BioAmber Inc.
Form 10-K
March 28, 2014
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UNITED STATES

SECURITIES AND EXCHANGE COMMISSION

Washington, D.C. 20549

FORM 10-K

(Mark One)

x **ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934**

For the fiscal year ended December 31, 2013

OR

¨ **TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934**

For the transition period from to

Commission file number: 001-35905

BioAmber Inc.

(Exact name of registrant as specified in its charter)

Delaware	**20-1579162**
(State or other jurisdiction of incorporation)	**(I.R.S. Employer Identification No.)**
1250 Rene Levesque West, Suite 4110	
Montreal, Quebec, Canada H3B 4W8	**H3B 4W8**
(Address of principal executive offices)	**(Zip Code)**

(514) 844-8000

(Registrant s telephone number, including area code)

Securities Registered pursuant to Section 12(b) of the Act:

Title of Each Class	**Name of Exchange on Which Registered**
Common Stock, par value $0.01 per share	**The NASDAQ Global Market**

Securities Registered pursuant to Section 12(g) of the Act:

None

Indicate by check mark if the registrant is a well-known seasoned issuer, as defined in Rule 405 of the Securities Act. Yes ¨ No x

Indicate by check mark if the registrant is not required to file reports pursuant to Section 13 or Section 15(d) of the Act. Yes ¨ No x

Indicate by check mark whether the registrant: (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or for such shorter period that the Registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days. Yes x No ¨

Indicate by check mark whether the registrant has submitted electronically and posted on its corporate Web site, if any, every Interactive Data File required to be submitted and posted pursuant to Rule 405 of Regulation S-T during the preceding 12 months (or for such shorter period that the registrant was required to submit and post such files). Yes x No ¨

Indicate by check mark if disclosure of delinquent filers pursuant to Item 405 of Regulation S-K is not contained herein, and will not be contained, to the best of registrant s knowledge, in definitive proxy or information statements incorporated by reference in Part III of this Form 10-K or any amendment to this Form 10-K. ¨

Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, or a smaller reporting company. See the definitions of large accelerated filer, accelerated filer and smaller reporting company in Rule 12b-2 of the Exchange Act. (Check one):

Large accelerated filer ¨	Accelerated filer ¨
Non-accelerated filer x (Do not check if a smaller reporting company)	Smaller reporting company ¨

Indicate by check mark whether the registrant is a shell company (as defined in Rule 12b-2 of the Exchange Act). Yes ¨ No x

The aggregate market value of common stock held by non-affiliates of the registrant based on the closing price of the registrant s common stock as reported on the New York Stock Exchange on June 28, 2013, was $6.80. Shares of voting and non-voting stock held by executive officers, directors and holders of more than 5% of the outstanding stock have been excluded from this calculation because such persons or institutions may be deemed affiliates. This determination of affiliate status is not a conclusive determination for other purposes.

As of March 28, 2014, there were 18,561,869 shares of the registrant s common stock, par value $0.01 per share, outstanding.

DOCUMENTS INCORPORATED BY REFERENCE

Portions of the registrant s definitive Proxy Statement relating to its 2014 Annual Meeting of Stockholders are incorporated by reference into Part III of this Annual Report on Form 10-K where indicated. Such Proxy Statement will be filed with the U.S. Securities and Exchange Commission within 120 days after the end of the fiscal year to which this report relates.

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SPECIAL NOTE REGARDING FORWARD-LOOKING STATEMENTS

This Annual Report on Form 10-K contains forward-looking statements that involve risks and uncertainties, as well as assumptions that, if they never materialize or prove incorrect, could cause our results to differ materially from those expressed or implied by such forward-looking statements. The statements contained in this Annual Report on Form 10-K that are not purely historical are forward-looking statements within the meaning of Section 27A of the Securities Act of 1933, as amended, or Securities Act, and Section 21E of the Securities Exchange Act of 1934, as amended, or Exchange Act. Such forward-looking statements include any expectation of earnings, revenue or other financial items; any statements of the plans, strategies and objectives of management for future operations; factors that may affect our operating results; statements related to adding employees; statements related to future capital expenditures; statements related to future economic conditions or performance; statements as to industry trends and other matters that do not relate strictly to historical facts or statements of assumptions underlying any of the foregoing. Forward-looking statements are often identified by the use of words such as, but not limited to, anticipate, believe, can, continue, co estimate, expect, intend, may, will, plan, project, seek, should, target, will, would, and simi variations intended to identify forward-looking statements. These statements are based on the beliefs and assumptions of our management based on information currently available to management. Such forward-looking statements are subject to risks, uncertainties and other important factors that could cause actual results and the timing of certain events to differ materially from future results expressed or implied by such forward-looking statements. Factors that could cause or contribute to such differences include, but are not limited to, those identified below, and those discussed in the section titled Risk Factors included in Item 1A of Part I of this Annual Report on Form 10-K, and the risks discussed in our other Securities and Exchange Commission, or SEC, filings. Furthermore, such forward-looking statements speak only as of the date of this report. Except as required by law, we undertake no obligation to update any forward-looking statements to reflect events or circumstances after the date of such statements. Forward-looking statements in this Annual Report on Form 10-K may include statements about:

- the expected funding sources of our planned Sarnia, Ontario plant and our other planned manufacturing facilities and the expected timing of the completion of construction and the start of commercial operations at each of these facilities;
- our joint venture with Mitsui & Co. Ltd., or Mitsui;
- our take-or-pay agreement with Vinmar International Ltd., or Vinmar, related to bio-based 1, 4 BDO;
- the expected applications of our products and the sizes of addressable markets;
- our ability to gain market acceptance for bio-succinic acid, its derivatives and other building block chemicals;
- the benefits of our transition from our *E. coli* bacteria to our yeast;

our ability to commence commercial sales and execute on our commercial expansion plan, including the timing and volume of our future production and sales;

the expected cost-competitiveness and relative performance attributes of our bio-succinic acid and the products derived from it;

our ability to cost-effectively produce and commercialize bio-succinic acid, its derivatives and other building block chemicals;

customer qualification, approval and acceptance of our products;

our ability to maintain and advance strategic partnerships and collaborations and the expected benefits and accessible markets related to those partnerships and collaborations;

our ability to economically obtain feedstock and other inputs;

the achievement of advances in our technology platform;

our ability to obtain and maintain intellectual property protection for our products and processes and not infringe on others rights;

government regulatory and industry certification approvals for our facilities and products; and

government policymaking and incentives relating to bio-chemicals.

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PART I

Item 1. Business

Overview

We are an industrial biotechnology company producing sustainable chemicals. Our proprietary technology platform combines industrial biotechnology and chemical catalysis to convert renewable feedstocks into sustainable chemicals that are cost-competitive replacements for petroleum-derived chemicals, which are used in a wide variety of everyday products including plastics, resins, food additives and personal care products. We currently sell our first product, bio-succinic acid, to customers in a variety of chemical markets. We intend to produce bio-succinic acid that is cost-competitive with succinic acid produced from petroleum at our planned facility in Sarnia, Ontario. We currently produce our bio-succinic acid in a large-scale demonstration facility using a 350,000 liter fermenter in Pomacle, France, which we believe to be among the largest bio-based chemical fermenters in the world. We have produced approximately 2.35 million pounds, or 1,065 metric tons, of bio-succinic acid at this facility as of December 31, 2013.

Succinic acid can be used to manufacture a wide variety of products used every day, including plastics, food additives and personal care products, and can also be used as a building block for a number of derivative chemicals. Today, petroleum-derived succinic acid is not used in many potential applications because of its relatively high production costs and selling price. We believe that our low-cost production capability and our development of next-generation bio-succinic derived products including 1,4 BDO, which is used to produce polyesters, plastics, spandex and other products, will provide us with access to a more than $10 billion market opportunity. Combining these opportunities with other building block chemicals we are developing, such as adipic acid which is used in the production of nylons, we believe that our total addressable market is in excess of $30 billion.

We believe we can produce bio-succinic acid that is cost-competitive with succinic acid produced from oil priced as low as $35 per barrel, based on management s estimates of production costs at our planned facility in Sarnia, Ontario and an assumed corn price of $6.50 per bushel. While we can provide no assurance that we will be able to secure corn at $6.50 per bushel given the fluctuations in corn prices, we believe this assumption is reasonable given the historic price of corn and management s expectations as to their ability to manage the cost of glucose from corn and other inputs for our planned facility in Sarnia, Ontario. Over the past five years, the price of corn ranged from a low of $2.68 per bushel to a high of $8.44 per bushel. As of March 13, 2014, the spot price was $4.63 per bushel and the six month forward price was $4.46 per bushel. We estimate that a $1.00 increase or decrease in the per bushel price of corn would result in just a $0.024 per pound change in our variable cost of our bio-succinic acid. We expect the productivity of our yeast organism and on-going process improvements to further reduce our production costs. Our ability to compete on cost is not dependent on government subsidies or tariffs.

We are working to rapidly expand our accessible markets and product portfolio. We have entered into strategic relationships with several leading companies, such as our multi-year agreement with Mitsubishi Chemical for bio-succinic acid. We have also entered into agreements with LANXESS Inc., or LANXESS, Faurecia S.A., or Faurecia, NatureWorks LLC, or NatureWorks, and others for the development of derivatives of bio-succinic acid.

We have also entered into technology partnerships to lower our production costs, expand our product portfolio and enhance our biochemical production platform. For example, we entered into a technology partnership with Cargill through which we exclusively license a proprietary yeast organism for use in our fermentation process to produce our products. We refer to the yeast organism that we have licensed from Cargill as our yeast. We have also established other technology licenses and collaborations, including with DuPont, Evonik and Celexion.

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Our business strategy is to leverage the value of our technology by building and operating production facilities around the world. However, depending on our access to capital and third-party demand for our technology, we may also enter into technology licenses on an opportunistic basis.

In order to support our growth strategy, we have begun to rapidly expand our manufacturing capacity. We have entered into a joint venture agreement with Mitsui & Co. Ltd. for our planned facility in Sarnia, Ontario, which has an initial projected capacity of 30,000 metric tons of bio-succinic acid and could subsequently be expanded to produce another 20,000 metric tons of bio-succinic acid. A portion of our aggregate capacity could be further converted to produce bio-based 1,4 BDO. As an example, we estimate that approximately 30,000 metric tons of bio-succinic acid production could be converted into approximately 22,000 metric tons of bio-based 1,4 BDO production. We have commenced construction of this facility and the initial phase is expected to be mechanically complete in late 2014 or early 2015, at which time we plan to begin commissioning and start-up. We expect this facility will be fully funded through equity contributions by both us, with a portion of the net proceeds of our initial public offering, and Mitsui, as well as a combination of government grants, interest-free loans and interest-bearing loans. We expect to terminate production of our products at the large-scale demonstration facility in Pomacle, France at the end of 2014. Our joint venture with Mitsui also contemplates the potential construction and operation of an additional facility, which we expect to occur over the next three to five years.

On January 22, 2014, we entered into a 15 year take-or- pay contract for bio-based 1,4-Butanediol (BDO) with Vinmar International Ltd., a privately held marketing, distribution, and project developed company headquartered in Houston, Texas. Under the terms of the master off-take agreement, Vinmar has committed to purchase 100% of the bio-based 1, 4 BDO produced in a 100,000 metric ton per year capacity plant that we plan to build in North America and commission in 2017. Vinmar also plans to invest in the facility alongside us. While this agreement is binding, our inability to finance and construct the BDO plant would relieve Vinmar of its obligation to purchase BDO under the terms of the take-or-pay agreement.

We are committed to managing our economic, social, environmental and ethical performance through continued sustainable business practices. We have completed a life cycle analysis for our planned facility in Sarnia that indicates that no carbon dioxide equivalent (or greenhouse gases) will be emitted per kilogram of our bio-succinic acid produced, making our process carbon neutral. This is significantly less carbon intensive than the current petrochemical process for making succinic acid, in which 7.1 kilograms of carbon dioxide equivalent are emitted per kilogram of succinic acid produced. This represents a 100% reduction in greenhouse gases for our bio-succinic acid process, relative to the current petrochemical process for making succinic acid. The life cycle analysis also indicates that our planned facility in Sarnia will consume 60% less energy than the current petrochemical process.

We were incorporated in the State of Delaware in October 2008 as DNP Green Technology, Inc. and were established as the result of the spin-off of certain assets from Diversified Natural Products, Inc. In September 2010, we acquired the 50% interest in our joint venture Bioamber S.A.S. that we did not already own, after which, Bioamber S.A.S. became wholly owned by us. Concurrent with this acquisition, we changed our name from DNP Green Technology, Inc. to BioAmber Inc. and changed our fiscal year end from June 30 to December 31.

Our Industry

The global chemical industry is a $4.1 trillion market, based on total global chemical shipments in 2012, according to the American Chemistry Council. Chemicals are utilized in a broad range of end-use markets, including heavy industry, mining, construction, consumer goods, textiles and healthcare. While there is significant ongoing process innovation and technological development in the broader chemicals industry, producers are still heavily reliant on petroleum-derived feedstocks. The following table lists five of the key

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chemical classes from two carbon, or C2, to six carbon, or C6, that are primarily being produced from fossil fuels today along with examples of derivative compounds and end-use applications.

	C2	C3	C4	C5 and greater
	Ethylene	**Propylene**	**n-Butane Butadiene**	**Benzene/Toluene/Xylene**
Derivatives	Ethylene glycol	Acrylic	Maleic anhydride	Adipic acid
	Polyethylene	Polypropylene	Succinic Acid	Caprolactam
	PVC		1,4 BDO and THF	Caprolactone
	Vinyl			Cyclohexane
				Hexamethylenediamine (HMDA)
				Hexanediol
Applications	Anti-freeze	Automotive components	Adhesives	Carpet fiber
	Building materials	Coatings	Elastomers	Clothing
	Foam packaging	Packaging	Footwear	Nylon
	Plastic bags	Plastic parts	Synthetic rubber	Thread, ropes and netting
	Plastic films	Textiles and fibers	Tires	

Reliance on Petrochemicals

While the global chemical industry provides many value-added products to industrial and consumer end-markets, it is facing an increasing number of challenges as a result of its significant reliance on petroleum as its primary feedstock for the following reasons:

A Finite, Non-Renewable Resource as its Primary Input. Chemical companies are heavily dependent on oil, a finite, non-renewable resource that is in growing demand, particularly from developing economies such as India and China. While worldwide demand is growing, recent supply growth has been limited. As petroleum companies access increasingly remote reserves, the cost of replacing reserves is also increasing. Given the supply and demand pressures on such a critical input, the purchasers of chemical have shown growing interest in finding cost-effective, renewable alternatives.

Hydrocarbon Feedstock Price Volatility. Crude oil prices have experienced significant price volatility over time. For example, during the last five years, the market price per barrel of West Texas Intermediate crude oil ranged from a low of $30.81 to a high of $145.66 and was $98.20 on March 13, 2014. As a result, we believe chemical companies are looking for more stable solutions.

Potential for Margins Pressure at Existing Petrochemical Facilities. Given the price volatility around crude oil, chemical companies are increasingly concerned about rapid raw material price increases driven by supply shortages in basic petrochemical inputs that could negatively impact their profit margins. Due to the nature of contracts with their customers, chemical companies often cannot pass-through rising raw materials costs to their customers quickly.

Reduced Supply of C4 Chemicals. In the past five years, there has been a 25% reduction in the supply of C4 chemicals due to the emergence of relatively inexpensive natural gas in certain geographies including shale gas in North America. In these geographies there has been a shift away from naphtha cracking to natural gas liquid cracking as a means of producing ethylene. As such, there is significantly less crude C4 fraction produced, which is a principal source of supply for C4 chemicals. Consequently, the shift to natural gas cracking has led to a drop in the supply of crude C4, a primary feedstock for C4 chemicals. This has led to increased volatility in the prices of C4 derived chemicals, including butadiene, maleic anhydride and 1,4 BDO. According to Tecnon Orbichem data, the United States and European Union regional market prices of 1,4 BDO increased by 222% and 173%, respectively, between 2004 and 2014, and the United States and European Union regional market prices of maleic anhydride (which is the precursor to petrochemical succinic acid) increased by 187% and 177%, respectively, between 2004 and 2014.

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Increasing Governmental Regulation. Increasing government regulation and climate change initiatives are driving up the cost of using high carbon emitting processes, such as chemical production via petrochemicals. The third phase of the European Union s Emission Trading System when implemented is expected to more broadly cover petrochemical production activities, potentially increasing costs at European petrochemical plants by 5 to 10%. In addition to regulation of carbon emitting processes, the use of petrochemicals in certain products, such as plasticizers containing phthalates, are subject to increasing regulatory pressure.

Customer Demand for Renewable and Sustainable Products. Consumers are increasingly choosing renewable alternatives to products when available. As consumers become more aware of the environmental footprint of petroleum-derived products, they may shy away from less sustainable products in favor of readily available, non-petrochemical based alternatives, especially if these products are priced competitively. We believe that there is demand among certain players in the chemical industry for sustainable alternatives in order to differentiate themselves from their competitors.

Biochemical Alternatives

We believe there is significant and growing demand for a low-cost and sustainable alternative to using petroleum for chemical production. Multiple biochemical processes have been developed to address this demand, primarily using microorganisms that can convert sugars derived from renewable feedstocks into various chemical building blocks including:

Bio-succinic acid: A biologically produced, chemically identical replacement for petroleum-derived succinic acid that can be utilized to produce derivative products such as bio-based 1,4 BDO, and can substitute petrochemicals such as maleic anhydride, phthalic acid, acetic acid and adipic acid in a number of applications. Target end-uses for bio-succinic acid include plasticizers, polyurethanes, personal care products, resins and coatings, de-icing solutions, lubricants and food additives.

Bio-adipic acid: A biologically produced, chemically identical replacement for adipic acid. Target end-uses for bio-adipic acid include nylon fibers, resins, plasticizers, solvents and adhesives.

Bio-succinic acid and bio-adipic acid are often referred to as building block chemicals because they can be converted into intermediate chemicals that are then used in the production of a wide array of consumer end-products.

Bio-succinic acid is produced from renewable sugars in a carbon dioxide-sequestering process, which results in higher theoretical yields than other bio-based chemicals, as shown in the table below.

Chemical	Theoretical Yield	Kg Sugar Needed to Produce a Kg of Product
Bio-succinic acid	**112%**	**0.9**
Lactic acid	100%	1.0
Bio-based 1,4 BDO via succinic acid	**85%**	**1.2**
1,3 Propanediol	63%	1.6
Adipic acid	**58%**	**1.7**

1,4 BDO via direct fermentation	54%	1.9
Ethanol	51%	2.0
Iso-Butanol	41%	2.4
Farnesene	29%	3.5

Bio-adipic acid is also produced from renewable sugars in a process that does not consume carbon dioxide, but is free of nitrous oxide emissions, which are a significant drawback of the petrochemical process. We produce bio-based succinic acid and we intend to produce bio-based 1,4 BDO via succinic acid and are also developing a bio-based route to adipic acid.

