacturing facility at the LANXESS Bio-Industrial Park Sarnia. With a capital investment of \$80 million, the plant will produce biosuccinic acid, a platform chemical from which a number of products can be created, along with 1,4 butanediol. In its corporate development BioAmber is strategically partnering with leading global companies including **Cargill**, **DuPont**, **LANXESS**, **Mitsui**, **Mitsubishi**, **NatureWorks** and **PTTMCC Biochem**.

Sarnia-Lambton's petrochemical renaissance A renaissance of the local petrochemical sector is underway, driven by the economical and abundant source of natural gas liquids from the Marcellus Shale in the northeastern United States.

NOVA Chemicals is spending in excess of \$250 million to convert its Corunna Site, located in Lambton County, to utilize 100% natural gas liquids in the production of ethylene. The company is also evaluating several large capital projects, including the establishment of a new world-scale polyethylene facility. The scope of these investments is in the hundreds of millions of dollars.

Sarnia-Lambton's existing and emerging industries are enthusiastically embracing green technologies



Suncor Energy Products operates the largest ethanol facility in Canada, with a capacity of over 105.6 million US gallons of fuel-grade ethanol per year at its St. Clair Township plant in Sarnia-Lambton. About 85% of the corn currently used at the plant is grown in Ontario and represents 10% of the total demand for corn in the province. A high-grade animal feed is also manufactured as a by-product at this plant.



A strategic initiative of **LANXESS Inc.**, the world's largest producer of synthetic rubber, is the commitment to utilize bio-based raw materials. As part of this commitment to sustainable biochemistry, LANXESS has invested \$27 million to become a

minority shareholder in **Gevo Inc.**, the Colorado based company focused on the development of renewable chemicals and advanced biofuels, including biobutanol, a key raw material. Similarly, the company is partnering with BioAmber on the development of renewable and phthalate-free plasticizers and in February 2012 invested \$10 million in BioAmber Inc.

LANXESS owns and operates the **Bio-Industrial Park Sarnia**. The ability to co-locate within an existing plant site and utilize existing infrastructure creates synergies and significant cost efficiencies for emerging biochemical tenants. Likewise, similar synergies can be achieved at the neighbouring **Bluewater Energy Park**, which is owned by **TransAlta Energy**.



Bluewater Power, the largest electric utility in Lambton County, is generating electricity from landfill gases at two sites in Sarnia-Lambton. These projects are examples of several clean energy projects the

utility employs to reduce demand on the province's electricity system and secure itself in case of a power outage in the rest of the province.

Woodland Biofuels is building a cellulosic ethanol demonstration plant at the Bioindustrial Innovation Centre located at the Western University Research Park, Sarnia-Lambton Campus. The \$12 million project is being supported by a \$4 million investment from the Ontario Innovation Demonstration Fund. The plant is expected to be operational in late 2012.

Methes Energies Canada Inc. is in the process of commissioning its Sombra facility, located south of Sarnia in St. Clair Township, for the production of biodiesel. When operational, the plant will produce over 13 million US gallons per year utilizing Methes' own technology, the Denami 3000 biodiesel processor.



Photo - Methes Energies Canada Inc., St. Clair Township facility, Sarnia-Lambton

Solutions4CO2 Inc. is developing a 50,000 sq. ft. demonstration facility at the Bluewater Energy Park in Sarnia. The company designs, builds, operates and maintains industrial solutions to capture waste gas/water streams and process them into value added co-products.

Agriculture – a key partner for the Biohybrid Chemistry

Cluster With Sarnia-Lambton on-farm revenues of \$500 million, agriculture is a strategic partner in the community's development of the Biohybrid Chemistry Cluster. Traditional focus has been on commodity crops and livestock but a proactive effort is underway to find opportunities to add value to the sector.

With over 500,000 acres of cultivated land, Lambton County is a leading Ontario producer of soybeans, winter wheat, and corn. The region is a one day drive to 1.6 billion bushels of corn and 621 million bushels of soybeans. At its St. Clair Ethanol facility, Suncor Energy utilizes locally grown corn along with U.S. Midwest crop. Local producers are partnering with staff at the Bioindustrial Innovation Centre on the production of energy crops such as miscanthus and switch grass.

The researchers at the Western University Research Park, Sarnia-Lambton Campus, conducted a series of studies, sponsored by Ontario Power Generation and the Ontario Federation of Agriculture, to investigate the feasibility of utilizing local biomass resources for heat and power generation.

