Perspectives on Ontario's chemical-biochemical industry

The Canadian province of Ontario is the nation's economic powerhouse and also the chemical hub of the country. The strengths and investment opportunities in the chemical industry in Ontario were showcased to a group of international journalists during a recent tour arranged by the Ontario Ministry of Economic Development, Employment and Infrastructure (MEDEI). In the first part of our report on the Ontario chemical and allied industry (which appeared in October 20, 2015, issue), we highlighted some of the established and upcoming chemical firms in the region and the leading integrated industrial parks located in Sarnia. In this issue, we will put the spotlight on those parts of the industry value chain, which remain in the background, but are essential building blocks of the successful chemical-biochemical model that Ontario boasts of. These include the agricultural groups who are key participants in ensuring a successful bioeconomy model; natural gas storage and transmission firms; institutes of learning that not only provide the qualified human resources to drive research and production activities in the region, but also actively engage with other stakeholders to chart out the future roadmap for the industry; and few others.

BREEDING GROUND

University of Guelph and agricultural trade groups drive bioeconomy related projects

The Guelph region in the south west part of Ontario is among the largest agricultural areas in the province and also offers the largest amount of sustainably harvestable crop residues in Ontario – mainly from grain corn, winter wheat and soybean.

A number of farmer and agricultural trade groups operating in the region keenly support the creation of bioprocessing industries, which use these residues. These initiatives help in crop diversification and new uses for agricultural residues, enabling risk reduction and increased farm revenue; further benefit also accrue through participation or ownership positions in various components of the value chain. These groups actively support the adoption of new technologies and crop applications for industrial biotechnology applications, apart from providing feedstock for the biochemical industry.



Biomass feedstock and value addition

According to Ms. Nicole Mackellar, Manager-Market Development at Grain Farmers of Ontario – a 28,000-member strong farmer body – about $1.5-mn has been committed by the group towards innovations in the bioeconomy in the past five years. Some of the research projects that the group has been supporting include development of high oil soybeans for biodiesel, a new class of engineered green composites from soy meal and soy-based thermoplastic composites.

Mr. Don McCabe, President of Ontario Federation of Agriculture (OFA), which lays claim to being Canada's largest voluntary farm organisation representing over 37,000 farm families, said the farmer lobby had started out by supplying biomass for bioenergy applications, but has now evolved to capture value in areas like biochemicals and bioplastics.

Ontario Agri-Food Technologies (OAFT), which comprises members from grower associations, universities, industry and provincial governments, focuses on developing new market opportunities beyond traditional food markets, informed Dr. Tyler Whale of OFAT. The body provides support in terms of funding and matchmaking activities to companies looking to develop a business plan, capacity expansion or research project.

Similarly, the Soy 20/20 project seeks to bring government, academic and industry partners together to explore new bioscience opportunities for players in the soybeans sector in Canada. Mr. Jeff Schmalz, CEO of the group, pointed out that about 20 new opportunities in non-food sector have been identified by Soy 20/20.

"We have done work in many of these areas and three of the largest opportunities include lubricants, polyols and paints & coatings. We match Ontario grown speciality soybean varieties like high oleic and high linoleic acid soybeans to these business opportuni-



ties," he said. "We seek out products/ catagories, which will utilise speciality varieties of soybeans, and develop products accordingly. The farmers receive incremental profit by growing such identity-preserved soybean varieties," he added.

Research activities

Even as the agricultural trade groups provide the impetus for value-addition activities in biomass, the fulcrum of bioeconomy related research activities in the region is undoubtedly the prestigious University of Guelph, which has a long history of research in agriculture. The partnership between the University and the Ontario Ministry of Agriculture, Food, and Rural Affairs is said to have direct and spin-off impacts on the Ontario economy worth more than $1 billion per year.