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Despite their inherent benefits, there has not been a critical mass of bio-based chemical manufacturing facilities operating at sufficient scale to prove out the cost and quality necessary to compete with their petrochemical equivalents. We believe that if manufacturers of bio-based chemicals can produce at reduced costs compared to their petrochemical equivalents, the market for the bio-based chemicals could be significantly larger than it is today. The high cost of producing succinic acid from petroleum feedstock has limited its use. We believe there is a significant opportunity for bio-based chemical manufacturers who can reliably deliver product at scale, with the required specifications of potential customers and at a competitive cost.

Our Strengths

Our business benefits from a number of competitive strengths, including:

Proprietary Technology Platform that Addresses a Large Market Opportunity

Our proprietary technology platform integrates industrial biotechnology, and chemical catalysis to produce bio-based chemicals as cost-competitive, chemically identical replacements for petroleum-derived equivalents. We own or have exclusive rights to specific microorganisms, chemical catalysis technology and a scalable and flexible purification process that, when combined and optimized, convert renewable feedstocks into platform chemicals. We believe the strength of our platform, our intellectual property portfolio and our licensing agreements with Cargill, Celexion and DuPont will allow us to extend our chemical production beyond our current product, bio-succinic acid, to large markets including bio-based 1,4 BDO and bio-based adipic acid. We believe our bio-based chemicals can serve as drop-in replacements for existing petroleum-based chemicals in these markets. Together, these chemicals address what we believe to be an approximately $30 billion market opportunity.

Selling Commercial Product Today

We believe we were the first company selling bio-succinic acid in commercial quantities. Our customers utilize our product as a cost-competitive, sustainable alternative to the petroleum-based specialty chemicals they currently use in polymers, food additives and flavorings, bath salts, polyurethanes, pharmaceutical and other applications. Our ability to supply large scale quantities of bio-succinic acid allows our customers to develop new applications and initiate commercialization of their products.

Cost-Competitive Economics at Large Scale

Our experience operating the large-scale demonstration facility in Pomacle, France for over four years has helped us refine our process and make bio-succinic acid cost-competitively without subsidies. We expect to produce bio-succinic acid that is cost-competitive with succinic acid produced from oil priced as low as $35 per barrel, based on management s estimate of input prices in Sarnia, Ontario and an assumed corn price of $6.50 per bushel. Through extensive research and development efforts relating to our bio-succinic acid production process, including pilot plant phase, process efficiency enhancements and scaling up our process to our current scale, we have been able to thoroughly address the operational complexities in our process. We believe that our experience operating at this scale in France has provided us with the know-how to efficiently design, build and operate our planned Sarnia facility.

Limited Exposure to the Availability and Price of Sugar

Our process requires less sugar than other renewable products. We require approximately 50% less sugar to produce a pound of bio-succinic acid than is needed to produce a pound of ethanol (0.15 gallons), and even less sugar than is needed to produce a pound of several other bio-based chemicals. This makes our process less vulnerable to price

increases in sugar, relative to other bio-based processes. This efficient use of sugar translates into reduced consumption. To produce $1 billion worth of bio-succinic acid and $1 billion worth of bio-based

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1,4 BDO at current prices, we would require approximately 1.2 million metric tons of sugar. Even if the entire $2 billion worth of bio-succinic acid and bio-based 1,4 BDO were produced in North America, it would require only 6.0% of the sugar produced in existing corn wet mills. Given this modest demand and our ability to source sugar from a variety of sources, rapid growth in our production capacity would not likely have a material impact on the sugar markets from which we plan to source.

Established, Diverse Customer Base

Our leadership in bio-succinic acid technology, our product quality and the economics of our process are validated by the contracts we have signed with customers in a variety of end-markets. We have entered into supply agreements for the sale of approximately 145,000 metric tons of bio-succinic acid and its derivatives over the next five years. These supply agreements typically obligate our customers, subject to certain conditions, to purchase 75% to 100% of their succinic acid needs from us, contingent on our ability to meet their price and other requirements. There are no penalties in the event these customers do not purchase or we do not supply them with bio-succinic acid in the projected purchase volumes indicated in the agreements.

Global Manufacturing Expansion Plan

We have signed a joint venture agreement with Mitsui to build a planned facility in Sarnia, Ontario, that is expected to initially produce bio-succinic acid and subsequently produce 1,4 BDO. We commenced construction of this facility in 2013 and expect the facility to be mechanically complete in late 2014 or early 2015. This facility has been designed to have an initial capacity of 30,000 metric tons of bio-succinic acid and could subsequently be expanded to produce another 20,000 metric tons of bio-succinic acid. A portion of our aggregate capacity could be further converted to produce bio-based 1,4 BDO. As an example, we estimate that approximately 30,000 metric tons of bio-succinic acid production could be converted into approximately 22,000 metric tons of bio-based 1,4 BDO production. We expect this facility will be fully funded through equity contributions by both us, with a portion of the net proceeds of our initial public offering, and Mitsui, as well as a combination of government grants, interest-free loans and interest-bearing loans.

Experienced Management Team with Strong Track Record

Our management team consists of experienced professionals, possessing on average over 25 years of relevant experience in scaling up, manufacturing and commercializing chemicals, gained at both large companies and entrepreneurial start-ups. Members of our senior management team have worked at companies including Abengoa, Cargill, DuPont, Dow Corning Corporation, Royal DSM N.V., Suncor, Sanofi, Tate & Lyle and the Genencor division of Danisco A/S.

Our Strategy

Our goal is to be the leading provider of renewable chemicals by replacing petroleum-based chemicals with our bio-based alternatives which we believe could revolutionize the global chemical industry.

Rapidly Expand Our Global Manufacturing Capacity

We currently operate a large-scale demonstration facility in Pomacle, France, and are building our first commercial facility in cooperation with Mitsui in Sarnia, Ontario. We expect this facility to be mechanically complete in late 2014 or early 2015, at which time we plan to begin commissioning and start-up. We plan to construct additional large-scale bio-based succinic acid facilities in multiple geographic regions employing a standardized design that facilitates

expedient and capital-efficient growth. We expect to benefit from incremental cost reductions and further technological and engineering improvements at each additional facility. To further streamline production and reduce costs, we plan to integrate production and locate these facilities in proximity to required infrastructure and feedstock. We intend to retain operational control and a majority interest in these

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facilities and collaborate with third parties to obtain capital, construct the facilities, secure feedstock, sell future output and assist with manufacturing and market access.

Target the Large and Established 1,4 BDO Market

We intend to leverage our ability to produce high quality bio-succinic at low cost, as well as high value-added derivatives of bio-succinic, such as bio-based 1,4 BDO, which is used in the production of polyesters, plastics, spandex and other products. We have licensed technology from DuPont, which we believe will enable us to produce bio-based 1,4 BDO at a lower cost than alternative processes with equivalent purity. In January 2014 we announced our intention to build a 100,000 ton per year capacity bio-based 1,4-BDO plant in North America, which we plan to commission in 2017. We have entered into a 15 year take-or-pay contract with Vinmar International Ltd. in which they will guarantee 100% off-take of bio-based 1,4 BDO from the 100,000 ton per year facility. We expect to benefit from Vinmar s global logistics expertise and its experience selling large volumes of BDO and executing large chemical facility projects. We expect that Vinmar will invest alongside us in the planned North American facility, and Mitsui may also participate as a minority equity partner in the plant.

Develop Next-Generation Succinic-Derived Products

We intend to leverage our proprietary technology platform and expertise in the production of bio-succinic acid to target high value-added products such as bioplastics and plasticizers that can be made with succinic acid. To further this strategy, we:

- licensed technology from DuPont to convert bio-succinic acid to bio-based 1,4 BDO, THF and GBL, and partnered with Evonik to optimize and scale up the DuPont catalysts;
- entered into a joint development agreement with Lanxess related to the development and commercialization of bio-based succinate esters as phthalate-free plasticizers;
- entered into an exclusive supply arrangement with Mitsubishi Chemical for PBS;
- entered into a joint venture with NatureWorks to commercialize new bio-based polymers based on blends of PBS and PLA;
- developed and are jointly marketing silicone replacements for personal care with Inolex.
- signed a 15 year take-or-pay agreement with Vinmar for 100% of the output of a 100,000 ton per year biobased 1,4-BDO plant that we plan to commission in 2017

Continue to Reduce the Cost of Our Products

Our goal is to be the low-cost producer of the bio-based chemicals we manufacture. Our bio-succinic acid production process has high yields and benefits from our proprietary, low-cost purification. We believe that at our manufacturing

facility under construction in Sarnia, Ontario, we will produce bio-succinic acid at a significantly reduced cost compared to the cost of other bio-based succinic acid processes and petroleum-derived succinic acid, according to our estimates of what the costs of the inputs will be at our facility in Sarnia. We have reduced our production costs by increasing the scale of our manufacturing process to realize economies of scale and by transitioning from our first generation *E. coli* bacteria to our second generation yeast organism licensed from Cargill.

Expand Product Platform to Additional Building Block Chemicals

We intend to expand our product portfolio to C6 building block chemicals including adipic acid, hexamethylene diamine (HMDA) and caprolactam. These products are used in the production of carpeting, rugs, textile laminations, garment linings, adhesives for shoe soles and resins used in the paper products industry. We expect to use our flexible technology platform to expand our product base, starting with bio-adipic acid, by leveraging our extensive experience developing, producing and marketing bio-succinic acid. We believe our

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technology platform, including an exclusive license to a biochemical pathway discovered by Celexion, an exclusive license to use Cargill s proprietary yeast and our innovative purification process will provide us with a competitive advantage.

Our Products

Our bio-based specialty chemicals can be used in multiple end-markets and applications and can serve as key building blocks for a wide variety of products used every day. The table below sets forth, for both C4 and C6 chemicals, the development stage of each of the products we currently sell or are in our pipeline and typical applications for these products. The dollar amounts set forth in the table represent management s estimates of the addressable market size for each of these products, which together represent a total addressable market in excess of $30 billion. Management s estimates of the addressable market sizes are based on industry reports from the last five years, pricing information in the industry reports and from ICIS pricing, publicly available information, and management s estimates of what portion of the total market size may be addressable through bio-succinic acid.

Market Opportunity

	C4 Platform			C6 Platform		
	Commercial	**Pre-Commercialization(1)**		**In Development(2)**		
	Bio-Succinic Acid	**1,4 BDO / THF / GBL**	**Polyesters made with Succinic Acid, including PBS and blends**	**Adipic Acid**	**Caprolactam**	**HMDA**
Applications	Plasticizers	Elastomers	Automotive interiors	Carpets	Carpets	Carpets
	Polyurethanes	Engineering plastics	Fibers and non-wovens	Engineering plastics	Films	Engineering plastics
	Personal care products	Shoe soles	Food packaging	Textiles and fibers	Textiles and fibers	Polyurethanes
	Resins and coatings	Spandex	Plastic bags			Textiles and fibers
	De-icing and coolant solutions	Solvents	Plastic cups			
	Fine chemicals		Organic composite boards			
	Lubricants					
	Food additives					

$4.0 billion	$4.3 billion	$2.0 billion	$4.9 billion	$10.7 billion	$4.7 billion

(1) Pre-Commercialization refers to products that have been produced at pilot scale and tested and for which the production process is in the process of being scaled up, with samples available for product testing and qualification.

(2) In Development refers to products that have not yet been produced at the laboratory scale in adequate quantities to undergo testing. These are early stage research projects and no samples are expected to be available for at least two years.

Bio-Succinic Acid

We chose to develop bio-succinic acid as our first product because it is a platform chemical that can be used in a broad range of markets, from high value niche applications such as personal care products and food additives, to large volume applications such as plasticizers, polyurethanes, resins and coatings. Bio-succinic acid is also unique in terms of the limited quantity of sugar that is needed for its production. In 2004, the DOE published a report on Top Value-Added Chemicals from Biomass, identifying the top opportunities for the production of chemicals from biomass. The study prioritized twelve chemicals, from a group of over 300 possible building blocks that could be most effectively manufactured from sugars. Bio-succinic acid was

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recognized as one of the renewable building block chemicals with the greatest technical feasibility and commercial potential.

We have identified three main market opportunities for our bio-succinic acid platform:

First, we intend to replace petroleum-based succinic acid in applications where it is currently in use, such as food additives and fine chemicals, where the natural aspect of bio-based succinic acid adds value to these applications and drives greater market demand.

Second, we intend to expand into new applications for succinic acid, such as phthalate-free plasticizers, silicone replacements and bioplastics such as PBS, using application development and technical service to demonstrate performance advantages as well as health and environmental benefits of products made with bio-succinic acid compared to the petrochemicals currently being used for these applications.

Third, we intend to convert bio-succinic acid to bio-based 1,4 BDO, THF and gamma-butyrolactone, or GBL, which are large volume, existing markets accessible to our drop-in bio-based alternatives. These chemical intermediates are used to produce polyesters, plastics, spandex and other products. We are also exploring the opportunity to cost-effectively convert 1,4 BDO to butadiene.

Historically, the high cost of producing succinic acid from petroleum feedstock limited its use to a narrow range of applications such as pharmaceuticals and food ingredients. As a result, based on 2011 estimates, the market for petroleum-based succinic acid is only approximately 51,000 metric tons per year, representing a market size of approximately $350 million. However, market research firms and consultants predicted that manufacturing bio-succinic acid will make succinic acid economically feasible for use in greater volumes across a spectrum of new applications. A study published in May 2012 by Nexant projects that the global market for succinic acid will be 424,000 metric tons in 2016, representing a compounded annual growth rate in excess of 50% between 2010 and 2016. A study published in August 2012 by Roland Berger, a consulting firm, projects that the succinic acid market will grow at a compounded annual growth rate of between 25% and 30% through 2020, when the global market size is expected to be between 500,000 and 700,000 metric tons. We have entered into supply agreements for the sale of approximately 145,000 metric tons of bio-succinic acid and its derivatives over the next five years. These supply agreements obligate our customers to exclusively fulfill 75% to 100% of their needs for bio-succinic acid from us, contingent on our ability to meet their price and other requirements; however, there are no penalties in the event they do not purchase or we do not supply them with bio-succinic acid in the projected purchase volumes indicated in the agreements.

We are currently focused on the following applications for bio-succinic acid, listed in descending size of the addressable markets:

Plasticizers. Plasticizers are organic esters that are primarily used to render polyvinyl chloride, or PVC, more flexible. PVC is widely used in multiple end-markets because it is low cost, durable and versatile. Bio-succinic acid esters can serve as replacements for the major phthalate-based plasticizers, which account for over 80% of the worldwide plasticizer market. There is increasing demand for renewable, phthalate-free plasticizers, particularly in sensitive applications such as children s toys and childcare articles. We entered

into a joint development agreement with Lanxess, a global leader in phthalate-free plasticizers, to develop a portfolio of bio-succinic-based phthalate-free plasticizers that can exceed the performance of general purpose plasticizers at competitive prices. Lanxess has begun to market a range of succinic acid based plasticizers, under the Uniplex brand. These succinic acid based plasticizers have been tested by Solvin, a division of Solvay and one of the world s leading producers of PVC, and they achieved positive results that collectively outperformed existing phthalate alternatives. While the global market for plasticizers exceeds $30 billion, we believe the addressable market for phthalate-free plasticizers is approximately $1.5 billion.

Polyurethanes. Succinic acid, and to a greater extent adipic acid, are currently used in polyester polyols, which are used to make polyurethanes. Polyurethanes are used in, among other things, soles

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for footwear, molded foams for automotive applications like car seats and arm rests, and non-foam applications such as coatings, adhesives and sealants. Bio-succinic acid can be used to replace adipic acid in this market and is currently the only renewable alternative to adipic acid for the production of polyurethanes. Suppliers of polyester polyols are actively looking for bio-based, cost-effective substitutes for adipic acid to improve the environmental profile and reduce the cost of their products. Some of the largest producers in Western Europe and North America have tested and validated our bio-succinic acid as a replacement for adipic acid in polyester polyols. Due to our first mover advantage, low cost of production and strong relationships with key customers, we believe we will be able to capture a significant portion of the market for bio-succinic acid in polyurethanes. We believe the addressable market for polyurethanes exceeds $1 billion.

Personal Care Products. Our initial focus in the personal care market has been the use of esters of bio-succinic acid as natural emollients and surfactants. Emollients are used in lotions, liquid soaps and cleansers to improve and moisturize skin, while surfactants are used in soaps, body washes and shampoos to allow easier spreading. We believe there is a significant opportunity for bio-based alternatives as consumers are increasingly demanding renewable products and ingredients in the personal care products they use including the replacement of silicone based ingredients in shampoos and other products. We believe the addressable market for succinic acid and succinate esters in the personal care industry is approximately $500 million.

Resins and Coatings. Bio-succinic acid can be used to replace adipic acid in polyester coating resins, powder coatings, unsaturated polyester resins, or UPR, and polyester polyols used in urethane surface coatings. Bio-succinic acid can also replace, or be used in conjunction with phthalic anhydride in UPR and alkyd resins. Bio-succinic acid offers performance equivalent to petroleum-based raw materials, as well as environmental advantages and cost-effectiveness. We believe the addressable market for resins and coatings exceeds $500 million.

Food Additives. Succinic acid is currently used for its multiple functions in food applications; as an acidulant, to increase the tartness or acidity of food, as a pH regulator for food ingredients, and as a flavoring agent. The unique umami flavor of succinic acid gives a salty, soy-like taste to food and is used in the production of soy sauce, miso, sake and synthetic liquors in Asia. Outside of Asia, succinic acid is primarily used in the baking industry. Succinic acid can also be used to replace malic acid, which provides a bitter salty taste similar to succinic acid, and adipic acid that is used as a flavor in fruit drinks and as a gelling aid for gelatin desserts. Initially, we are targeting existing succinic acid applications, but we believe our bio-succinic acid will rapidly expand succinic acid s portion of the overall flavors and food ingredients market as a natural alternative. We believe the addressable market for food additives is approximately $200 million.

Lubricants. Adipate esters are widely used in the lubricants market as base oils or as additives to form industrial lubricants and metal-working fluids. Bio-succinic acid is capable of replacing adipate esters and producing sustainable succinate esters that meet the demand for more environmentally friendly, non-toxic lubricants. We are working with third parties to assess our bio-succinate esters and accelerate market penetration. To date, our bio-succinate esters have performed well in product testing, showing improved flowability in cold temperatures and better prevention of oxidation, rust and corrosion. We believe the

addressable market for lubricants exceeds $100 million.