Bioindustrial feedstocks and the agricultural industry Agricultural crops and residues are important sources of biomass feedstocks for the bioproduct value chain.

Sarnia-Lambton is an important supplier of bio-based feedstock in Ontario. Lambton leads all other counties in Ontario for acreages of soybeans and wheat.

Lambton County offers excellent growing conditions for field crops, with flat, well-drained lands, desirable heat levels in the summer, and good snow cover in the winter.

2010 field crops – Sarnia-Lambton and Ontario

	Sarnia-Lambton Acres Harvested Provincial %	Ontario Acres Harvested
Soybeans	300,000 – 10.8%	2,437,000
Winter Wheat	100,000 – 10.2%	815,000
Grain Corn	99,700 – 5.6%	1,860,000

2010 field crop production – Sarnia-Lambton and Ontario

	Sarnia-Lambton (‘000 bushels)	Ontario (‘000 bushels)
Soybeans	12,000	112,000
Winter Wheat	8,700	64,800
Grain Corn	14,656	305,000

Source – Ontario Ministry of Agriculture, Food and Rural Affairs, 2011

Through its combination of agricultural and chemistry Sarnia-Lambton has the necessary components to fulfill the industrial biotechnology value chain; from bio-feedstocks and conversion processes to finished products.

This is supported by a favourable investment climate created by location factors such as education, R&D, and a unique and effective industrial infrastructure that is able to support additional plants and commercial enterprises.

Approximately 10% of Ontario’s agricultural land can produce over 6.5 million US tons of energy crop biomass annually. An additional 2.7 million US tons/year of agricultural residues, such as corn stover and wheat straw, can be harvested sustainably. Biomass fuels from energy crops and agricultural residues from Ontario farms have the potential to power the province’s coal-fired power plants. The biomass fuels could also economically provide energy for space heating applications, where expensive propane and heating oil are currently used.

Education and Research

Centres The Western University Research Park, Sarnia-Lambton Campus, is a joint venture of Western University, the County of Lambton, and



the City of Sarnia, and is operated by Western. The Park’s focus is on key industrial sectors in the region, and innovation opportunities in alternative energies; advanced materials; and environmental process and biotechnologies. The Park acts as a conduit to innovation; connecting industry to knowledge, talent, and the resources required to facilitate innovation. Companies can access world-class scientists and developers, leading-edge research, equipment, and commercialization resources.

The development of alternative energy technologies and industrial bioproducts is a key focus of The Western University Research Park.

Western University is one of the leading institutions in Canada for research into biotechnology, including biomaterials, biochemical engineering, biomedical engineering, and green engineering. Research is taking place in the development of biofuel cell technology to replace expensive platinum catalysts with low cost and carbon dioxide negative enzymes; investigations into emerging materials such as nanotubes to assist in the storage and delivery of hydrogen fuel; and the mathematical modeling of distributed energy systems.



Lambton College Lambton College offers training that continues to evolve to meet the changing needs of industry.

Lambton College’s Advanced Materials Engineering Research Lab provides a state-of-the-art facility for students, local manufacturers, and the community at large. It is dedicated to research into the use of polymer and biodegradable materials and the use of advanced manufacturing technologies that can be easily transferable to the manufacturing floor.

Lambton College’s Alternative Energy Engineering Technology Program is a three year program with a co-op component. It provides students with a combination of theory and application skills in current and emerging energy technologies. Graduates deal with the integration of current energy sources along with newly developing alternative energy distribution systems. These specialists are given technical and applied knowledge in renewable energy concepts combined with energy efficient design principals.

Lambton College and the Sustainable Chemistry Alliance recently entered into a collaboration agreement to assist companies in achieving their business and research ventures. The collaboration will create future commercial opportunities that will provide researchers and research facilities, as well as specialists in a variety of areas.



Imperial Oil Sarnia Research Automotive Test Centre Imperial’s Sarnia operation is the most integrated fuels, lubricating oil and chemicals manufacturing and petroleum research facility in Canada. Since 1985, the Sarnia research automotive test facility has been providing lubricant and fuel as well as engine, vehicle, and fleet testing to the petroleum, additive, and automotive industries. This facility is equipped with state-of-the art technologies and is ISO 9001 registered.