Pioneering research on biomaterials at the University is undertaken in the Bioproducts Discovery and Development Centre (BDDC) – an interdisciplinary centre where plant biologists, chemists and engineers pool their expertise. The BDDC team is led by the Director Prof. Amar Mohanty, Professor and Ontario Premier's Research Chair in Biomaterials and Transportation at the University of Guelph.

The experts at the BDDC combine distinct areas of study including genetics, molecular biology, agronomy, and materials engineering to turn non-food plant materials into resins, polymers and tough fibres for the production of petroleum-free plastics. BDDC is focussed on providing sustainable alternatives to petroleum-based resources, while trying to capture value for co-products, such as lignin and glycerol from biofuels, which might otherwise be waste products.





"BDDC is actively engaged in industry-led projects that will see commercial application in the near-term. Companies working in the automotive, packaging or building materials sectors will find the BDDC a valuable partner in biomaterials production and processing," observed Prof. Mohanty.

Some of the successes from the work done at the Centre include plastic bins, flower pots and bird feeders made from switchgrass, which are already available through at least two major Canadian hardware stores. The products have made an economic impact, with at least two-spin-off companies.



Speaking about one of the other success stories catalysed by the BDDC, Prof. Mohanty pointed to the example of 'P-rPod100' developed by Club Coffee, a leading roaster, contract manufacturer and distributor of packaged coffees in Canada. 'P-rPod100' is the world's first 100% compostable, fully certified single-serve pod for coffee, tea and other hot beverages. It is made with renewable, bio-based materials, including the coffee bean chaff from the roasting process.

"We wanted to have an environmentally-acceptable single serve pod. Dr. Mohanty and his team were able to help us with all the expertise we needed. And BDDC was critical in linking us to partners such as Atul Bali at Competitive Green Technologies," informed Mr. Claudio Gemmiti, Senior Vice President, Innovation & Strategic Growth at Club Coffee.

HYBRID MODEL

Sarnia-Lambton keen on developing chemical clusters that synergise bio- and petro-based routes

The Sarnia-Lambton Economic Partnership (SLEP), a public-private partnership that offers handholding services to companies looking to set up businesses in Lambton County and City of Sarnia, is keen on developing bio-hybrid chemical clusters in the region.

Sarnia is home to more than 60 refineries and chemical plants and is known as Canada's 'Chemical Valley'. About 40% of Canada's chemical industry is located in this region.



Mr. George Mallay



Western Lambton Sarnia Research Park

Established multinationals include Air Products, Cabot Carbon, CF Industries, DuPont, Exxon-Mobil, Styrolution, Lanxess, Nova Chemicals, Suncor Energy, etc. Agriculture – the second largest economic sector in the region – is a key source of biomass. "Sarnia-Lambton provides unique access to fossil-based and renewable materials. The region has access to natural gas & crude oil from Western Canada, shale gas from North American basins, and crop residues & forestry products in Ontario," said Mr. George Mallay, General Manager, SLEP.

Sarnia-Lambton's target industries include bio-chemical & bio-hybrid chemicals, traditional refining & chemicals, cleantech & energy infrastructure, agriculture/food processing, etc.

"For the next two decades we will be focused on promoting bio-hybrid model of chemical industry. The number of renewable-based companies will increase as we build on this hybrid concept. Increasing shale gas use is resulting in lower production of C4s and aromatics and driving new bio-based opportunities in chemicals like n-butanol, isobutanol, adipic acid, isoprene, etc.," said Mr. David Moody, Project Leader, Business Growth Services, SLEP.

Another agency driving efforts in establishing networked hybrid clusters

by accelerating and commercialising new technologies in Ontario is Bio-industrial Innovation Canada (BIC). BIC was the catalyst for Canada's first hybrid chemistry cluster in Sarnia-Lambton. BIC was set up with $15-mn in seed funding from Canada's Centres of Excellence for Commercialization and Research (CECR) programme in 2008. It established an incubator facility at the Sarnia-Lambton Campus of the Western University Research Park to provide client companies with access to over 50,000 square feet of office, laboratories and pilot plant infrastructure for research, commercialisation and entrepreneurship. The accelerator facility is designed to help bridge the gap between research and market in chemicals and energy production from biomass. Bowman Centre's pilot plant clients include Woodland Biofuels, KmX and GreenCore Composites among others.