Fine Chemicals. Succinic acid is used today in a variety of high value added applications including dyes, inks, and toners. Succinic acid is also used in pharmaceutical applications. Derivatives of succinic acid such as succinimides can provide multiple functions in pharma applications, such as a pH buffer, an antibacterial or chelating agent, a coatings/sizing agent, or as a stabilizer for other ingredients. We believe the addressable market for fine chemical applications exceeds $100 million.

De-icing Solutions. Chlorides are the most commonly used de-icer for roadways. Potassium salts are typical non-chloride de-icers used for roadways as well as airport runways and other surfaces. We have developed a patented bio-succinic acid-based de-icer formulation for use on airport runways. Our

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bio-based product is significantly less corrosive than potassium acetate and potassium formate. We are also developing bio-succinic acid based products as wetting agents for chlorides in the larger roadway market, which can reduce the corrosiveness of the chlorides applied. We believe the addressable market for de-icing solutions exceeds $100 million.

Other Markets. Other applications of bio-succinic acid that are currently being developed and tested by potential customers and partners include anti-freeze solutions, coolants solvents, water treatment chemicals, effervescence agents such as laundry tablets and bath salts, artificial leather products and foams made with recycled polyethylene terephthalate (PET).

Our Product Pipeline

Derivatives of Bio-Succinic Acid

Succinic acid can be used to produce 1,4 BDO, THF and GBL. Succinic acid is also a monomer used to produce certain polyesters, including PBS. We are actively targeting these derivatives of bio-succinic acid, which offer large existing drop-in markets to broaden our addressable market and maximize the value of our technology.

1,4 Butanediol (1,4 BDO)

The major uses of 1,4 BDO are in the production of THF and polybutylene terephthalate, or PBT. THF is used to produce spandex fibers and other performance polymers, resins, solvents and printing inks for plastics. PBT is an engineering-grade thermoplastic that combines excellent mechanical and electrical properties with robust chemical resistance. The automotive and electronics industries heavily rely on PBT to produce connectors, insulators, wheel covers, gearshift knobs and reinforcing beams. We believe there is also growing demand in the automotive industry to produce PBT and blends that are partially bio-based to enable automobile manufacturers to meet their sustainability goals. There is also growing demand in the apparel industry for renewable, bio-based spandex. In 2010, we licensed DuPont s hydrogenation catalyst technology to make bio-based 1,4 BDO and bio-THF from our bio-succinic acid. We have been working with several third parties to validate the technology performance. We believe the addressable market for 1,4 BDO and THF exceeds $4.3 billion.

Gamma-Butyrolactone (GBL)

The hydrogenation catalyst technology we license from DuPont can also convert our bio-succinic acid into bio-based GBL. GBL is used to produce a number of value added specialty chemicals, including 2-pyrrolidone, N-methyl pyrrolidone and N-vinyl pyrrolidone. Pyrrolidones are generally produced from the reaction of GBL with amines. GBL and the pyrrolidones have wide use as solvents in applications from extraction solvents in petroleum processing to surface coatings. These materials are also intermediates used in the manufacture of pharmaceuticals, fine chemicals and agrochemicals. Poly-vinyl pyrrolidone, or PVP, polymers are used in pharmaceuticals, food, agrochemicals, cosmetics and personal care and detergent applications. We believe the addressable market for GBL is approximately $900 million and the pyrrolidones market is approximately $1 billion.

Succinic Acid Based Polyesters

Succinic acid can be reacted with different alcohols to produce polyesters. Polybutylene succinate, or PBS, is one such polyester. PBS is a biodegradable polymer made by reacting succinic acid with 1,4 BDO. The market for this biopolymer is currently limited by capacity and price, and the fact that it has traditionally been made with petroleum-derived succinic acid and 1,4 BDO. Applications range from single use in food service ware, including

cutlery, cups and lids, agricultural mulching film and compostable bags. Our bio-succinic acid enables PBS to be lower cost and partially renewable, and upon commercialization, we expect our bio-based 1,4 BDO will enable PBS to be 100% bio-based. We believe that this will drive PBS market growth beyond current applications to include paper coating, food packaging, fibers and non-wovens, and durable applications including

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automotive interiors, consumer goods and household appliances. We are the exclusive supplier of bio-succinic acid to Mitsubishi Chemical, which they use to produce partially bio-based PBS.

PBS can be used in combination with other biopolymers such as PLA, PHA and poly(3-hydroxybutyrate-co-3-hydroxyvalerate), or PHBV, and with petrochemical polymers such as polypropylene, polystyrene and polycarbonate. These combinations, known as blends, combine the properties of the polymers that are being mixed and can lead to specific properties and performance that are being sought by customers. PBS composites are compounds in which PBS is filled with fibers (such as natural fibers, glass fibers or carbon fibers) or fillers (such as wood flour or starch). Blends and composites can alter properties such as stiffness, mechanical resistance and density, and lead to more cost-effective solutions. Potential applications include automotive interiors, non-wovens (such as disposal hygiene products), construction materials, consumer goods and appliances. We believe the potential addressable market for succinic acid based polyesters, including PBS, along with polyester and composites is approximately $2 billion.

C6 Building Block Chemicals

We expect to use our flexible technology platform, including our partnership with Celexion and our exclusive rights to the Cargill yeast, to expand our product base to C6 building block chemicals, starting with bio-adipic acid, by leveraging our extensive experience developing, producing and marketing bio-succinic acid. We also plan to produce bio-based caprolactam, bio-based hexamethylenediamine, bio-based hexanediol and bio-based caprolactone.

Adipic Acid

Adipic acid is primarily used in the production of Nylon 6,6 fibers, plastics and resins. Nylon fibers are used in carpeting and rugs, nylon plastics are used in molding and extrusion applications and nylon resins are used mainly for injection molding in automotive and electrical applications, as well as for hardware, appliance and machine parts. We believe the addressable market for adipic acid exceeds $4.9 billion.

Caprolactam

Caprolactam is an intermediate used in the production of Nylon 6, a major engineering plastic. Nylon 6 finds significant use in film and wire and cable insulation, as well as in automotive applications like intake manifolds, previously made with aluminum ingots, replaced by plastics such as Nylon 6 in order to reduce weight and obtain flexibility of design. We believe the addressable market for caprolactam is approximately $10.7 billion.

Hexamethylenediamine (HMDA)

Our C6 Platform also offers a proprietary route to bio-HMDA, which is an intermediate used to produce Nylon 6,6. Nylon 6,6 polymer is principally converted into fibers, with the remainder going into Nylon 6,6 plastics used in molding and extrusion applications, primarily in automotive applications such as exterior body components, under-the-hood components, and some mechanical components. Other Nylon 6,6 resin applications include electronics, film and extrusion coatings. A major use of Nylon fibers is in carpeting and rugs. We believe the addressable market for HMDA exceeds $4.7 billion.

Our Commercial Strategy and Partnerships

Existing Markets for Succinic Acid

For the past five years we have been sampling and qualifying our bio-succinic acid among existing purchasers of succinic acid. Our initial focus was to identify customers that valued natural, bio-based succinic

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acid, and to sign them to long-term supply agreements. The figure below illustrates the existing markets and applications we have targeted with this product. The use of succinic acid in these markets and applications is already well-established.

We sold bio-succinic acid to 37, 19 and 19 customers in 2013, 2012 and 2011, respectively. During the year ended December 31, 2013, 64% our sales were to International Flavor and Fragrances, Inc, or IFF, and Brenntag AG, or Brenntag. During the year ended December 31, 2012, 63% of our sales were to IFF and Mitsubishi Chemical Corporation, or Mitsubishi Chemical.

Emerging Markets for Bio-Succinic Acid

Beyond the established markets for succinic acid, we have been working with third parties in a number of applications to expand the use of bio-succinic acid. These partnerships are currently immaterial to our financial results and many of these partnerships are in the early stages in most cases pursuant to non-binding letters of intent so we can provide no assurances as to the timing or amount of commercial sales that may result from these partnerships, if any. We have and intend to continue to utilize collaborations in an effort to secure development expertise, intellectual property, market access and commercialization capabilities, in an effort to establish barriers to entry for our competitors and accelerate market uptake of our bio-succinic acid. The figure below illustrates the emerging markets for bio-succinic acid that we have targeted. We believe our collaboration

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strategy for these markets provides us with a cost-effective approach to expanding our addressable markets while capitalizing on our first-mover advantage for bio-based alternatives.

Bio-Succinic Acid Based Esters

Phthalate-Free Plasticizers. Plasticizers are softeners that are primarily used in PVC and other plastics to make these materials more flexible. Most plasticizers are phthalate-based, and phthalates have been identified as a possible health risk. We have partnered with a leader in phthalate-free plasticizers and have jointly developed bio-succinic acid-based plasticizers that are both renewable and phthalate-free. We have developed a portfolio of succinic acid based plasticizers, which our partner is now sampling to the marketplace and actively promoting. We have also been working with a leading producer of PVC, which has tested our succinic acid based plasticizers and found them to collectively outperform existing phthalate alternatives.

Silicone Replacements. Silicone replacements are used across all segments of the personal care market, including skin care, hair care (shampoos), antiperspirants and deodorants, as well as color cosmetics. In the past, attempts by third parties to develop silicon replacements have generally resulted in the need to compromise performance. We have been collaborating with a specialty ingredients company and have jointly developed bio-succinic acid based esters that are effective silicone replacements without compromising performance. We are jointly marketing these natural silicone replacements with our partner, which has begun to commercialize a range of bio-based silicone replacements to the personal care industry.

Bio-Based Lubricants. We have been collaborating with a manufacturer of lubricant formulations to develop formulations containing bio-based succinate esters to be used as a substitute for conventional petroleum-based lubricants. Pursuant to this collaboration, we are developing a range of succinic acid based esters that are renewable and testing a range of esters for lubricant applications. The lubricant manufacturer is currently seeking

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to complete the development and testing of these formulations and we will jointly own the intellectual property rights related to the formulations and we expect to jointly commercialize successful formulations.

Bio-Succinic Acid Based Bioplastics

Bio-Based PBS/PLA Resins for Food Service Applications. We have partnered with a leading producer of polylactic acid (PLA), a biodegradable polyester. We have been jointly developing and bringing to market a new family of bio-based compounded PBS/PLA resins, which are initially designed for food service applications.

Bio-Based PBS for the Automotive Industry. We have been collaborating for several years with a leader in automotive interiors. The goal of the collaboration was to develop succinic acid based polyesters that could be combined with natural fibers and other proprietary ingredients into lightweight composites that could be used to make injected molded parts for automobile interiors. The automotive parts company intends to commercialize this technology and has established a partnership with Mitsubishi Chemical, whereby we will supply bio-succinic to Mitsubishi Chemical and the automotive parts company will source PBS from Mitsubishi Chemical for the subsequent manufacture of its proprietary composites.

Organic Composite Boards. We have been collaborating with a sustainable construction products designer and manufacturer to incorporate succinic acid polyesters into organic composite boards. These boards could replace medium density fiberboard, offering superior strength without formaldehyde. We have signed an exclusive supply agreement whereby we supply the composite board company with succinic acid based polyester, which we source from Mitsubishi Chemical.

Bio-Succinic Acid Based Salts

De-icers. We have been working with a company engaged in the development and marketing of chemical solutions, to develop an innovative bio-based airport runway de-icer, which we expect will be commercialized through our collaborator s existing marketing channels. We have also entered into a collaborative arrangement with a company engaged in the development, production and sale of deicer formulations, to develop formulations based on our proprietary succinate salt compositions to be used as a bio-based, non-toxic and biodegradable deicers for roadway, consumer and windshield washer applications. We will supply the bio-succinic acid and jointly own with our partner the intellectual property rights related to the formulations. We intend to work together to commercialize successful formulations.

Heat Transfer Fluids. We are collaborating with a leading manufacturer and distributor of oenological products, to develop a formulation based on succinate salts to be used as a heat transfer fluid in the production of wines. Our collaborator is completing the development and testing of such formulation based on the succinate salts, and, if the development of the formulation is successful and our collaborator commercializes the formulation, we expect to enter into a supply agreement with our collaborator for a five year period governing the sales of bio-based succinic acid or the salts. We will also jointly own the intellectual property rights related to the further development made on these salts.

Other Succinic Acid Based Polyesters. In addition to our work on PBS, we have explored succinic acid in combination with other alcohols and monomers. We are evaluating the performance of these polymers in broad applications such as automotive, adhesives and packaging. These materials are complimentary to PBS and we believe the addressable market for all succinic acid based polyesters, blends and composites, is approximately $2 billion.

Existing Markets for Derivatives of Bio-Succinic Acid

In an effort to expand the addressable markets for our bio-succinic acid, we secured catalyst technology from DuPont in 2010 that allows us to convert our bio-succinic acid into drop-in 1,4 BDO, THF and GBL, which together represent existing chemical markets with annual sales in excess of $4.3 billion. We subsequently established an exclusive partnership with Evonik, a global leader in catalyst development, to optimize the

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DuPont catalysts and further improve their performance and economics. Since then, we have established several relationships with the goal to commercialize value-added derivatives of 1,4 BDO, THF and GBL. The figure below illustrates value-added derivatives we have targeted.

Bio-Based 1,4 BDO

Spandex. We have established a collaboration with a global leader in the manufacture and distribution of spandex fibers, and our collaborator has tested our bio-based 1,4 BDO in the production of bio-spandex. We are currently assessing opportunities for joint production of bio-based 1,4 BDO, from which our collaborator would off-take a portion of the BDO produced for its bio-spandex needs.

Polyesters including PBT. We have been collaborating with several manufacturers of PBT, a heat resistant polymer used widely in automotive and electronic applications. We expect to sell our bio-based 1,4 BDO to these companies for the subsequent manufacture of bio-based polyesters.

Butadiene. Butadiene is used in the production of synthetic rubber and we estimate that the market for butadiene is approximately $14.5 billion. We are collaborating with a leading manufacturer of synthetic rubbers to explore a technology that could produce butadiene using our integrated technology platform (sugar to succinic acid to 1,4 BDO to butadiene). If the results of our feasibility study to confirm the economic and technical feasibility of this approach, we expect to enter into an agreement with this leader in synthetic rubber for the development and scale-up of an integrated butadiene technology.

N-Vinyl-Pyrrolidone (NVP)

NVP is used in the production of specialty polymers. We have established a collaboration with a specialty chemicals company to develop a new technology that would allow the production of a bio-based NVP from our bio-succinic acid. Our collaborator has identified a large addressable market for NVP in oil and gas drilling, using proprietary technology. The collaboration involves a three-phased development program with the goal of constructing a large-scale plant to produce NVP products using jointly developed NVP technology.

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Diaminobutane (DAB)

1,4 Diaminobutane, or DAB, is an intermediate used in the production of Nylon 4,6 and other high performance polyamides. These materials have a higher crystallinity and temperature performance than Nylon 6,6 and can be injection molded and extruded into fibers, tubes, and hoses. They are used in components for computers, mobile phones and personal electronics as well as in electrical applications such as connectors, circuit breaker housings, micro-switches and electric motor parts. We are in discussion with several potential partners that are producers of high performance polyamides. We believe the addressable market for DAB is approximately $500 million.

Our Technology

Our proprietary technology platform combines commercial scale industrial biotechnology and chemical catalysis to convert renewable feedstocks into chemicals that are cost-competitive replacements for petroleum-derived chemicals. We are developing three distinct technologies:

- the production of succinic acid through fermentation;
- the conversion of succinic acid into 1,4 BDO, THF and GBL by catalyst assisted hydrogenation reaction; and
- the production of adipic acid and other C6 chemical intermediates through fermentation and purification.

Succinic Acid Production

Our process is based on a fermentation of sugar using a proprietary yeast organism to produce bio-succinic acid. Following separation, purification, and polishing steps, bio-succinic acid, in its finished form, is a white crystal that physically resembles table salt. Two ways to produce bio-succinic acid through fermentation are using a bacteria, such as *E. coli*, or using yeast. Our process currently uses *E. coli,* however, we are in the process of transitioning to using our yeast. We have been using a proprietary *E. coli* bacteria that is under exclusive license from entities funded by the DOE. From 2005 to 2010, we scaled up our proprietary *E. coli* technology in a series of steps, from a 1,000 liter fermenter in 2005, moving to a 10,000 liter fermenter in 2007, and an 80,000 liter fermenter in 2008. Since 2010, we have been producing bio-succinic acid in a 350,000 liter fermenter.

One disadvantage of using bacteria like *E. coli*, is that bacteria produces succinic acid in a salt form as opposed to an acid form. This has two negative consequences: (1) it requires energy to acidify the succinic acid; and (2) it generally leads to additional processing steps, which in turn lead to higher capital and operating costs. Another disadvantage of bacteria relative to yeast, is the risk of contamination that can significantly reduce fermentation performance. *E. coli* is also limited in terms of fermenter size relative to yeast due to sensitivity to pH, agitation, process disruption and contamination.

Given the limitations of *E. coli* described above, in 2010 we signed a license with Cargill granting us exclusive rights to their yeast platform for the production of bio-succinic acid that could offer lower capital costs and lower operating costs. Cargill has a proprietary yeast host that is very robust and capable of thriving in harsh fermentation conditions, including high tolerance to organic acids such as succinic acid, good tolerance to low pH, physical robustness to heat, agitation and processing, high glycolytic rates and the ability to grow in a simple medium with inexpensive nutrients.

Cargill has a patent portfolio to protect the yeast platform.

We worked with Cargill for over three years to develop our yeast and reached the final development milestone in the fall of 2013. Working with Cargill, we sequentially scaled up our yeast at the 20 liter, 600 liter, 2,000 liter and 180,000 liter scale, and we have seen the same performance (measured as succinic acid production over time) for our yeast at each successive size of fermenter. We have also validated the production process we plan to run in Sarnia, Ontario both at small-scale and at the large-scale demonstration facility in

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Pomacle, France. We have seen that the succinic acid we produce with our yeast offers improved purity compared to succinic acid produced using our *E. coli* bacteria, with fewer impurities, including reduced levels of other organic acids.

The figure below summarizes the performance of a production strain of our *E. coli* bacteria, an earlier development strain of our yeast, and a production strain of our yeast that we are developing for use at our facility in Sarnia, Ontario. The figure also highlights the improved performance of yeast generally relative to *E. coli* bacteria.

The development strain of our yeast was engineered and tested at small scale in the fall of 2012, while the production strain of our yeast was engineered and tested at small scale in early 2013. Both strains were tested in the large scale demonstration facility in Pomacle, France in the first quarter of 2013. The dotted line in the graphic below indicates the succinic acid concentration that was originally targeted for the commercialization of our yeast.

In the fall of 2013 we announced that we had achieved the final milestone of our yeast joint development program with Cargill. Our yeast has met the performance targets that we had set out when we initially licensed the technology, and was ready for commercial use. The Sarnia plant under construction has been designed to operate with our yeast.