Scientists, engineers, technologists, and support staff are engaged in developing and improving lubricating oils and specialty products; carrying out crude oil analyses; and providing technical support to Imperial’s refining, marketing, and distribution operations. Examples include engine oils to meet

new industry quality standards, premium unleaded gasoline to reduce intake-valve deposits, new generation natural-gas engine oils, improved synthetic greases, and all-weather drive-train and hydraulic lubricants.

The engine test lab provides a range of industry standard and in-house tests, as well as customized tests specific to customer needs. The all-weather chassis dynamometer provides a wide spectrum of environmental conditions for vehicle testing from subcompact cars to class 8 heavy duty trucks.

Supporting commercialization in the Biohybrid Chemistry Cluster With funding from both the Canadian and Ontario governments, resources have been put in place to foster the growth and development of emerging firms in the industrial bio economy.



BIOINDUSTRIAL
INNOVATION CENTRE

Canada's Bioindustrial Innovation Centre, a Centre of Excellence for Commercialization of Research with funding from the

Government of Canada, is located within the Bowman Centre for Technology Commercialization at the Western University Research Park, Sarnia-Lambton Campus. The Bioindustrial Innovation Centre focuses on the commercialization of large-scale industrial biotechnology. The facility offers many benefits for companies working to bring their products to market, including lab space, analytical services, 2,800 sq. ft. of 12 ft. low-bay pilot plant space, 3,400 sq. ft. of 26 ft. high-bay pilot plant space, a closed-in fermentation room, warehouse space, and loading docks.

In January 2011 the Bioindustrial Innovation Centre and the Institute for Chemicals and Fuels from Alternative Resources forged a collaboration agreement to accelerate the development and commercialization of biofuels, renewable chemicals, and co-products into the Canadian marketplace.

The **Sustainable Chemistry Alliance** is a not-for-profit organization established in 2008 to promote growth and prosperity by fostering and supporting innovation, development, and commercialization in the area of green and sustainable chemistry. The Alliance is supported by the Bioindustrial Innovation Centre. The Sustainable Chemistry Alliance has been investing in the commercialization of green sustainable technologies, processes, and businesses that are beyond concept and into the piloting stage. In addition to providing access to "smart venture capital", the Sustainable Chemistry Alliance is able to provide business connectivity through its staff and its distinguished board of directors.

Sustainable development There is a keen sense of community, cooperation, and participation in Sarnia-Lambton. This is especially evident in areas such as the environment and sustainable development.

The **Bluewater Sustainability Initiative** is an incorporated not-for-profit organization whose vision is for Sarnia-Lambton to become internationally recognized as a biohybrid green community. The goal is to follow best practices and set new standards in environmental protection, as well as lead discoveries in alternative energy sources. The organization has a steering committee comprised of 15 community leaders including Suncor, NOVA Chemicals, LANXESS, Imperial Oil, Lambton College, the Sarnia-Lambton Chamber of Commerce, the Sarnia-Lambton Economic Partnership, the City of Sarnia, the County of Lambton, the Sarnia-Lambton Environmental Association, the Urban Nature Centre, and RBC Dominion.

Located on the Lambton College campus, and with the College as a key partner, the Bluewater Sustainability Initiative is involved in the development and delivery of courses on sustainability that are available as post secondary

and continuing education offerings. Public seminars and workshops are offered on an ongoing basis.



The **Sarnia-Lambton Environmental Association** and its 20 member companies are committed to promoting and fostering a healthy environment consistent with sustainable development. State-of-the-art air and water monitoring programs are building on the database of historical information begun in 1952. The record demonstrates dramatic improvements in local environmental quality and highlights areas where additional improvements are needed. All information is shared with the community.

Infrastructure and community support Sarnia-Lambton offers industrial infrastructure that is ideal for the bioindustrial sector; a moderate climate not prone to earthquakes or extreme weather; and an industrial base of 80 local firms experienced in providing customer-oriented solutions from plant concept, through construction, to full operation and maintenance.

Sarnia-Lambton strongly supports the initiatives taking place in the bioindustrial sector. Local workforce development is being structured to meet the needs of the community's bioindustrial sector. Industry, local government, organizations, and residents have a common vision for the community.

Life in Sarnia-Lambton Miles of sandy Lake Huron shoreline ensures that no one is far from a beach in Sarnia-Lambton! Affordable housing, friendly neighbourhoods, good schools, excellent health care, and great recreational facilities are just some of the things that make Sarnia-Lambton a place to put down roots.