Mr. Sandy Marshall

In its bid to build on the success of Sarnia hybrid chemical cluster, Mr. Sandy Marshall, Chairman, BIC, said the agency is exploring viability of constructing a cellulosic sugar conversion plant in Southern Ontario by 2018, which will process up to 250,000-tonnes of agricultural residue annually.

PETROCHEMICALS

Nova Chemicals' Ontario site competitiveness improves post cracker revamp

Nova Chemicals Corporation, the Calgary (Alberta, Canada) based firm with focus on ethylene, polyethylene and performance styrenic polymers, is looking at improved prospects for its Ontario operations after a $250-mn retrofit project to enable use of 100% NGL (natural gas liquids) feedstock sourced from growing North American supplies.



The firm's current businesses and joint ventures focus on ethylene & polyethylene and performance styrenic polymers. Owned by International Petroleum Investment Company (IPIC) of the Emirate of Abu Dhabi, United Arab Emirates, the company has major manufacturing operations in Ontario and Alberta (in Canada) and in the US.

In Ontario, the sites are located in Sarnia-Lambton district at Corunna, Mooretown and St. Clair Township. In Corunna, the company produces 1.8 billion pounds of ethylene and up to 700 million pounds of co-products annually. The Corunna site is the hub of Canada's largest petrochemicals cluster – pipelines from the site supply olefins to the firm's other facilities in the region, as also to plants of leading companies like Lanxess and Styrolution located in the vicinity. Companies like Suncor Energy, Imperial Oil, Shell, Praxair, apart from feedstock & utility firms like Union Gas and TransAlta, are also part of this extensive pipeline network.

Nova Chemicals' facilities at Moore Site and St. Clair Township convert ethylene received from the Corunna site into up to 1.3 billion pounds of low-density polyethylene (LDPE) and high-density polyethylene (HDPE). In the period before 2009, the company's operations in Corunna, which were based on naphtha (and so linked to the high crude oil prices prevailing at that time), were not found to be competitive with its Western Canadian assets in Alberta with access to cheaper oil sands.

According to Mr. Rob Thompson,



Nova Chemicals regional operations leader, this prompted the company to embark on a three-phase revamp and pipeline project. The $250-mn retrofit project in the first phase, which was completed in 2014, has seen the Corunna cracker becoming the first in the world to source ethane feedstock from the Marcellus Shale Basin.

In the phase two, involving an investment of over $300-mn, the company plans to focus on completing a conversion to full ethane utilisation along with an expansion of the Corunna cracker by around 2018. This phase will also see the development of a pipeline project to gain access to Utica Shale Basin ethane, as the company moves to ensure multiple pipeline options with varied supply of feedstock for the Corunna cracker.

In the third phase, the company will investigate a second polyethylene facility based on its proprietary 'Advanced SCLAIRTECH technology' (AST). The company also said plans remain under way for a LDPE debottleneck and HDPE retrofit at the Mooretown plant.The existing and planned projects are part of the company's Nova 2020 growth strategy, which includes continued capital spending on strategic petrochemicals expansion in Ontario and Alberta, based on North America's increased demand as well as its emerging feedstock opportunities.

"We are a cornerstone of Ontario's petrochemical industry. We have invested more than $1 billion over the last 10 years into our Ontario manufacturing facilities to ensure ongoing safe and reliable operations that will remain competitive in global markets. We have announced more than $300-mn in projects over next few years and there is potential for more than $1-bn investment in the future," said Mr. Thompson.