Our yeast produces succinic acid at a low pH, so that there is very little base added during the fermentation. This results in reduced energy consumption and a simplified purification process. Yeast also gives us the ability to use larger, less complex fermenters relative to *E. coli*, leading to significantly lower capital intensity. Our Sarnia plant has been designed to operate the yeast. We are continuing to make improvements to our yeast to further improve its performance and reduce the cost of production and the capital intensity of future plants.

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1,4-BDO / THF / GBL Production

We utilize catalyst technology licensed from DuPont to transform our bio-succinic acid into bio-based 1,4 BDO, bio-THF and bio-GBL. The process involves passing bio-succinic acid and hydrogen gas into a fixed bed reactor over a heterogeneous catalyst, converting the bio-succinic acid into a mixture of bio-based 1,4 BDO, bio-THF and GBL, followed by distillation to separate, purify and recover the bio-based 1,4 BDO, bio-THF and bio-GBL. The relative concentrations of these three products can be modified by adjusting the reaction conditions.

We have partnered with Evonik, a world leader in catalyst manufacturing, to scale up the catalyst compositions under license from DuPont using bio-succinic acid as a starting material. Evonik is assisting us in the optimization of the catalyst and its manufacturing scale-up. It is important for catalyst production to be scaled-up in parallel to the scale-up of the 1,4 BDO process, to ensure that adequate catalyst is available at an acceptable cost. In the spring of 2012, we produced several tons of 1,4 BDO and THF at a toll manufacturing facility in Germany, using bio-succinic acid produced in our French demonstration plant and a catalyst produced by Evonik. The bio-based 1,4 BDO we produced was sent to over 20 potential customers. These companies found the purity to be equivalent to petroleum derived 1,4 BDO and they were able to successfully produce their products (PBT, polyurethanes) with our bio-based 1,4 BDO. Our goal is to have a 4,000 ton per year capacity toll manufacturing plant operational in late 2015 and we expect Vinmar to purchase 100% of this production, as pursuant to the terms of the take-or pay agreement.

Adipic Acid and Other C6 Intermediates

We have licensed worldwide, exclusive rights to a metabolic pathway that transforms sugar into any one of a family of value-added products, including adipic acid, caprolactam, HMDA, caprolactone and hexanediol. The patents covering this pathway have been issued in the United States and are pending in a number of other jurisdictions. We believe this pathway has the advantage of offering a good yield on sugar, relative to alternative routes to these products, and having several products that can be derived from a common pathway.

We are currently focused on the development of adipic acid, which allows us to leverage our experience in producing and scaling up succinic acid, including our experience with our yeast. We have secured an exclusive, worldwide license from Cargill to use their proprietary low pH yeast platform to produce adipic acid.

Technology Partnerships

We have developed our succinic acid, BDO/THF/GBL and C6 platforms through open innovation using partnerships and licenses to access the best available technologies, facilities and know-how. We have complemented these third party contributions with in-house development efforts, integrating the whole into competitive platforms. The use of open innovation has reduced the capital and operating costs of development and accelerated the development efforts. This approach to technology development contributed to our winning the 2011 ICIS Innovation Award, which recognized our use of open innovation to develop our succinic acid platform. Our principal technology partnerships are summarized below.

ARD

In September 2010, we entered into two agreements with Agro-Industrie Recherches et Développements, or ARD, to cover a two-part consecutive plan for our exclusive use of the large-scale demonstration facility in Pomacle, France. Under the first agreement we developed a work plan with ARD to improve the manufacturing efficiency of the plant, improve the purity and quality of the product, meet certain target usage factors and implement quality control procedures. We compensated ARD for labor costs, the full cost of producing successful batches of bio-succinic acid

and the partial cost of lost batches. Once these objectives were met, we entered into a toll manufacturing agreement pursuant to which we retained ARD to produce succinic acid in this facility exclusively. We compensate ARD per metric ton of product, a price that is a calculated by multiplying

the cost of raw materials and utilities by agreed quantities consumed per metric ton of succinic acid produced. We also pay labor fees and half of any additional capital investments and equipment leasing. We exercised our options to renew the toll manufacturing agreement for three successive six-month periods ending December 31, 2014 for a renewal fee. Pursuant to the renewal terms, we have secured 60% of the capacity at the large-scale demonstration facility in Pomacle, France and must pay, in addition to the variable and labor costs that we have been paying to date, a portion of the annual depreciation of the plant. We will cease to have access to the toll manufacturing facility on January 1, 2015 and our objective is to build up inventory levels through 2014 so that we can manage the transition from the French toll production to manufacturing in our Sarnia facility under construction.

Cargill

In April 2010, we entered into a commercial license agreement with Cargill Inc., or Cargill, pursuant to which Cargill granted to us an exclusive, worldwide, royalty bearing license, with a limited right to sub-license, to use certain patents that cover our yeast strain that we expected would eventually replace the *E. coli* bacteria currently used in our fermentation process. We agreed to pay Cargill a royalty based on net sales of our products, but in no event less than a minimum annual royalty payment if we wish to maintain our exclusive license. If royalties based on net sales are below the minimum annual royalty payment we may elect to pay the difference. If we elect not to pay the difference in any one year, Cargill may transform the exclusive license granted to us under the agreement to a non-exclusive, worldwide, royalty-free license. This is a long-term agreement that renews automatically, unless previously terminated.

Concurrently with the commercial license agreement, we entered into a development agreement with Cargill for a term of four years. Under the development agreement, Cargill had further developed our yeast for use in producing bio-succinic acid. We made an initial payment to Cargill and agreed to pay Cargill certain fixed amounts per year for each full-time equivalent person to perform under the agreement in accordance with a work plan. In addition, we had agreed to make certain payments to Cargill upon reaching various milestones. The first milestone was a proof of concept milestone that was reached in May 2011. The second milestone related to a performance target and was met in the second quarter of 2012. The final milestone related to completion of our yeast s development was achieved in the third quarter of 2013. The results stemming from the development work under the agreement are licensed to us pursuant to the commercial license agreement. To the extent Cargill exits the development agreement, we believe we have the rights necessary to perform the work ourselves. We also have an option under the development and license agreements to further develop our yeast so that it can consume ligno-cellulosic, non-food feedstocks.

In May 2012, we secured an exclusive, worldwide, royalty-bearing license from Cargill to use certain patents that cover Cargill s yeast for the production of adipic acid. In addition to the license, we were granted the option to further develop Cargill s yeast so that it can consume ligno-cellulosic and non-food feedstocks, as well as the option to secure rights to the yeast for the production of caprolactam, HMDA, caprolactone and hexanediol. We have begun a research and development program under which Cargill has provided assistance in metabolically engineering its yeast to produce adipic acid. This is an early stage research and development program and there is no assurance of its successful development, scale-up or commercialization.

Celexion

In September 2010, we entered into a technology license agreement with Celexion. Under the agreement, we have an exclusive, worldwide, royalty bearing license to develop, make, use or sell certain C6 derivatives, including adipic acid, hexamethylene diamine and hexanediol, under patent applications in the United States and certain foreign countries held by Celexion that describe metabolically engineered host cells for producing difunctional alkanes and methods for producing difunctional alkanes. Under the agreement, we are obligated to pay Celexion a low single digit

percentage royalty based on net sales of the products, or in circumstances in which we sublicense the technology, a royalty equal to a percentage of compensation received by us as a result of the sublicense. We are also obligated to make certain payments upon achieving various milestones under the

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agreement. The term of the agreement runs until the later of September 2025 or expiration of the last-to-expire licensed patents. This is an early stage research and development program and there is no assurance of its successful development, scale-up or commercialization. Further under the terms of the agreement, Celexion has been carrying out experimental work on our behalf relating to enzyme activity and selectivity in connection with the licensed patents in exchange for certain annual, milestone and royalty payments.

DuPont

In June 2010, we entered into a license agreement with DuPont under which DuPont granted us worldwide sub-licenses and licenses to catalyst technology to develop and commercialize the hydrogenation of our bio-succinic acid to produce bio-based 1,4 BDO and/or bio-THF. Under the agreement, we will own all right, title and interest to any improvements to the sub-licensed patents discovered or developed by us during the term of the agreement to the extent that such improvements are not incorporated in DuPont s technology. In consideration of these rights, we made an initial payment to DuPont and pay a low single-digit percentage royalty to DuPont based on a percentage of net sales of products manufactured at plants built and operated by us or plants in which we own a controlling interest, although no royalties are paid on sales of certain products to DuPont. A minimum amount of royalties must be paid to DuPont each year to maintain the non-exclusive rights granted to us in the agreement. Under the agreement, DuPont has the option to secure a portion of the bio-based 1,4 BDO and/or bio-THF we produce using DuPont s catalyst technology through an off-take agreement with our future manufacturing facilities.

Evonik

We are partnering with Evonik Industries AG, or Evonik, a world leader in catalyst manufacturing, to jointly develop improved and/or new catalysts to be used in the conversion of bio-succinic acid into 1,4 BDO, bio-THF and/or bio-GBL. We have also entered into arrangements with Evonik pursuant to which Evonik will supply us, on a long-term basis, with selected catalysts to be used in the conversion of bio-succinic acid into 1,4 BDO, bio-THF and/or bio-GBL.

National Research Council of Canada

We are partnering with the National Research Council of Canada, the Government of Canada s premier organization for research and development, and with the INRS, a Canadian university dedicated to fundamental and applied research, to develop an organism that can consume methanol for the production of bio-succinic acid. We began this relationship in November 2012 and expect to complete the project within three years.

NatureWorks (AmberWorks LLC)

In February 2012, we entered into a series of agreements with NatureWorks LLC to create AmberWorks LLC, a 50/50 joint venture formed for the purpose of developing and bringing to market a new family of bio- based compounded modified PBS/PLA, or mPBS, resins grades, initially designed for food service applications. Under the technology license agreement, we provided AmberWorks with a non-exclusive worldwide license to use certain mPBS/PLA compounding intellectual property owned by our wholly-owned subsidiary, Sinoven. In addition, under the technology license agreement NatureWorks provided AmberWorks with a non-exclusive worldwide license to use certain patents owned by or licensed to NatureWorks. Under the exclusive distribution agreement, NatureWorks was also granted the rights to exclusively market, promote and sell the products produced by the joint venture. Each of NatureWorks and Sinoven made equal initial cash contributions in order to finance the initial operations of AmberWorks.

UT-Battelle, LLC and UChicago Argonne, LLC

In July 2009, we entered into an exclusive commercial patent license agreement with UT-Battelle and UChicago Argonne, each of which are entities that manage and operate laboratories under contracts with the DOE. Under the agreement, we have an exclusive commercial license to patents that cover the *E. coli* microorganism that we use in our manufacturing process. The license is limited to use in the production of

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bio-succinic acid using the bacteria covered by the licensed patents, and is subject to certain government rights, as well as licenses that UT-Battelle and UChicago Argonne may grant outside our field of use and/or for non-commercial purposes. Under the agreement, we pay all fees, patent maintenance and filing costs. In addition we are obligated to pay running royalties calculated as a price per metric ton of bio-succinic acid sold, or if we sublicense the patents, a royalty equal to the greater of a price per metric ton of bio-succinic acid sold or a single-digit percentage of sublicensing revenues. We are obligated to pay a minimum annual royalty per accounting period to the extent that running royalties and sublicensing royalties do not exceed an agreed upon fixed amount. We also have limited sub-license rights. We also agree to invest in the development of technology and market for bio-succinic acid in accordance with a development and commercialization plan. Unless terminated sooner, the term of the agreement runs until the expiration of the last-to-expire licensed patents, which is 2024.

Intellectual Property

Our success depends in large part upon our ability to obtain and maintain protection for our proprietary technologies and to operate without infringing the intellectual property rights of others. We primarily protect our intellectual property in the United States, Europe and certain other jurisdictions through a combination of patents and patent applications on inventions, trademark protection on our product names and trade secret protection as we deem appropriate. We also seek to ensure a competitive position through several partnership, joint development and joint venture agreements.

We own or have rights in patents and patent applications directed to various aspects of our business. With regard to our fermentation process we have in-licensed rights to three U.S. patents and counterpart patents in Canada, Europe and other countries directed to our *E. coli* organism and to methods of producing succinic acid. The U.S. patents are scheduled to expire from 2015 to 2021 and patents that have issued outside the U.S. are scheduled to expire from 2016 to 2024. Our licensing agreement with Cargill gives us access to six existing patent families covering topics such as methods and materials for the production of organic products including organic acids using genetically-modified yeast species to fermentation process optimization. Patents resulting from these six patent families are scheduled to expire from 2019 to 2026. Our collaboration with Cargill has also generated three international patent applications licensed to us or owned by us that are directed to the production of succinic acid. Patents, if granted on these patent applications, would expire in 2031 and 2033.

With regard to the purification of bio-succinic acid and other dicarboxylic acids produced by fermentation, we own one U.S. patent, seven U.S. patent applications, and counterpart patent applications in Europe and other countries directed to processes for producing succinic acid, adipic acid, and other di-carboxylic acids, or their ammonium salt forms from fermentation broths. Our U.S. patent to this purification technology is scheduled to expire in 2031 and patents, if granted, from these applications could expire in 2031. For the conversion of bio-succinic acid to bio-based 1,4 BDO, we have in-licensed five U.S. patents from DuPont that are scheduled to expire from 2017 to 2022, and we own two U.S. patents, two U.S. patent applications, and counterpart patent applications in Europe, Canada, and in other countries directed to the conversion of bio-succinic acid to 1,4 BDO. Our two U.S. patents to the conversion of bio-succinic acid to bio-based 1,4 BDO are scheduled to expire in 2031 and patents, if granted, on our pending patent applications to this technology could expire in 2031. In addition, we own one international patent application, four U.S. patent applications, and counterpart patent applications in Europe, Canada, and in other countries directed to the conversion of bio-succinic acid to other compounds such as diaminobutane, succinic dinitrile, succinamide, and pyrrolidones. Patents, if granted on these applications, could expire in 2031. We also own or have rights in patents and patent applications directed to the use of succinic acid and succinic acid salts. For example, we own or have rights in U.S. patents, a U.S. patent application, and under certain circumstances, foreign counterparts, directed to deicing compositions, methods of deicing using such compositions, methods of producing a runway deicer composition, biodegradable antifreeze, and methods of cooling an engine with such an antifreeze. The U.S. patents are scheduled to

expire from 2020 to 2029, and the U.S. application, if granted as a patent, could expire in 2030.

We have filed for trademark protection in the United States, Canada, the European Union and certain other jurisdictions, for the mark BioAmber with and without our logo, and our tag line Chemistry Inspired by

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Nature in connection with succinic acid, succinic salts and derivatives, dicarboxylic acid, dicarboxylic salts and derivatives. We have also filed several trademarks for our C4 and C6 technology platform, including BIO-SA (bio-based succinic acid), BIO-AA (adipic acid), BIO-BDO (1,4-butanediol), mPBS and BIOmPBS (modified polybutylene succinate), BIOGBL and BIOTHF (gamma-butyrolactone and tetrahydrofuran).

BioAmber has also filed the BioAmber Inspired trademark for co-branding of products and applications.

We also protect our proprietary information through written agreements. Our employees, consultants, contractors, partners and other advisors are required to execute nondisclosure and assignment of invention agreements upon commencement of employment or engagement. In addition, we protect our proprietary information through written confidentiality agreements with outside parties who may be exposed to confidential information.

Our Feedstock Strategy

Our yeast can use a range of renewable feedstocks as a source of fermentable sugars including glucose (also called dextrose) from corn, wheat, tapioca and other starch sources, sucrose (also called sugar) from cane or beets, and ligno-cellulosic sugars containing significant quantities of xylose derived from agricultural and forestry waste. Given the small quantity of fermentable sugars that we require to produce bio-succinic acid, we have initially used commercially available 95% dextrose syrup, which we believe to be the most cost competitive source of fermentable sugars today. As ligno-cellulosic sugar technologies mature and become commercially available at competitive prices, our plan is to shift to non-food fermentable sugars.

At the demonstration plant in France, our source of fermentable sugars comes from the hydrolysis of starch obtained from a wheat wet mill located adjacent to the plant. At our planned facility under construction in Sarnia, Canada, we expect that the fermentable sugars will come from corn wet mills. 95% dextrose corn syrup is an intermediate product in the production of high fructose corn syrup and is readily available on the open market. We have not yet entered into long-term feedstock supply agreements given that our needs for our planned facility in Sarnia represent only a small fraction of the production capacity available in any of the several corn wet mills located near the planned facility.

We would require less than 0.4% of the 12.4 billion bushels of corn harvested in the United States in 2012 to produce $1.0 billion worth of bio-succinic acid, based on management estimates and historic petroleum-based succinic acid prices. We would require less than 0.5% of the 19.2 billion pounds of high fructose corn syrup produced in North America in 2012 to operate at full capacity our Sarnia facility under construction (30,000 tons per year). Given our modest demand for fermentable sugars, rapid growth in our production capacity would not likely have a material impact on the markets from which we plan to source. This is in sharp contrast to first-generation ethanol, which is a major consumer of corn.

While we do not have a near-term economic incentive to move to non-food fermentable sugars, we recognize the growing need to focus the food chain on human nutrition, and to use sustainable, non-food, sources of biomass to produce chemicals and materials. As such, we plan to move to non-food fermentable sugars when they become commercially available and economically viable. We will pursue three strategies to achieve this goal: (i) incorporate Cargill s proven technology into the succinic acid producing yeast, so that it can consume ligno-cellulosic sugars efficiently at low pH; (ii) actively screen ligno-cellulosic sugar technologies to determine which are best adapted to our technology (our yeast and purification process) and have the most competitive cost structure; and (iii) develop a next-generation organism that can consume methanol or methane as the source of carbon to produce succinic acid. This would allow us to use alternative feedstocks such as syngas.

Our Approach to Sustainability

We are committed to managing our economic, social, environmental and ethical performance through continued sustainable business practices. Bio-based chemicals as a foundational technology offer the potential to significantly reduce greenhouse gas emissions, energy use, and fossil fuel consumption by displacing chemicals

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derived from fossil resources. Environmental impact is measured by the life cycle analysis, or LCA, of the bio-based chemical production process. LCA results for bio-based chemicals and products have grown in importance in recent years as a distinct measure of impact relative to petrochemical production processes. Investors and corporate partners are interested in life cycle results as an evaluation of a conversion technology s environmental performance. Customers, including large global chemical and consumer companies are interested in LCA results as they strive to meet or exceed their sustainability targets, and meet growing consumer demand for greater transparency and more sustainable products.

Manufacturing Operations

Scale-Up History

From the late 1990s to 2005, our first generation *E. coli* organism was developed and optimized in the lab through a combination of molecular biology and fermentation development. This work was undertaken primarily at DOE sponsored labs (UT-Battelle and UChicago Argonne), the licensors of the *E. coli.* In parallel to this work, we worked on purification approaches in-house and through collaborations with Michigan State University and the Lulea University of Technology in Sweden.

In 2005, we began working with ARD on the progressive scale up of the *E. coli* technology, which involved running fermentations in increasingly larger vessels and testing and adapting the fermentation conditions and the purification process as needed to obtain the desired product purity and manufacturing costs. The process we use today in the ARD owned demonstration plant in France was scaled up in a series of progressive steps, starting with a 1,000 liter fermenter in 2006, moving to a 10,000 liter fermenter in 2007, and an 80,000 liter fermenter in 2008. We have operated 180,000 and 350,000 liter fermenters at the large-scale demonstration facility in Pomacle, France since January 2010. At the 350,000 liter scale, we believe we operate one of the largest bio-based manufacturing fermenters in the world and have been doing so for over four years, gaining valuable experience and data.

* graphic approximately to scale

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Our operating history of running large-scale batch fermentation and continuous purification has enabled us to:

- validate our process in terms of both cost-effectiveness and product quality;
- identify and implement process improvements at large scale;
- incorporate these process improvements into our engineering basic design package; and
- minimize scale-up risk for our future manufacturing facilities.

Our strategy is to build and operate additional manufacturing facilities that have economies of scale and are able to use multiple feedstocks to produce value-added products. Our proprietary technology platform allows us to maintain lower capital and operating expenses, given that:

- there are no byproducts, such as fertilizer and other salts, that are costly to handle, store, purify and dispose;
- our process is less energy-intensive than other bio-processing approaches;
- our fermentation operates at low pH and is feedstock-flexible; and
- our integrated process can make multiple products, including bio-based 1,4 BDO, THF and GBL.

We intend to select future facility locations strategically, based on proximity to feedstock and chemical manufacturing infrastructure.

Pomacle, France

We currently produce bio-succinic acid at a large-scale demonstration facility in Pomacle, France, which is owned by ARD and was built at a reported cost of 21.0 million. The facility is integrated into an existing bio-refinery that supplies the bio-succinic acid plant with glucose, carbon dioxide, steam, ammonia and process water. We have a toll manufacturing agreement with ARD for the use of the facility that expires in December 2014 and gives us 60% access to the plant. We also have the right to use the large-scale demonstration facility in Pomacle for research and development activities.

We currently sell directly to our customers and commercial partners as well as indirectly through Mitsui, our exclusive distributor in the Asia-Pacific region. Mitsui is assisting us in selling bio-succinic acid and pre-marketing bio-based 1,4 BDO. Mitsui is one of the world s largest general trading companies, with a broad presence in the global chemicals market. Mitsui provides know-how regarding shipping and logistics, warehousing, credit checks, freight insurance, and trade finance that facilitate sales in Asia, and brings additional credibility to our customers in Asia.

Sarnia, Ontario

Our planned facility under construction in Sarnia, Ontario is being built on land we own and is located within a bio-industrial park owned by Lanxess. The site is co-located in a large petrochemical hub with existing infrastructure that facilitates access to utilities and certain raw materials and finished product shipment, including steam, electricity, hydrogen, water treatment and carbon dioxide. The facility will ferment at approximately one million liter scale (representing an approximately three times scale up compared to the fermenter size in Pomacle, France), have initial capacity of approximately 30,000 metric tons of bio-succinic acid and is expected to be mechanically complete in late 2014 or early 2015, at which point we plan to commission and start-up the facility. We anticipate that this facility will ramp up to full capacity over a three year time frame.

In November 2011, we entered into a joint venture agreement with Mitsui to finance and build our planned facility in Sarnia, Ontario through BioAmber Sarnia, a joint venture 70% owned by us and 30% owned by Mitsui. The joint venture agreement also establishes the parties intent to build and operate an additional facility

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in the future. In connection with the joint venture, Mitsui has agreed to provide know-how regarding shipping and logistics, warehousing, credit checks, freight insurance, trade finance globally and will facilitate sales in Asia. We have licensed our technology to the joint venture, and we will provide application development and technical sales support, hire and train plant personnel.

We expect to retain full operational control of the planned facility currently under construction in Sarnia and are not restricted from developing other applications outside of the joint venture on the premises. The construction of our planned facility is expected to cost approximately $125.0 million and we expect the funding to come from available cash, a portion of the net proceeds of our initial public offering, equity contributions from Mitsui, government grants and loans. To date, we have secured a total of $45 million from five government programs in the form of interest-free loans, low interest loans and grants. The Sarnia plant could be subsequently expanded to produce another 20,000 metric tons of bio-succinic acid, or some other reasonably equivalent combined production capacity of bio-succinic acid and bio-based 1,4 BDO. Increasing the succinic acid capacity of this plant by 20,000 metric tons is expected to cost approximately $31.0 million, and could be partially financed by securing project financing or obtaining low-interest and/or interest-free loans and government grants.

(shaded area indicates location of our planned facility in Sarnia)

Government Grants and Loans Related to Sarnia Facility

BioAmber Sarnia, our joint venture entity with Mitsui that will build and operate the Sarnia plant, has received certain government grants and loans in connection with the construction of our planned facility. The grants and loans total CAD $45.0 million and are described below. BioAmber Sarnia is in the process of securing approximately CAD $20.0 million in additional loan commitment from a commercial consortium including Canadian Crown Corporations, subject to certain conditions.

On September 16, 2011, BioAmber Sarnia entered into a contribution agreement with the Federal Economic Development Agency for Southern Ontario, or FedDev, pursuant to which FedDev has agreed to make a

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repayable contribution of up to CAD $12.0 million to construct our planned facility in Sarnia, Ontario. The contribution is interest free and required repayment of principal from October 2013 to September 2018 in 60 monthly payments of CAD $0.2 million. On March 20, 2013, we agreed with FEDDEV to amend the repayment of principal from the period October 2013 to October 2018, to October 2014 to October 2018. The agreement contains a statement of work that requires BioAmber Sarnia to work towards reaching certain distinct project goals that relate to the physical construction of the facility and certain other objectives including addressing the growing global demand for bio-succinic acid and job-creation. A federal environment assessment was required as a condition of the loan. The final report was submitted to FedDev and approved in 2012. As of December 31, 2013, BioAmber Sarnia had received CAD $5.75 million.

On September 30, 2011, BioAmber Sarnia entered into a loan agreement with Minister of Economic Development and Trade, or MEDT, pursuant to which MEDT has agreed to make available to BioAmber Sarnia a secured non-revolving term loan in principal amount of CAD $15.0 million in connection with the construction of our planned facility in Sarnia, Ontario. The loan is interest free for the first five years if BioAmber Sarnia is successful in creating an average of 31 jobs, calculated on an annual basis. Thereafter, the loan bears interest at an annual rate of 3.98%, or if BioAmber Sarnia is not successful in reaching the job target for the first five years, an annual rate of 5.98%. The principal is required to be repaid in five annual equal installments from the sixth anniversary of the date of the disbursement of the loan. The loan is guaranteed by BioAmber Inc. and Mitsui & Co. (U.S.A.) and is secured by collateral including BioAmber Sarnia s present and future accounts, inventory, equipment and other property including the land purchased from Lanxess on which the facility will be located. The loan also contains terms that require BioAmber Sarnia to work towards reaching certain project milestones that range from selecting an engineering and construction firm and beginning construction on the site through to commissioning the plan and selling bio-succinic acid by March 31, 2015. On March 20, 2013, BioAmber Sarnia received CAD $929,000.

On November 29, 2011, BioAmber Sarnia entered into a contribution agreement with Sustainable Development Technology Canada, or SDTC, pursuant to which SDTC has agreed to grant BioAmber Sarnia up to CAD $7.5 million in connection with the construction of our planned facility in Sarnia, Ontario. The funds are payable in installments, the first CAD $1.9 million of which was paid upon execution of the agreement. All subsequent installments are contingent on meeting certain deliverables as defined in three milestones. The deliverable as defined under the first milestone which has already been met, included conducting site-specific engineering work and environmental assessments, and recruiting plant personnel.

SDTC advanced CAD $3.35 million (less a 10% holdback as provided in the contribution agreement) for purposes of the second milestone, expected to be met by December 31, 2014. Deliverables defined under the second milestone the procurement of equipment, continued plant personnel recruitment and the construction of our facility in Sarnia.

The third and final milestone, expected to be met by March 31, 2015, includes the commissioning and start-up of the facility, optimization of the downstream process, making modifications and adjustments to the process for quality control and other reasons, documenting the downstream process and achieving steady state operation at 95% of design capacity and 95% availability on a rolling twelve month basis at a maximum of 110% of projected cost.

On November 30, 2011, BioAmber Sarnia was issued a loan for CAD $0.5 million from the Sustainable Chemistry Alliance in connection with the construction of our planned facility in Sarnia, Ontario. The principal amount is repayable in 20 successive quarterly installments of CAD $25,000 each beginning upon the fourth anniversary of the funding. Interest are accrued at 5% per annum since October 1, 2013. Accrued interest will be payable upon the third anniversary of funding then quarterly thereafter. Under the debenture as amended, BioAmber Sarnia covenants to, among other things, complete construction of the facility by October 1, 2014. We are seeking a waiver to extend this timing.

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On March 10, 2014, BioAmber Sarnia entered into a repayable contribution agreement in the form of a non-interest bearing loan (the loan) with the Minister of Agriculture and Agri-Food of Canada in the amount of CAD$10 million for the AgriInnovation Program. The loan provides for progressive disbursements as eligible costs are incurred up to an amount of CAD $10 million, for building construction, installation of equipment and start-up and commissioning of the Sarnia facility. The loan is repayable in equal, monthly installments beginning March 31, 2016 through March 31, 2025. The loan agreement contains various legal and financial covenants ordinarily found in such government agency loan agreements.

In addition to the government grants and loans described above, we are in discussions with a commercial consortium including Canadian Crown Corporations for approximately CAD $20.0 million in additional interest-bearing loans, which would reduce our and Mitsui s capital contributions with respect to our planned facility in Sarnia.

Additional Planned Manufacturing Facilities

We have entered into an agreement with Mitsui that contemplates the potential construction and operation of an additional facility. We expect this facility to produce bio-based 1,4 BDO, THF and/or GBL, with the exact ratio of such end products being a function of the demand we secure. We plan to start up a bio-based 1,4 BDO toll manufacturing plant in the United States in late 2015, which we expect to have an annual production capacity of approximately 4,000 metric tons. Several companies have been identified that have the infrastructure, know-how and purification equipment needed to convert our bio-succinic acid to bio-based 1,4 BDO on a toll manufacturing basis. We plan to design and install a proprietary hydrogenation reactor at the selected toll manufacturer, provide catalyst produced by Evonik, and supply bio-succinic acid produced in Sarnia. We then plan to build a 100,000 ton per year BDO integrated facility that will produce bio-succinic acid and then further transform the bio-succinic acid into bio-based 1,4 BDO, and we have signed a 15 year take-or-pay agreement with Vinmar for 100% of the output of this anticipated plant. Vinmar also plans to take a 10% equity stake in the plant. Mitsui could also be an equity partner in the plant. Based on current estimates and assumptions, we expect this commercial scale manufacturing facility to have construction costs of approximately $350.0 million, and be mechanically complete in 2017. As part of the take-or-pay agreement, Vinmar has an option to secure 100% of the output from a second BDO plant that would be built in the future.

Research and Development

As of December 31, 2013, our research and development department activities funded 27 scientists and engineers that are employed by us. We also work with partners, including Cargill and Evonik, to accelerate time to market and leverage existing know-how and infrastructure. Our technology development was initially focused on capabilities in fermentation engineering, analytical chemistry and molecular biology. We have more recently expanded our focus to include catalysis, purification process development and application development for bio-succinic acid.

Our net research and development expenditures were approximately $16.7 million, $20.4 million and $16.6 million for the years ended December 31, 2011, December 31, 2012 and December 31, 2013 respectively.

Competition

We expect our advanced bio-based specialty chemicals to compete with petrochemical equivalents that are proven in the market and manufactured by established companies, such as Gadiv Petrochemical Industries Ltd., Kawasaki Kasei, DSM and numerous small Chinese producers including Anqing Hexing Chemical Co. Ltd, and Anhui Sunsing Chemicals Co., Ltd. In addition, our products will compete against other companies in the bio-based specialty chemical industry, both early stage companies, such as Genomatica, Inc. (for bio-based 1,4 BDO) and Myriant

Corporation (for bio-succinic acid), and established companies, such as Reverdia, a collaborative venture between DSM and Roquette Frères S.A. and Succinity, a collaborative venture between BASF and Purac (both for bio-succinic acid).

We believe that the primary competitive drivers include:

- price and production costs relative to both bio-based and petroleum-derived suppliers of our products;
- capital requirements and access to capital, particularly in relation to our bio-based competitors;

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feedstock and technology platform flexibility;

the ability to use yeast as opposed to a bacteria in the production of bio-succinic acid;

technology performance including overall yields and fermentation productivity relative to our bio-based competitors;

location and size of production facilities, which dictate raw material and utility prices and the economies of scale that can be achieved for capital expenditures, labor and maintenance;

drop-in and replacement capability for existing large markets;

the ability to rapidly scale-up production to large scale, produce meaningful volumes and offer customers reliable supply in qualified facilities;

the purity and quality of our products; and

the ability to refrain from being subject to price volatility and reliability of our feedstock supply.

We believe we compete favorably with respect to all of these companies. With our yeast and our simple purification process, we are confident that we will be a cost competitive producer of high quality bio-succinic acid both relative to our bio-based competitors and existing petroleum producers. In addition to our technology advantage, we believe the size of our planned Sarnia plant currently under construction should also provide a cost advantage in terms of depreciation and fixed costs, given that our bio-succinic competitors operate or plan to commission plants that will all be less than half our annual capacity, and in the case of DSM-Roquette and Purac-BASF, one third the size of Sarnia. The location of our plant will also provide us with lower cost sugars and energy than in Southern Europe, where the DSM-Roquette and Purac-BASF plants are located.

Our first-to-market leadership in bio-succinic acid provided us with a lead-time advantage that we leveraged to secure customer relationships, enter into contractual agreements and establish partnerships for new succinic acid applications and derivative products. However, our competitors include large chemical companies that are better capitalized, with larger research and development departments and budgets, and well-developed distribution systems and networks for their products. These companies have relationships with our potential customers and have sales and marketing programs in place to promote their products.

With respect to our bio-based 1,4 BDO/THF/GBL, we believe we can compete with petroleum derived processes. We believe that the least expensive way to produce petroleum-derived BDO is by using an n-butane feedstock. We calculate that our technology to produce bio-based 1,4 BDO will require approximately 30% less capital expenditures than the n-butane-based process and will have comparable plant gate costs (variable costs, fixed costs and depreciation). As we scale-up our processes and our variable costs decrease, we believe our bio-based 1,4 BDO will cost approximately 10% less than the n-butane-based process in the future. Given the competitive cost structure of our bio-succinic acid, which will serve as the starting material for the production of bio-based 1,4 BDO/THF/GBL in our

integrated production plants, we project that our full cost for bio-based 1,4 BDO will be situated in the bottom quartile of the cost stack for existing worldwide capacity.

We also believe that we will be cost competitive with other bio-based routes to 1,4 BDO due to the high yield on sugar that we gain from converting sugar to succinic acid. Our integrated process involves two steps: fermentation of sugar to produce succinic acid, followed by the catalytic conversion of succinic acid to 1,4 BDO, as opposed to a single step production that other companies, such as Genomatica achieve by directly fermenting sugar to 1,4 BDO. However, sugar is a significant component of variable cost in both processes, and the theoretical yield for the Genomatica one-step process requires roughly 50% more sugar than the theoretical yield of our two-step process. The term theoretical sugar yield with respect to these processes refers to the quantity of sugar obtained from the complete conversion of a feedstock in a chemical reaction under ideal conditions with perfect efficiency. Real-life processes inevitably incur processing losses and produce small quantities of by-products that reduce the overall yield on sugar, so that the actual yields are inferior to theoretical yields. Because there is approximately 24% weight loss during the conversion of bio-succinic acid to bio-based 1,4 BDO due to

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the production of water, the theoretical sugar yield for bio-based 1,4 BDO production is 85%, which is approximately 50% higher than the theoretical sugar yield for direct fermentation to 1,4 BDO.

We believe the cost competitiveness of converting succinic acid to BDO/THF/GBL is significantly reduced if the process is not integrated in a common production facility. If the succinic acid is produced and sold at arm s length to a third party for subsequent conversion to 1,4 BDO, with a selling price that recovers the depreciation costs and an acceptable return on capital employed, the cost of the resulting 1,4 BDO is significantly higher and the production cost of the BDO is in our view not competitive. We believe that we are currently the only bio-succinic acid producer with an integrated technology for making both bio-succinic acid and bio-based 1,4 BDO. We recognize however, that BASF is the world leader in 1,4 BDO production and as such, could have the ability to integrate its bio-succinic acid production in its Purac joint venture, with its existing 1,4 BDO production in the future.

Regulatory Overview

We are subject to various international, federal, state and local regulatory laws, rules and regulations, including those relating to pollutant discharges into the environment, the management of hazardous materials, the protection of endangered species and the health and safety of our employees. For example, in the United States, the Occupational Safety and Health Act and analogous state laws and regulations govern the protection of the health and safety of employees. The Clean Air Act and analogous state laws and regulations impose obligations related to emissions of air pollutants, including greenhouse gases. CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act) and analogous state laws and regulations govern the clean-up of hazardous substances. The Water Pollution Control Act, also known as the Clean Water Act, and analogous state laws and regulations govern discharges into waters. The TSCA and analogous state laws and regulations impose requirements on the production, importation, use and disposal of chemicals and genetically modified microorganisms.

In Canada, similar regulatory programs exist under the Canadian Environmental Protection Act (CEPA 1999). In particular, a regulatory program similar to TSCA requires that Environment Canada approve the manufacture of any chemical not already included on the Domestic Substances List (DSL). We have secured approval from Environment Canada for our use of *E. coli* and the manufacture of our bio-based succinic acid and the derivatives of succinic acid that we plan to commercialize. We also obtained the approval from Environment Canada with respect to the use of our yeast in 2013. If Environment Canada requires any of our future C6-based products, to undergo extensive testing, which we currently do not anticipate, securing approval to manufacture such products would potentially be subject to significant delays or costs. In the European Union, we are subject to a chemical regulatory program known as REACH (Registration, Evaluation, Authorization, and Restriction of Chemical Substances). Under REACH, we are required to register our products with the European Commission. The registration process requires the submission of information to demonstrate the safety of chemicals as used and could result in significant costs or delay the manufacture or sale of our products in the European Union.

In addition, we are or will be required to obtain, maintain or file various approvals, permits, licenses, registrations, certifications, intents to manufacture, environmental assessments and other requirements, such as air emission and water discharge permits, construction permits and boiler licenses. Such laws, regulations and permit conditions can result in substantial liabilities and the potential for permit revocations and plant shutdowns in the event we fail to comply with the applicable law, regulation or permit condition. The development of new processes, manufacture of new products using our processes, commercial sales of products produced using our processes, as well as geographic expansion, and in particular international expansion, will subject us and our industry partners to additional regulatory laws, rules and regulations.