GAS TRADING HUB

Union Gas aims to further boost natural gas transmission activities at Dawn hub

Union Gas Ltd., a major Canadian natural gas storage, transmission and distribution company based in Ontario, is planning to pump in around C$1.5-bn in the next two years to expand its pipeline and compressor infrastructure as it looks to increase takeaway capacity by 20%. Compression facilities are essential to the movement of natural gas through pipeline systems.

Union Gas' storage and transmission business offers a variety of storage and transportation services to its customers with the help of the largest integrated underground storage facility in Canada, and one of the largest in North America, located at Dawn, Southwest of Sarnia.





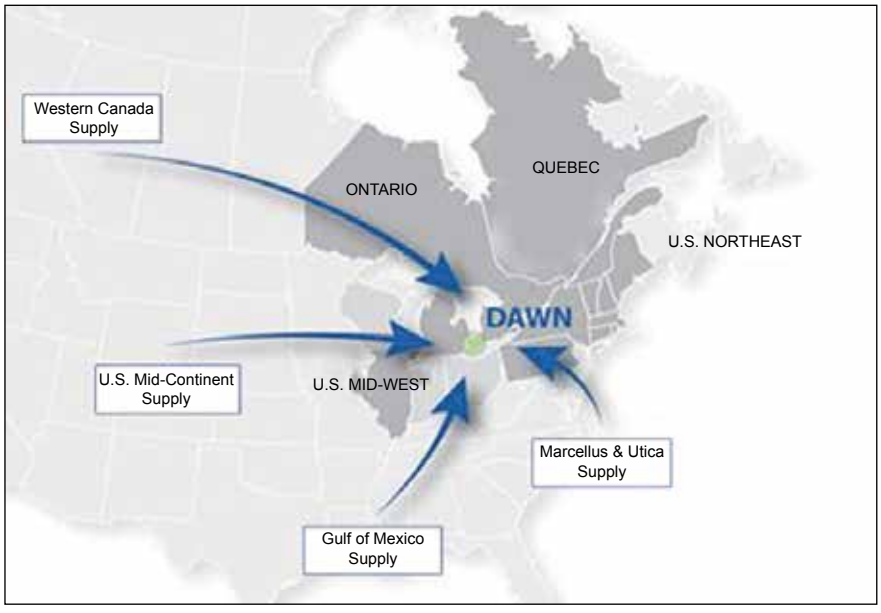


The Union Gas Dawn Hub is the second most physically traded hub in North America averaging over seven billion cubic feet of trading activity per day. Its strategic location provides direct access to North America's major supply basins, including natural gas supplies in Utica and Marcellus.

Dawn consists of 23 interconnected storage pools and is also fully integrated into the North American supply and transportation system, enabling customers to source natural gas from all major North American supply basins and transport gas downstream to markets in eastern Canada and the Northeastern US.

"The integrated nature of Union Gas' storage and transmission systems ensures our customer's contract demands are met during peak times and allows Union Gas to offer our customers flexible and customised storage services to meet their needs," informed Mr. Chris Young, Administration Manager, Storage and Transmission Operations, Union Gas.

Speaking about the Dawn-Parkway System – one of the key natural gas transmission corridors between Dawn and Parkway (Milton, Ontario), he said that about 4,800-km of pipeline move gas between the Dawn Hub and the Parkway compressor station located near Toronto, Ontario. The proposed C$1.5-bn expansion of the Dawn-Parkway system is likely to increase takeaway capacity from Dawn by 20%, said Mr. Young.



Mr. Jeff Gallie, Manager – System Operations and Compression Storage and Transmission Operations, Union Gas, noted that leading firms like Esso, Suncor, Nova Chemicals, etc. typically purchase their gas at Dawn and deliver this to Union Gas at Dawn for redelivery to their plant.

"Energy-intensive companies need easy access to a liquid market hub where gas can be bought or sold without affecting the price. The Dawn Hub offers all the features of a liquid market hub.

The price of natural gas at Dawn is set by the open market and is publicly available through energy industry publications. It is connected to multiple sources of gas supply through 10 major pipelines. Moreover natural gas supply options are expected to grow by 40% in three years through three more proposed pipeline projects," he added.