The construction and operation of our production plants require obtaining permits and other approvals in various jurisdictions. For example, the production plant in Sarnia, Ontario, Canada required Certificates of Approval from the Ministry of Environment, an Environmental Assessment under the Canadian Environmental Assessment Act, approval of the organism under the Canadian Environmental Protection Act (CEPA 1999) and

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planning, construction, building, occupancy and fire permits from the City of Sarnia. Similar requirements are anticipated to apply in other countries where production plants are or may be planned. As a condition to granting the permits and other approvals, regulators could make demands that increase our partnerships construction and operating costs and result in the need to procure additional financing. Failure to obtain and comply with all applicable permits and other approvals could halt construction and subject us and our partners to future claims. We therefore cannot guarantee procurement or compliance with the terms of all permits and all other approvals needed to complete, and later continue to operate, our and our partners production plants. In addition to actual plant operations, liabilities could arise from investigation and clean-up of environmental contamination at our and our partners production plants. We and our partners may also be subject to third-party claims alleging property damage or personal injury due to the release of or exposure to hazardous substances.

In addition, new laws, new regulations, new interpretations of existing laws or regulations, future governmental enforcement of environmental laws or other developments could result in significant expenditures. For example, in 2009, the Environmental Protection Agency announced its Essential Principles for Reform of Chemicals Management Legislation and in April 2011, the Safe Chemicals Act of 2011 was introduced in Congress. This bill would amend TSCA to be more like REACH and require safety testing of all industrial chemicals and could result in the need to disclose confidential business information relating to chemical safety. We are monitoring this and other legislative and regulatory developments. Any failure by us or our industry partners to comply with applicable regulatory rules and regulations could harm our reputation as well as our business, financial condition and operating results. In addition, regulatory approvals, registrations, permits, licenses, certifications and other requirements may be denied or rescinded resulting in significant delays, additional costs and abandonment of certain planned activities or require us to engage in costly and time consuming efforts to remediate. Compliance with applicable regulatory rules and regulations can be costly and time consuming.

Employees

As of December 31, 2013, we had 54 full-time employees. Of these employees, 16 were engaged in research and development, 10 were engaged in sales and marketing, 14 were engaged in general and administrative activities and 14 were engaged in operations activities including engineering. 20 employees are based in Canada, 28 are based in the United States and the remaining six employees are located in Europe. We also employ other temporary staff across the organization to augment support for our employees. None of our employees are represented by a labor union. We have never experienced any employment-related stoppages and we consider our employee relations to be good.

Item 1A. Risk Factors

You should carefully consider the risks described below and the other information in this Annual Report on Form 10-K. Our business, prospects, financial condition, or operating results could be harmed by any of these risks, as well as other risks not currently known to us or that we currently consider immaterial. If any of such risks and uncertainties actually occurs, our business, financial condition or operating results could differ materially from the plans, projections and other forward-looking statements included in the section titled Management s Discussion and Analysis of Financial Condition and Results of Operations and elsewhere in this report and in our other public filings. The trading price of our common stock could decline due to any of these risks, and, as a result, you may lose all or part of your investment.

Risks Related to Our Business and Our Industry

We have a limited operating history, a history of losses, anticipate continuing to incur losses for a period of time, and may never achieve or sustain profitability.

We are a development stage company that has only been in existence since October 2008 and, therefore, we have a limited operating history upon which you can base your evaluation of our business. As a result, any assessments of our current business and predictions you make about our future success or viability may not be as

accurate as they could have been if we had a longer operating history. Since our inception, we have incurred substantial net losses, including net losses of $30.9 million for the year ended December 31, 2011, $39.5 million for the year ended December 31, 2012, and $33.8 million for the year ended December 31, 2013. We expect these losses to continue. As of December 31, 2013, we had an accumulated deficit of $115.0 million. We expect to continue to incur substantial costs and expenses related to the continued development and expansion of our business, including those related to the development, continuation and operation of our additional manufacturing facilities, research, testing and development of new products and the growth of our sales and marketing efforts. We will need to generate and sustain increased revenues in future periods in order to become profitable. We cannot assure you that we will ever achieve or sustain profitability on a quarterly or annual basis.

To achieve profitability, we need to execute our manufacturing expansion strategy, including the construction of our planned facility in Sarnia, Ontario.

We are currently building our first facility in cooperation with Mitsui in Sarnia, Ontario. We expect this facility to be mechanically complete in late 2014 or early 2015, at which time we plan to begin commissioning and start-up. We intend to build two additional facilities over the next three to four years. We have not yet constructed or operated a commercial-scale production facility, and our technology may not perform as expected when applied at the scale that we plan or we may encounter operational challenges for which we are unable to devise a workable solution. We can provide no assurance that our planned facility in Sarnia, Ontario will be completed on the schedule or within the budget that we intend, or at all. If the construction of our Sarnia facility takes longer than expected, or if we encounter unforeseen issues during construction, testing and operation, we will not be able to sell cost-competitive products within the timeline that we expect, or at all. We currently produce our products at a large-scale demonstration facility in France, which was constructed by ARD. We expect to terminate production at the French facility once we have completed construction of our Sarnia facility in 2014. Under our agreement with ARD, we have access to only 60% of the facility s capacity since June 30, 2013, which we estimate to be adequate to meet expected customer demand and inventory accumulation during the time period when we are transitioning to our planned Sarnia facility. To the extent customer demand is greater than expected or our transition takes longer than expected, we may not be able to meet the demands of our customers and our customer relationships and commercialization growth may suffer.

Even if we successfully fund, construct and design our planned facility in Sarnia, Ontario, there is no guarantee that this facility will produce at full capacity, and even if we do meet these goals, we may encounter operational challenges for which we are unable to devise a workable solution or which may result in additional costs. In addition, our technology may not perform as expected when applied at our planned scale and any resulting adjustments to our process may result in additional costs or otherwise adversely affect our business and results of operations. To date, we have entered into agreements that contemplate, but do not obligate, us to supply approximately 145,000 metric tons of bio-succinic acid, and we are actively seeking to enter into additional supply agreements. These supply agreements obligate our customers to exclusively fulfill their needs for bio-succinic acid from us, contingent on our ability to meet their price and other requirements, however there are no penalties in the event they do not purchase or we do not supply them with bio-succinic acid in the projected purchase volumes they have indicated in the agreements. Without increasing our production capacity by completing our Sarnia and other future facilities, we will not be able to produce sufficient amounts of bio-succinic acid to deliver the full amounts contemplated by these agreements and execute on our growth strategy.

The funding, construction and operation of our future facilities involve significant risks.

We have limited experience constructing a manufacturing facility of the type and size required to produce commercial quantities of chemicals, and doing so is a complex and lengthy undertaking that requires sophisticated, multi-disciplinary planning and precise execution. The funding, construction and operation of manufacturing facilities

are subject to a number of risks, any of which could prevent us from executing on our expansion strategy. In particular, the construction costs associated with future facilities may materially exceed budgeted amounts, which could adversely affect our results of operations and financial condition. We estimate the initial phase of the Sarnia, Ontario plant will cost approximately $125.0 million, and will be mechanically

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completed in 2014. However, we may suffer construction delays or cost overruns, which may be significant, as a result of a variety of factors, such as labor and material shortages, defects in materials and workmanship, adverse weather conditions, transportation constraints, construction change orders, site changes, labor issues and other unforeseen difficulties, any of which could delay or prevent the completion of our planned facilities. As a result, we may not be able to expand our production capacity and product portfolio as quickly as we planned. While our goal is to negotiate contracts with engineering, procurement and construction firms that minimize risk, any delays or cost overruns we encounter may result in the renegotiation of our construction contracts, which could increase our costs.

In the event that the initial phase of our planned facility in Sarnia, Ontario is not mechanically complete on or before December 31, 2014, we could be in default under our credit agreement with Hercules Technology Growth Capital and its affiliates and assignees or HTGC, which in absence of a waiver from HTGC, may require repayment of the borrowed amounts and have a material and adverse impact our ability to fund our manufacturing strategy.

In addition, the construction of our facilities may be subject to the receipt of approvals and permits from various regulatory agencies. Such agencies may not approve the projects in a timely manner or may impose restrictions or conditions on a production facility that could potentially prevent construction from proceeding, lengthen its expected completion schedule and/or increase its anticipated cost. If construction costs, or the costs of operating and maintaining our manufacturing facilities, are higher than we anticipate, we may be unable to achieve our expected investment return, which could adversely affect our business and results of operations.

We may also encounter new design and engineering or operational challenges as we seek to expand the range of organisms and feedstocks we use. Any design and engineering or operational issues at our future facilities may result in diminished production capacity, increased costs of operations or periods in which our facilities are non-operational, all of which could harm our business, financial condition and results of operations. We intend to obtain and maintain insurance to protect against some of the risks relating to the construction of new projects. However, such insurance may not be available or adequate to cover lost revenues or increased costs if we experience construction problems, cost overruns or delays. If we are unable to address these risks in a satisfactory and timely manner, we may not be able to implement our expansion strategy as planned or at all. In addition, in the event that our products are defective or have manufacturing failures, we may have to write off and incur other charges and expenses for products that fail to meet internal or external specifications. We also may have to write off work-in-process materials and incur other charges and expenses associated with contamination and impurities should they occur.

Our failure to comply with milestone covenants contained in certain of our agreements, including certain debt instruments, government grants and government loans, could result in events of default, and if not cured, would require their accelerated or immediate repayment, in which case our assets and cash flow may be insufficient to make such repayments or fund our manufacturing expansion strategy.

The terms of our debt instruments require us to comply with various milestone covenants related to the construction and start-up of our planned facility in Sarnia, Ontario. A breach of any of these covenants could result in an event of default under one or more of these debt instruments which, if not cured or waived, could give the holders of the defaulted indebtedness the right to terminate commitments to lend and cause all amounts outstanding with respect to the indebtedness to be due and payable immediately. In addition, we are party to certain agreements with governmental entities that provide grants and loans in connection with the construction of our planned Sarnia facility. If we fail to meet any of the milestones and project goals contained in these grant and loan agreements, we may not receive additional grant installments, may be forced to repay grants received or the repayment of the loans may be accelerated. If additional government grant amounts are withheld or if we are forced to repay amounts under our government loans, our assets and cash flow may be insufficient to make such repayments or fund our manufacturing expansion strategy.

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We have generated only limited sales of bio-succinic acid to date, are dependent on a limited number of customers and face challenges to developing our business.

To date, all our revenue has been derived from the sale of our bio-succinic acid through product and market development efforts related to our bio-succinic acid product, and we have not made sales of any other products. In order to generate sales of our bio-succinic acid and any future products, we must be able to reduce our production costs and produce sufficient quantities of our products, both of which are dependent on our ability to build commercial-scale manufacturing operations. If we are not successful in constructing and operating planned manufacturing facilities or otherwise increasing our manufacturing capacity, developing products that meet our customers specifications and further advancing our existing commercial arrangements with strategic partners, we will be unable to generate meaningful revenue from the sale of our products. In addition, we depend, and expect to continue to depend, on a limited number of customers for sales of our bio-succinic acid. During the year ended December 31, 2013, 64% our sales were to International Flavor and Fragrances, Inc, or IFF, and Brenntag. During the year ended December 31, 2012, 63% of our sales were to IFF and Mitsubishi Chemical. In the future, a small number of customers may continue to represent a significant portion of our total revenue in any given period. We cannot be certain that such customers will consistently purchase our products at any particular rate over any subsequent period. A loss of, or any credit issues related to, any of these customers could adversely affect our financial performance.

We may not obtain the additional financing we need in order to grow our business, develop or enhance our products or respond to competitive pressures.

We will need to raise additional funds in the future in order to grow our business. Any required additional financing may not be available on terms acceptable to us, or at all. Our ability to secure financing and the cost of raising such capital are dependent on numerous factors, including general economic and capital markets conditions, credit availability from lenders, investor confidence and the existence of regulatory and tax incentives that are conducive to raising capital. Current turmoil and uncertainty in the financial markets has caused banks and financial institutions to decrease the amount of capital available for lending and has significantly increased the risk premium of such borrowings. In addition, such turmoil and uncertainty has significantly limited the ability of companies to raise funds through the sale of equity or debt securities. If we are unable to raise additional funds, obtain capital on acceptable terms, secure government grants or co-sponsorships for some of our projects or take advantage of federal and state incentive programs to secure favorable financing, we may have to delay, modify or abandon some or all of our expansion strategies.

The amount of any indebtedness that we may raise in the future may be substantial, and we may be required to secure such indebtedness with our assets and may have substantial interest expenses. If we default on any future secured indebtedness, our lenders may foreclose on the facilities securing such indebtedness. The incurrence of indebtedness could require us to meet financial and operating covenants, which could place limits on our operations and ability to raise additional capital, decrease our liquidity and increase the amount of cash flow required to service our debt. If we experience construction problems, cost overruns or delays that adversely affect our ability to generate revenues, we may not be able to fund principal or interest payments under any debt that we may incur.

Based on our current operating plan, we anticipate that the net proceeds of our initial public offering, equity contributions from Mitsui, the loan from HTGC, a combination of government grants, interest-bearing and interest-free loans and our existing cash and cash equivalents, will be sufficient to enable us to maintain our currently planned operations, including the funding of the construction of our planned facility in Sarnia, Ontario. We have no additional committed external sources of funds. Additional financing may not be available when we need it or may not be available on terms that are favorable to us. In addition, we may seek additional capital due to favorable market conditions or strategic considerations, even if we believe we have sufficient funds for our current or future operating

plans. If adequate funds are not available to us on a timely basis, or at all, we may be required to halt construction or delay capital expenditures on our planned facility in Sarnia, Ontario, and reduce or delay operating expenses as deemed appropriate in order to conserve cash.

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Any effort to sell additional debt or equity securities may not be successful or may not raise sufficient funds to finance additional facilities. The issuance of additional equity securities could result in dilution to our stockholders and the newly-issued securities may have rights senior to those of the holders of our common stock. If additional financing is not available when required or is not available on acceptable terms, we may need to delay, modify or abandon our expansion strategy and we may be unable to take advantage of business opportunities or respond to competitive pressures, which could have a material adverse effect on our offerings, revenue, results of operations and financial condition.

Our prior success in developing bio-succinic acid may not be indicative of our ability to leverage our bio-succinic acid technology to develop and commercialize derivatives of bio-succinic acid and other bio-based building block chemicals.

The success we have had in manufacturing bio-succinic acid using our four carbon, or C4, platform to date may not be indicative of our future ability to develop and commercialize derivatives of bio-succinic acid, and bio-based six carbon, or C6, building block chemicals. Although we expect to be able to leverage our bio-succinic acid technology for use in higher value-added products, we have never produced derivatives of bio-succinic acid or bio-based C6 building block chemicals at commercial scale. We may find that the new chemicals that we produce using our processes are more complex than we anticipated or require processes that we are unfamiliar with or which require larger scale development facilities than expected. The development of new products has required, and will require, that we expend significant financial and management resources. We have incurred, and expect to continue to incur, significant research and development expenses. If we are unable to devote adequate resources to develop new products or cannot otherwise successfully develop new products or enhancements that meet customer requirements on a timely basis, our products could lose market share, our revenues and/or margins could decline and we could experience operating losses. Although our management team has significant experience with industrial biotechnology, purification processes and chemical catalysis, the skills and knowledge gained in these fields and in the large-scale production of bio-succinic acid does not guarantee that we will be successful in our efforts to cost-effectively produce and commercialize bio-succinic acid derivatives or bio-based C6 building block chemicals at commercial scale.

In addition, each of the chemicals that we plan to manufacture are used in multiple and diverse end-markets and applications, each of which present unique requirements, pricing pressures and competitors. As a result, we may not be able to sufficiently serve each end-market adequately. In order to effectively compete in the chemicals industry, we will need to, among other things, be able to adapt our development and production processes to meet the rapidly changing demands of the industry and our customers and ensure that the quality, performance attributes and cost of our bio-based products compare favorably to their petroleum-derived equivalents. In each end-market, there may also be barriers to entry due to third-party intellectual property rights or difficulties forming and maintaining strategic partnerships. In addition, the products currently derived from our processes and the feedstocks we use in the production of bio-succinic acid and our future products, may not be applicable to or compatible with demands in existing or future markets. We may not be able to identify new opportunities as they arise since future applications of any given product may not be readily determinable.

If we are not able to successfully develop, commercialize, produce and sell new products, we may be unable to expand our business. Consequently, we may not succeed in our strategy to expand our product platform as expected or at all. If our ability to expand our product platform is significantly delayed or if we are unable to leverage our bio-succinic acid platform as expected, our business and financial condition could be materially and adversely affected.

Demand for our bio-succinic acid, bio-based 1,4 BDO and other bio-succinic acid derivatives may take longer to develop or be reduced by technological innovations in our industry that allow our competitors to produce them at a lower cost.

The development of sufficient customer demand for bio-succinic acid, bio-based 1,4 BDO and other bio-succinic acid derivatives will be affected by the cost competitiveness of our products, and the emergence of more

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competitive products. The market for bio-based chemicals will require most potential customers to switch from their existing petroleum-based chemical suppliers. In addition, there has been intense growth and interest in bio-based chemicals, and these industries are subject to rapid technological change and product innovation. Our products are based on our proprietary fermentation and purification process, but a number of companies are pursuing alternative processes and technologies and our success will depend on our ability to maintain a competitive position with respect to technological advances. It is possible that those advances could make bio-succinic acid, bio-based 1,4 BDO and other bio-succinic acid derivatives less efficient or obsolete, causing the renewable chemicals we produce to be of a lesser quality than competing bio-based chemicals or causing the yield of our products to be lower than that for competing technologies. These advances could also allow our competitors to produce bio-based chemicals at a lower cost than ours. We cannot predict when new technologies may become available, the rate of acceptance of new technologies by our competitors or the costs associated with such new technologies.

Technological breakthroughs in our industry or innovations in alternative sources of bio-based chemicals could reduce demand for our products. Our technologies and products may be rendered uneconomical by technological advances, more efficient and cost-effective biocatalysts or entirely different approaches developed by one or more of our competitors. If we are unable to adopt or incorporate technological advances or adapt our products to be competitive with new technologies, our costs could be significantly higher than those of our competitors, which could make our facilities and technology less competitive or uncompetitive.

Changes we make to our business model, product development and manufacturing process, or changes to our commercial partnerships and collaborations may not yield the benefits we expect and may have adverse impacts that we did not anticipate.

We are continually working to lower our operating costs, improve our product performance, increase our speed to market and access new markets. As a result, we have made and will continue to make changes we believe will accomplish these goals. For example, we are in the process of transitioning from an *E. coli* organism to our yeast. In addition, we have expanded the breadth of products we are seeking to commercialize, and entered into a number of early stage partnerships and collaborations related to those products, that we believe will significantly increase our accessible market. We can give no assurances that these and other changes we make will yield the benefits we expect and will not have adverse impacts that we did not anticipate. If these changes are not successful, we may incur additional costs, experience reputational and competitive harm and our business, financial condition and results of operations may be materially and adversely affected.

We are dependent on our relationships with strategic partners, licensors, collaborators and other third parties for research and development, the funding, construction and operation of our manufacturing facilities and the commercialization of our products. The failure to manage these relationships could delay or prevent us from developing and commercializing our products.

We have built our business largely by forming technology partnerships and licensing and other relationships with market leaders in the industrial biotechnology and chemicals industries. For example, through an exclusive worldwide license from Cargill, we have developed a next-generation yeast microorganism. In addition, we are developing a proprietary purification process that we believe will provide a key cost differentiator to our competitors by reducing the cost profile of our products and the capital intensity of our plants. We have also entered into license agreements with DuPont, entities funded by the DOE, Celexion and others. We expect that our ability to maintain and manage these collaborations will be significant factors in the success of our business.

Also, we expect that our ability to maintain and manage partnerships for the funding, construction and operation of our manufacturing facilities will be a significant factor in the success of our business. The large-scale demonstration

facility we operate in Pomacle, France is owned by ARD and we are guaranteed 60% the facility s capacity through a toll-manufacturing agreement with ARD. We have entered into a joint venture agreement with Mitsui for the financing and construction of our planned facility in Sarnia, Ontario. We have

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commenced construction and expect this facility to be mechanically complete in late 2014 or early 2015. We intend to work with Mitsui to build and operate an additional plant in the future.

We are working with strategic partners and collaborators through whom we either own or license the technology needed to develop new specialty chemical products, such as esterification with LANXESS, compounded polylactic acid/polybutylene succinate, or PLA/PBS, resin grades with NatureWorks, polybutylene succinate, or PBS, with Mitsubishi Chemical and silicone replacements in personal care products with Inolex Chemical Company, or Inolex. We will rely on these partners to commercialize our products and the success of these relationships will impact the market opportunity and demand for our products across our target end-markets.

Our partnering or collaboration opportunities could be harmed and our anticipated timelines could be delayed if:

- we do not achieve our objectives under our arrangements in a timely manner, or at all;
- our existing or potential industry partners become unable, unwilling or less willing to expend their resources on research and development or commercialization efforts with us due to general market conditions, their financial condition, feedstock pricing or other circumstances, many of which are beyond our control;
- we disagree with a strategic partner or collaborator regarding strategic direction, economics of our relationship, intellectual property or other matters;
- we are unable to successfully manage multiple simultaneous partnering arrangements;
- our strategic partners and collaborators breach or terminate their agreements with us or fail to perform their agreed activities or make planned equity contributions;
- our industry partners become competitors of ours or enter into agreements with our competitors;
- applicable laws and regulations, domestic or foreign, impede our ability to enter into strategic arrangements;
- we develop processes or enter into additional partnering arrangements that conflict with the business objectives of our other arrangements; or
- consolidation in our target markets limits the number of potential industry partners.

If any of these events occur, or if we fail to maintain our agreements with our strategic partners and collaborators, we may not be able to commercialize our existing and future products, further develop our business or generate sufficient revenues to support our operations. Additionally, our business could be negatively impacted if any of our industry partners undergoes a change of control or assigns the rights or obligations under any of our agreements.

Our operations are dependent upon certain raw materials and utilities, principally sugars, carbon dioxide, hydrogen, steam and electricity, which make us vulnerable to supply availability and price fluctuations.

We are vulnerable to the supply availability and price fluctuations of certain raw materials and utilities, principally sugars, carbon dioxide, hydrogen, steam and electricity. In many cases, we do not have long-term supply agreements in place, which may result in supply problems in the future. For example, we have not yet finalized supply agreements for the required feedstock or carbon dioxide for our planned facility in Sarnia, Ontario. Our operations may also be adversely impacted by the failure of our suppliers to follow specific protocols and procedures or comply with applicable regulations, equipment malfunctions and environmental factors, any of which could delay or impede their ability to meet our demand. Our reliance on third-party suppliers also subjects us to other risks that could harm our business, including that:

- we may not be able to obtain adequate supply in a timely manner or on commercially reasonable terms;

- we may have difficulty locating and qualifying alternative suppliers for sole-source supplies;

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- we may have production delays if products we source from alternative suppliers do not meet our standards;
- we are not, and do not expect to become, a major customer of most of our suppliers and such suppliers may give other customers needs higher priority than ours; and
- our suppliers may encounter financial hardships unrelated to our demand for components, which could inhibit their ability to fulfill our orders and meet our requirements.

In the event one or more of our suppliers are unable to meet our supply demands, we may not be able to quickly replace them or find adequate supply from a different source. Any interruption or delay in the supply of sugars, carbon dioxide, hydrogen, steam or electricity, or our inability to obtain these raw materials and utilities from alternate sources at acceptable prices in a timely manner, could impair our ability to meet the demands of our customers and expand our operations, which would have a material adverse effect on our business, financial condition and results of operations.

The price of our bio-succinic acid is based in large part on the price of sugars, which can be derived from corn, wheat or other feedstocks. Fluctuations in the commodity prices of sugars or other inputs required in our production processes may reduce our profit margins, especially if we do not have long-term contracts for the sale of our output at fixed or predictable prices. The price and availability of sugars or other inputs may be influenced by factors outside of our control, including general economic, market and regulatory factors.

Our production of bio-succinic acid is currently limited to a single demonstration facility owned by a third party.

Our bio-succinic acid is currently manufactured at a single large-scale demonstration facility in Pomacle, France, which is owned by ARD and we are guaranteed 60% the facility s capacity through a toll-manufacturing agreement. We anticipate having access to this facility until our planned facility in Sarnia, Ontario is mechanically complete and we can begin commissioning and start-up. As a result of our current dependence on a single large-scale demonstration facility, our operations and the growth of our business would be severely disrupted in the event of any material interruption at that facility. In addition, our dependence on ARD could also result in severe disruptions in our operations if ARD does not meet its contractual duties, provide quality services, meet expected deadlines or otherwise perform as expected under our toll-manufacturing agreement. Material interruptions may result from, among other things, operational difficulties, including equipment failures, contaminated fermentations, labor disputes, human error and cost overruns as well as disagreements with ARD. If operations at the large-scale demonstration facility in Pomacle, France were significantly disrupted or if we were to incur additional costs associated with engineering or operational difficulties, it would have a material adverse effect on our business, financial condition and results of operations.

Our process at our large-scale demonstration facility in Pomacle, France currently uses an E. coli organism, which is a type of bacteria and therefore has certain inherent disadvantages compared to other organisms. We will continue to be subject to these disadvantages while we are transitioning from E. coli to our yeast which we plan to use for production in our planned Sarnia facility.

Given the relatively high sensitivity of *E. coli* to pH, agitation, process disruption and contamination, the maximum size of an *E. coli* fermenter is limited. In addition, because it is necessary for *E. coli* to be fermented at a neutral pH, at the completion of the process the succinic acid is in salt form and needs to be acidified, which results in additional process steps and energy, thereby increasing operating costs. Finally, because *E. coli* is a bacteria, there is a potential for contamination of the fermentation facilities, which can increase operating costs and reduce performance. If we are

unable to successfully and completely transition to our yeast at our planned Sarnia facility, our business model will be subject to limits on the size of fermenters that we can use and higher operating costs.

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We may not be able to successfully introduce new organisms and feedstocks into our processes.

We intend to introduce new organisms and feedstocks into our processes and are working to increase our conversion yields, feedstock flexibility, manufacturing efficiency and product range through our research and development efforts and strategic partnerships. In partnership with Cargill, we develop a yeast that will potentially have higher yields and less contamination risk than the *E. coli* bacteria we currently use in our manufacturing processes. We may not, however, succeed in adopting our yeast for use in our manufacturing process for a number of reasons, including our inability to adapt our purification process for our yeast, the failure of our yeast to produce products that meet the quality standards of our customers and a higher than expected production cost as a result of using our yeast. We expect to use our yeast in the Sarnia facility and future facilities. When we do, the transition may not be as seamless as we expect, and our yeast may require different operating conditions or otherwise differ from our expectations. We also plan to expand the range of feedstocks we use from the fermentable sugars from the hydrolysis of starch from a wheat wet mill used in the large-scale demonstration facility in France to fermentable sugars from corn wet mills in our planned facility in Sarnia, Ontario.

We may face unexpected challenges when we run our second-generation purification process and fermentation process at a single facility.

We have piloted a second-generation purification process through our agreement with a strategic technology partner. We have tested this purification process at our partner s facility in conjunction with our fermentation processes in France. However, engineering issues, additional costs or other unforeseen obstacles may arise and create delays when we implement the two processes together at a single manufacturing facility. In addition to the second-generation purification process, we are also working to improve the purification process that we currently use in order to reduce capital expenditures and other purification-related costs, but we cannot assure you that these efforts will be successful.

If we are unable to manage our growth and expand our operations successfully, our business, financial condition and results of operations may be harmed.

We have significantly expanded our business since our inception and have grown to 54 full-time employees as of December 31, 2013. We currently conduct our business in several countries, including the United States, Canada and France, and we expect to continue to expand geographically in the future. We expect our growth to continue and accelerate in connection with our expansion strategy. As our operations continue to expand, we will need to continue to manage multiple locations and additional relationships with various third parties. We may not be able to maintain or accelerate our current growth rate, manage our expanding operations effectively or achieve planned growth on a timely or profitable basis. Managing our anticipated growth and expanding our operations will require us to do, among other things, the following:

- enhance our operational, financial and management controls and infrastructure, human resource policies, and reporting systems and procedures;
- effectively scale our operations, including successfully constructing our planned manufacturing facilities;
- diversify our product line to leverage our bio-succinic acid for use in multiple higher value-added products and other bio-succinic acid derivatives, and develop bio-based C6 building block chemicals;

successfully identify, recruit, train, maintain, motivate and integrate additional employees and continue to retain, motivate and manage our existing employees;

maintain partnerships with third parties for the development of our technology, funding and construction of our plants and the commercialization of our products; and

maintain and grow our intellectual property portfolio.

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These enhancements and improvements will require significant capital expenditures and allocation of valuable management and employee resources, which will place a strain on our operational, financial and management infrastructure. Our future financial performance and our ability to execute on our business plan will depend, in part, on our ability to effectively manage any future growth and expansion. There are no guarantees we will be able to do so in an efficient or timely manner, or at all. Our failure to effectively manage growth and expansion could have a material adverse effect on our business, financial condition and results of operations.

We have entered into certain non-binding letters of intent, memoranda of understanding and other arrangements with future customers and others, and cannot assure you that such arrangements will lead to definitive agreements, which could harm our commercial prospects.

We have entered into non-binding letters of intent, memoranda of understanding and other arrangements with future customers and others. We have also entered several non-binding memoranda of understanding with third parties related to our product development efforts. We cannot assure you that we will be able to negotiate final terms and enter into definitive agreements with any of our future customers or others in a timely manner, or at all, and there is no guarantee that the terms of any final, definitive, binding agreement will be favorable to us or reflect the terms currently contemplated under the letters of intent, memoranda of understanding and other arrangements we have. Delays in negotiating final, definitive, binding agreements could slow the development and commercialization of the products in our pipeline, which could prevent us from growing our business, result in wasted resources and cause us to consume capital significantly faster than we currently anticipate.

We have signed a binding take-or-pay contract for bio-based 1,4-Butanediol, or BDO, with Vinmar International, which, under the terms of the 15-year master off-take agreement, Vinmar has committed to purchase 100% of the BDO produced in a 100,000 ton per year capacity plant that BioAmber plans to build in North America and commission in 2017. Vinmar also plans to invest in the BDO plant alongside BioAmber. Following the financing, construction and commissioning of the 100,000 ton BDO plant, Vinmar will be obligated to purchase 100% of the BDO produced for 15 years, and BioAmber will be obligated to sell exclusively to Vinmar. As part of the agreement, Vinmar has a right of first refusal to invest in and secure 100% of the off-take from a second BDO plant that BioAmber would build in the future. While this agreement is binding, our inability to finance and construct the BDO plant would relieve Vinmar of its obligation to purchase BDO under the terms of the take-or-pay agreement.

We cannot assure you that we will be able to meet the product specification requirements of our customers or that our products will be accepted by our target customers.

We are currently selling our bio-succinic acid to customers today after having met their quality, purity, performance and cost requirements and intend to sell our product to other customers in the chemicals industry. These sales were made in connection with our product and market development efforts. We also intend to expand our market reach with the new products that we are developing as alternatives to the chemicals currently in use. Our potential customers include large specialty chemical companies that have well-developed manufacturing processes for the chemicals they use or pre-existing arrangements with suppliers for the chemical components they need. These potential customers frequently impose lengthy and complex product qualification procedures on their suppliers during which time they test and certify our products for use in their processes and, in some cases, determine whether products that contain the chemicals produced using our processes satisfy additional third-party specifications. Meeting these suitability standards could be a time-consuming and expensive process and we may invest substantial time and resources into such qualification efforts without ultimately securing approval by our customers. If we are unable to convince our potential customers that our products are equivalents of or comparable to the chemicals that they currently use or that using our products is otherwise beneficial to them, we will not be successful in expanding our market and our business will be adversely affected.

In addition, agreements for the sale and purchase of our products are customarily subject to the satisfaction of certain technical, commercial and production requirements. These agreements contain conditions that we and our counterparties agree on product specifications for our chemical products and that our products conform to those specifications. If we do not satisfy these contractual requirements, demand for our products and our reputation may be adversely affected.

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A significant decline in the price of petroleum and petroleum-based succinic acid and other chemicals may reduce demand for our products.

The bio-succinic acid we produce is a renewable alternative to petroleum-based succinic acid. Based on our current financial modeling with respect to our planned facility in Sarnia, Ontario, we anticipate that if the price of oil falls below $35 per barrel for a sustained period of time, we may be unable to manufacture bio-succinic acid at that facility as a cost-competitive alternative to competing petroleum-based succinic acid products, which would adversely impact our operating results. Significantly higher operating expenses at the demonstration facility in Pomacle, France, due to higher raw material, utility and other costs, severely limit our ability to produce cost-competitive products at that location. World prices for oil have fluctuated widely in recent years. For example, during the last five years, the market price per barrel of West Texas Intermediate crude oil ranged from a low of $30.81 to a high of $145.66 and was $98.20 as of March 13, 2013. We expect that prices will continue to fluctuate in the future. Declining oil prices, or the perception of a future decline in oil prices, may adversely affect the prices we can obtain from our potential customers or dissuade potential customers from entering into long-term agreements with us to buy our products.

Some of our competitors have significantly more experience and resources than we do and technology developed by our competitors could become more commercially successful than our technology, which could negatively impact our results of operations and market share.

Competition in the bio-based chemicals business from other chemicals companies is well established, with many substantial entities having well-financed multi-national operations. Our products will compete against those produced by established companies, including a collaborative venture between DSM and Roquette Frères S.A., a collaborative venture between BASF and Purac, Gadiv Petrochemical Industries Ltd. and Kawasaki Kasei Chemicals Ltd. Competition in the bio-based chemicals business is expanding with the growth of the industry and the advent of many new technologies. In addition to competing with new technologies, we also compete against traditional petroleum-derived chemicals, many of which are produced by large companies that have greater financial and other resources than we do. Larger companies, due to their better capitalization, will be better-positioned to develop and commercialize new technologies, build new production facilities and to install existing or more advanced equipment, which could reduce our market share and harm our business. In addition, our products will face competition from those produced by early stage companies, including Genomatica, Inc. and Myriant Corporation. Our ability to compete successfully will depend on our ability to develop proprietary technologies that cost effectively produce renewable alternatives to petroleum-based chemicals. Some of our competitors are developing new technologies that may be more successful than our technology. These competitors may also have substantially greater production, financial, research and development, personnel and marketing resources than we do or may benefit from local government programs and incentives that are not available to us. As a result, our competitors may be able to compete more aggressively and sustain that competition over a longer period of time than we could. Our technologies and products may be rendered less competitive by technological advances or entirely different approaches developed by one or more of our competitors. As more companies develop new intellectual property in our markets, the possibility increases of a competitor acquiring patent or other rights that may limit our products or potential markets, which could lead to litigation. In addition, we may be subject to aggressive competitive tactics from our competitors, who may use their strong positions in the market and established relationships with existing suppliers and customers to take measures that negatively affect our ability to compete effectively in this industry. Our inability to maintain our competitiveness and grow our market share may, adversely affect our results of operations and financial position, and prevent us from achieving or maintaining profitability.

Failure to obtain regulatory approvals or permits could adversely affect our operations.

While our business currently has all necessary operating approvals material to our current operations, we must obtain and maintain numerous regulatory approvals and permits in order to build and operate our planned manufacturing facilities, including our planned facility in Sarnia, Ontario. Recently, Health Canada confirmed that the microbial strain to be used in Sarnia is Biosafety level 1 organism and neither Health Canada nor

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Environment Canada found any risk associated with the activities proposed in our notification. This means that BioAmber can import and use its production strain in Sarnia for the manufacturing of bio-based succinic acid under the operational and safety procedures mentioned in its notification.

However in any given jurisdiction, new legislations could be implemented that would require additional or new regulatory approvals. Obtaining necessary approvals and permits could be a time-consuming and expensive process, and we may not be able to obtain them on a timely basis or at all. In the event that we fail to ultimately obtain all necessary permits, we may be forced to delay operations of the facility and the receipt of related revenues or abandon the project altogether and lose the benefit of any development costs already incurred, which would have an adverse effect on our results of operations. In addition, governmental regulatory requirements may substantially increase our construction costs, which could have a material adverse effect on our business, results of operations and financial condition. If there is a delay in obtaining any required regulatory approvals or if we fail to obtain and comply with any required regulatory approvals, the operation of our facilities or the sale of our bio-based chemicals could be delayed. For example, many countries require registration of chemicals before they can be distributed in the country, and a failure to register our chemicals would limit our ability to expedite sales into these markets. In addition, we may be required to make capital expenditures on an ongoing basis to comply with increasingly stringent federal, state, provincial and local environmental, health and safety laws, regulations and permits.

We face risks associated with our international business.