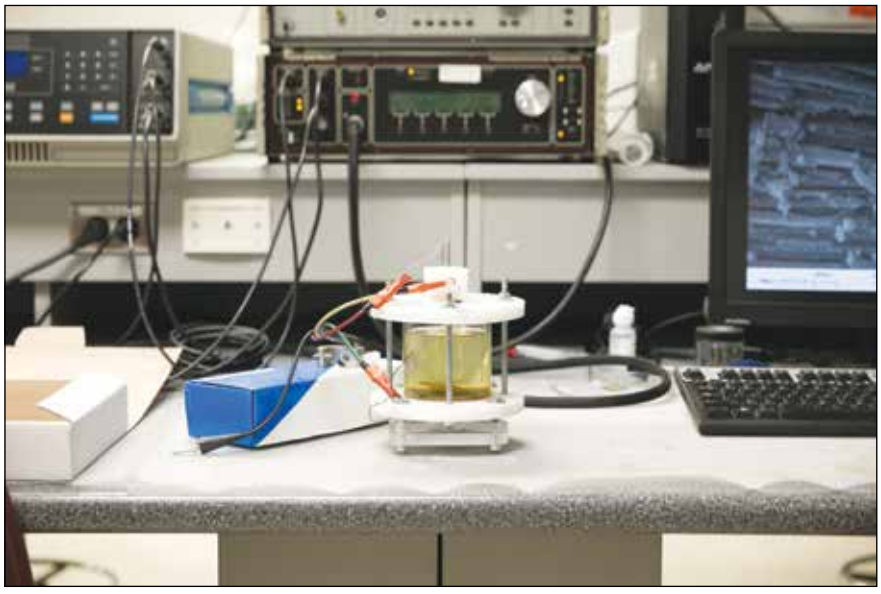
EDUCATION & RESEARCH

Lambton College: Focused on creating skilled workforce and applied research

Lambton College, a premier college of applied arts and technology in Sarnia, Ontario, which has been servicing Canadian and international students for over 47 years, is playing a vital role in the continuing success of Ontario's chemical-biochemical industry sectors. The college is not only the breeding ground for the future workforce of the industry, but also an active participant in initiating research and developing novel technologies in collaboration with industry.



Ms. Judith Morris, President, Lambton College, emphasises the two-pronged focus of the college: education & training and applied research. "We take pride in producing job-ready graduates. Through integration with our industrial partners, Lambton College ensures experiential learning, graduate placements, applied research, and professional development opportunities," she says. The college offers programmes like Chemical Production and Power Engineering Technology; Instrumentation & Control Engineering Technology; Power Engineering Technology and Advanced Power Engineering Technology.



The college's new Centre of Excellence in Energy & Bio-Industrial Technologies has been set up to provide professional training and education to support the need for skilled workforce in the energy and biotechnology industries. "Our faculty and facilities support local businesses through applied research, commercialisation, incubation, prototyping & pilot plant studies and projects to develop new technologies, products and processes," informs Ms. Morris.

Speaking about the college's focus on applied research and collaborations with companies in the Sarnia-Lambton region, Dr. Mehdi Sheikhzadeh, Dean, Applied Research and Development, Lambton College, says, "Through focussing on applied research and innovation, Lambton College has become a provincially recognised R&D hub. Our areas of expertise include a wide range technology related themes such as advanced materials, instrumentation & process control, advanced manufacturing, water, energy, biotechnology and information technology. We have been able to provide support in these areas to many organisations, small-to-medium enterprises (SMEs), and have helped to develop new products, improve existing ones and advance current processes and practices. Additionally, Lambton College has developed a unique partnership with the Western Sarnia-Lambton Research Park, leveraging the strengths of each organisation to form a unique innovation hub. The formation of this alliance allows us to provide a wide range of R&D services to a variety of companies."