We currently operate one large-scale demonstration facility located in Pomacle, France, are currently building and plan to operate a manufacturing facility in Sarnia, Ontario as well as additional manufacturing facilities in the future. Our international business operations are subject to a variety of risks, including:

- difficulties in staffing and managing foreign and geographically dispersed operations;
- having to comply with various Canadian, U.S. and other laws, including export control laws.
- changes in or uncertainties relating to foreign rule and regulations that may adversely affect our ability to sell our products, perform services or repatriate profits to the United States;
- tariffs, export or import restrictions, restrictions on remittances abroad, imposition of duties or taxes that limit our ability to move our products out of these countries or interfere with the import of essential materials into these countries;
- fluctuations in foreign currency exchange rates;
- imposition of limitations on production, sale or export of bio-based chemicals in foreign countries;

imposition of limitations on or increase of withholding and other taxes on remittances and other payments by foreign subsidiaries or joint ventures;

imposition of differing labor laws and standards;

economic, political or social instability in foreign countries;

an inability, or reduced ability, to protect our intellectual property, including any effect of compulsory licensing imposed by government action; and

the availability of government subsidies or other incentives that benefit competitors in their local markets that are not available to us.

We expect that we will begin expanding into other target markets, however there can be no assurance that our expansion plans will be realized, or if realized, be successful. We expect each market to have particular regulatory, feedstock sourcing and funding hurdles to overcome and future developments in these markets, including the uncertainty relating to governmental policies and regulations, could have a material adverse effect

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on us. If we expend significant time and resources on expansion plans that fail or are delayed, our business, reputation and financial condition may be materially and adversely affected.

Natural or man-made disasters, political, social or economic instability, or occurrence of a catastrophic or disruptive event in any of the areas where our existing or planned manufacturing facilities are located may adversely affect our business and results of operations.

We currently operate a large-scale demonstration facility in Pomacle, France and plan to build and operate manufacturing facilities strategically located throughout the world near sources of feedstock and our target markets. The operation of facilities may be harmed by natural or man-made disasters, including, without limitation, earthquakes, floods, tornadoes, fires, tsunamis, epidemics and nuclear disasters. Our facilities and the manufacturing equipment we use would be very costly to replace and could require substantial lead time to repair or replace. In addition, telecommunications failures or other systems interruptions, such as computer viruses or other cyber-attacks, at any of the locations in which we do business could significantly disrupt our operations, laboratory processes and delay shipments to our customers. Even in the absence of direct damage to our operations, large disasters, terrorist attacks, systems failures or other events could have a significant impact on our partners and customers businesses, which in turn could result in a negative impact on our results of operations. Extensive or multiple disruptions in our operations, or our partners or customers businesses, due to natural disasters or other unanticipated catastrophes could have a material adverse effect on our results of operations.

In the event any of our facilities are affected by a disaster, we may:

- be unable to meet the deadlines of our customers;
- experience disruptions in our ability to manufacture and ship our products and otherwise operate our business, which could negatively impact our business;
- need to expend significant capital and other resources to address any damage caused by the disaster; and
- lose customers and we may be unable to regain those customers thereafter.

Our precautions to safeguard our facilities, including insurance and health and safety protocols, may not be adequate to cover our losses in any particular case. Although we possess insurance for damage to our property and the disruption of our business from casualties, this insurance may not be sufficient to cover all of our potential losses and may not continue to be available to us on acceptable terms, or at all. Moreover, our facilities may experience unscheduled downtime or may not otherwise operate as planned or expected, which could have adverse consequences on our business and results of operations.

We may incur significant costs complying with environmental laws and regulations, and failure to comply with these laws and regulations could expose us to significant liabilities.

We use biological materials and genetically modified organisms, or GMOs, in our production processes and are subject to a variety of federal, state, and local laws and regulations governing the use, generation, manufacture and disposal of these materials. For example, the Toxic Substances Control Act, or TSCA, and analogous state laws and

regulations impose requirements on the production, importation, use and disposal of chemicals and GMOs in the United States. In Canada, similar regulatory programs exist under the Canadian Environmental Protection Act. In particular, a regulatory program similar to TSCA requires that Environment Canada to approve the manufacture of any chemical not already included on the Domestic Substances List, or DSL. We have secured approval from Environment Canada for our use of *E. coli* and the manufacture of our bio-based succinic acid and the derivatives of succinic acid that we plan to commercialize. Environment Canada has recently reviewed our notification dossier with respect to the use of our yeast, and we obtained a favorable response for the importation and manufacture of the yeast microorganism in January 2014. If Environment

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Canada requires our future C6-based products, to undergo extensive testing, which we currently do not anticipate, securing approval to manufacture such products could potentially be subject to significant delays or costs. In the European Union, we are subject to a chemical regulatory program known as REACH (Registration, Evaluation, Authorization, and Restriction of Chemical Substances). Under REACH, we are required to register our products with the European Commission. The registration process requires the submission of information to demonstrate the safety of chemicals as used and could result in significant costs or delay the manufacture or sale of our products in the European Union.

We obtained requisite regulatory approvals for use of *E. coli* in the large-scale demonstration facility we operate in Pomacle, France as well as in our research and development operations in the United States and Canada. In addition, the Cargill yeast we have licensed has been approved for use in the United States for the production of lactic acid. Although we have implemented safety procedures for the disposal of these materials and waste products to comply with these laws and regulations, we cannot be sure that our safety measures are compliant or capable of eliminating the risk of accidental injury or contamination from the use, generation, manufacture, or disposal of hazardous materials. In the event of contamination or injury, we could be held liable for any resulting damages, and any liability could exceed our insurance coverage. There can be no assurance that violations of environmental, health and safety laws will not occur as a result of human error, accident, equipment failure or other causes.

Compliance with applicable environmental laws and regulations may be expensive, and the failure to comply with past, present or future laws could result in the imposition of fines, regulatory oversight costs, third party property damage, product liability and personal injury claims, investigation and remediation costs, the suspension of production, or a cessation of operations, and our liability may exceed our total assets. We expect to encounter similar laws and regulations in most if not all of the countries in which we may seek to establish production capabilities, and the scope and nature of these regulations will likely be different from country to country. Environmental laws could become more stringent over time, requiring us to change our operations, or imposing greater compliance costs and increasing risks and penalties associated with violations, which could impair our research, development or production efforts and harm our business. Similarly, our business may be harmed if initiatives to reduce emissions of greenhouse gases, which tend to improve the competitiveness of our products relative to petrochemicals, do not become legally enforceable requirements, or if existing legally enforceable requirements relating to greenhouse gases are amended or repealed in the future. The costs of complying with environmental, health and safety laws and regulations and any claims concerning noncompliance, or liability with respect to contamination in the future could have a material adverse effect on our financial condition or operating results.

We use hazardous materials in our business and any claims relating to improper handling, storage or disposal of these materials or noncompliance with applicable laws and regulations could adversely affect our business and results of operations.

We use chemicals and biological materials in our business and are subject to a variety of federal, regional/state and local laws and regulations governing the use, generation, manufacture, storage, handling and disposal of these materials. Although we have implemented safety procedures for handling and disposing of these materials and waste products, we cannot be sure that our safety measures are compliant with legal requirements or adequate to eliminate the risk of accidental injury or contamination. In the event of contamination or injury, we could be held liable for any resulting damages, and any liability could exceed our insurance coverage. There can be no assurance that we will not violate environmental, health and safety laws as a result of human error, accident, equipment failure or other causes. Compliance with applicable environmental laws and regulations is expensive and time consuming, and the failure to comply with past, present, or future laws could result in the imposition of fines, third-party property damage, product liability and personal injury claims, investigation and remediation costs, the suspension of production, or a cessation of operations. Our liability in such an event may exceed our total assets. Liability under environmental laws can be

joint and several and without regard to comparative fault. Environmental laws could become more stringent over time, imposing greater compliance

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costs and increasing risks and penalties associated with violations, which could impair our research, development or production efforts and harm our business. Accordingly, violations of present and future environmental laws could restrict our ability to expand facilities, or pursue certain technologies, and could require us to acquire equipment or incur potentially significant costs to comply with environmental regulations.

Loss of key personnel or our inability to attract and retain additional key personnel could harm our research and development efforts, delay launch of new products and impair our ability to meet our business objectives.

Our business involves complex operations spanning a variety of disciplines that demands a management team and employee workforce that is knowledgeable in the many areas necessary for our operations. While we have been successful in attracting experienced, skilled professionals to our company, the loss of any key member of our management team or key research and development or operational employees, or the failure to attract and retain additional such employees, could slow our development and commercialization of our products for our target markets and executing our business plans. We may not be able to attract or retain qualified employees due to the intense competition for qualified personnel among biotechnology and other technology-based businesses and the scarcity of personnel with the qualifications or experience necessary for our business. Hiring, training and successfully integrating qualified personnel into our operation is a lengthy and expensive process. The market for qualified personnel is very competitive because of the limited number of people available with the necessary technical skills and understanding of our technology and anticipated products. If we are not able to attract and retain the necessary personnel to accomplish our business objectives, we may experience staffing constraints that will adversely affect our ability to support our internal research and development programs or satisfy customer demands for our products. In particular, our product development and research and development programs are dependent on our ability to attract and retain highly skilled scientific, technical and operational personnel. Competition for such personnel from numerous companies and academic and other research institutions may limit our ability to do so on acceptable terms, or at all. Substantially all of our employees are at-will employees, which means that either the employee or we may terminate their employment at any time.

In the ordinary course of business, we may become subject to lawsuits or indemnity claims, including those related to product liability, which could materially and adversely affect our business and results of operations.

From time to time, we may, in the ordinary course of business, be named as a defendant in lawsuits, claims and other legal proceedings. These actions may seek, among other things, compensation for alleged personal injury, worker s compensation, employment discrimination, breach of contract, infringement of the intellectual property rights of others, property damages or civil penalties and other losses of injunctive or declaratory relief. In the event that such actions or indemnities are ultimately resolved unfavorably at amounts exceeding our accrued liability, or at material amounts, the outcome could materially and adversely affect our reputation, business and results of operations.

In addition, payments of significant amounts, even if reserved, could adversely affect our liquidity position. In addition, the development, production and sale of our products involve an inherent risk of product liability claims and the associated adverse publicity. Our products may contain undetected defects or impurities that are not discovered until after the products have been used by customers and incorporated into products for end-users. This could result in claims from our customers or others, which could damage our business and reputation and entail significant costs to correct. We may also be sued for defects resulting from errors of our commercial partners or unrelated third parties, but any product liability claim brought against us, regardless of its merit, could result in material expense, divert management s attention and harm our business and reputation. Insurance coverage is expensive, may be difficult to obtain or not available on acceptable terms and may not adequately cover potential claims or losses. If claims or losses exceed our liability insurance coverage, we may go out of business. In addition, insurance coverage may become more expensive, which would harm our results of operations.

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Adverse conditions in the global economy and disruption of financial markets may prevent the successful development and commercialization of our products, as well as significantly harm our results of operations and ability to generate revenue and become profitable.

We are subject to the risks arising from adverse changes in global economic and market conditions. The worldwide economy has been experiencing significant economic turbulence, and global credit and capital markets have experienced substantial volatility and disruption. These adverse conditions and general concerns about the fundamental soundness of domestic and international economies could limit our partners or potential partners ability or willingness to invest in new technologies or capital. Moreover, these economic and market conditions could negatively impact our current and prospective customers ability or desire to purchase and pay for our products, or negatively impact our feedstock prices and other operating costs or the prices for our products. Changes in governmental banking, monetary and fiscal policies to address liquidity and increase credit availability may not be effective. Significant government investment and allocation of resources to assist the economic recovery of various sectors which do not include the bio-based chemical industry may reduce the resources available for government grants and related funding that could assist our expansion plans or otherwise benefit us. Any one of these events, and continuation or further deterioration of these financial and macroeconomic conditions, could prevent the successful and timely development and commercialization of our products, as well as significantly harm our results of operations and ability to generate revenue and become profitable.

If we engage in any acquisitions, we will incur a variety of costs and face numerous potential risks that could adversely affect our business and operations.

If appropriate opportunities become available, we may acquire additional businesses, assets, technologies, or products to enhance our business in the future. In connection with any future acquisitions, we could:

- issue additional equity securities which would dilute our current stockholders;
- incur substantial debt to fund the acquisitions; or
- assume significant liabilities.

Acquisitions involve numerous risks, including problems integrating the purchased operations, technologies or products, unanticipated costs and other liabilities, diversion of management s attention from our core businesses, adverse effects on existing business relationships with current and/or prospective collaborators, customers and/or suppliers, risks associated with entering markets in which we have no or limited prior experience and potential loss of key employees. We do not have experience in managing the integration process and we may not be able to successfully integrate any businesses, assets, products, technologies or personnel that we might acquire in the future without a significant expenditure of operating, financial and management resources, if at all. The integration process could divert management time from focusing on operating our business, result in a decline in employee morale and cause retention issues to arise from changes in compensation, reporting relationships, future prospects or the direction of the business. Acquisitions may also require us to record goodwill and non-amortizable intangible assets that will be subject to impairment testing on a regular basis and potential periodic impairment charges, incur amortization expenses related to certain intangible assets, and incur large and immediate write offs and restructuring and other related expenses, all of which could harm our operating results and financial condition. In addition, we may acquire companies that have insufficient internal financial controls, which could impair our ability to integrate the acquired

company and adversely impact our financial reporting. If we fail in our integration efforts with respect to any of our acquisitions and are unable to efficiently operate as a combined organization, our business and financial condition may be adversely affected.

Our ability to use our net operating loss carryforwards to offset future taxable income may be subject to certain limitations.

As of December 31, 2013, we had approximately $68.7 million of federal tax net operating loss carryforwards, or NOLs. In general, under Section 382 of the U.S. Internal Revenue Code of 1986, as amended,

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or the Code, a corporation that undergoes an ownership change (as defined in Section 382 of the Code) is subject to limitations on its ability to utilize its pre-change NOLs to offset future taxable income. We have not performed a detailed analysis to determine whether an ownership change has occurred after each of our previous issuances of common stock and warrants. In addition, if we undergo an ownership change, our ability to utilize NOLs could be limited by Section 382 of the Code. Future changes in our stock ownership, some of which are outside of our control, could result in an ownership change. Furthermore, we operate both in the United States and in certain jurisdictions outside the United States. Our non-U.S. operations in France and Canada may in the future generate taxable income that is subject to income or other taxes in the jurisdictions in which those operations are conducted. As of December 31, 2013 we had approximately $25.8 million and $2.5 million of NOLs in France and Canada, respectively. Each jurisdiction in which we operate may have its own limitations on our ability to utilize NOL or tax credit carryovers generated in that jurisdiction. Also, we generally cannot utilize NOLs or tax credits generated in one jurisdiction to reduce our liability for taxes in any other jurisdiction. Accordingly, we may be subject to tax liabilities in certain jurisdictions in which we operate notwithstanding the existence of NOLs or tax credits in other jurisdictions.

Ethical, legal and social concerns about genetically engineered products and processes, and similar concerns about feedstocks grown on land that could be used for food production, could limit or prevent the use of our products, processes and technologies and limit our revenues.

Some of our processes involve the use of genetically modified organisms, or GMOs, such as AFP 184, the bacteria we licensed from entities funded by the DOE. The use of GMOs is subject to laws and regulations in many countries, some of which are new and some of which are still evolving. In the United States, the Environmental Protection Agency regulates the commercial use of GMOs as well as potential products from the GMOs. Public attitudes about the safety and environmental hazards of, and ethical concerns over, genetic research and GMOs could influence public acceptance of our technology and products.

While our bacteria licensed from entities funded by DOE has been approved for commercial use in France, the United States and Canada, and has been given the lowest classification in terms of risk, our ability to commercialize this bacteria in other countries and to develop and commercialize new organisms, such as our yeast, could be limited by the following factors:

- public attitudes about the safety and environmental hazards of, and ethical concerns over, genetically engineered products and processes, which could influence public acceptance of our technologies, products and processes;

- public attitudes regarding, and potential changes to laws governing ownership of genetic material, which could harm our intellectual property rights with respect to our genetic material and discourage others from supporting, developing or commercializing our products, processes and technologies;

- public attitudes and ethical concerns surrounding production of feedstocks on land which could be used to grow food, which could influence public acceptance of our technologies, products and processes;

- governmental reaction to negative publicity concerning genetically engineered organisms, which could result in greater government regulation of genetic research and derivative products; and

governmental reaction to negative publicity concerning feedstocks produced on land which could be used to grow food, which could result in greater government regulation of feedstock sources.

Any of the risks discussed below could result in increased expenses, delays or other impediments to our programs or the public acceptance and commercialization of products and processes dependent on our technologies or inventions. In addition, the subjects of genetically engineered organisms and food versus fuel have received negative publicity, which has aroused public debate. This adverse publicity could lead to greater regulation and trade restrictions on imports of genetically engineered products or feedstocks grown on land suitable for food production.

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Risks Related to Our Intellectual Property

Our inability to adequately protect, or any loss of our intellectual property rights, could materially adversely affect our business, financial condition and results of operations.

Our success will depend, in part, upon our ability to maintain patents and other intellectual property rights to protect our products from competition. We rely principally on a combination of patent, copyright, trademark and trade secret laws, confidentiality agreements, and physical security measures to establish and protect the intellectual property rights relevant to our business. We own or have rights in issued patents and pending patent applications in the U.S. and in certain other jurisdictions. These patents and patent applications cover various aspects of our technologies, including the microorganism (biocatalyst) we use in our fermentation processes, methods of producing our products, and the use of our products in specific applications. In addition, we generally enter into confidentiality and invention assignment agreements with our employees, consultants, contractors, collaboration partners and scientific and other business advisers. These measures, which seek to protect our intellectual property from infringement, misappropriation or other violation, may not be effective for various reasons, including the following:

- we may fail to apply for patents on important technologies or processes in a timely fashion, or at all, or abandon applications when we determine that a product or method is no longer of interest;

- we cannot predict which of our pending patent applications, if any, will result in issued patents for various reasons, including the existence of prior art that we had not been aware of, conflicting patents by others, or defects in our applications;

- we do not know whether the examination of any of our patent applications by the United States Patent and Trademark Office, or USPTO, or any similar foreign patent offices will require us to narrow or even cancel any of the claims in our pending patent applications, or to abandon a patent application altogether;

- even if our patents are granted, they may be challenged by third parties through reexamination or interference proceedings in the U.S., or opposition or cancellation proceedings in Europe, or via similar proceedings in other jurisdictions, which could result in the cancellation of certain of our patent claims or the loss of the challenged patent entirely;

- we may not be able to protect some of our technologies, and even if we receive patent or similar protection, the scope of our intellectual property rights may offer insufficient protection against lawful competition or unauthorized use;

- our products and processes may rely on the technology of others and, therefore, may require us to obtain intellectual property licenses, if available, from third parties in order for us to manufacture or commercialize our products or practice our processes;

the patents we have been granted or may be granted may not include claims covering our products and processes, may lapse or expire, be challenged, invalidated, circumvented or be deemed unenforceable, or we may abandon them;

our confidentiality agreements may not effectively prevent disclosure or use of confidential information and may not provide an adequate remedy in the event of unauthorized disclosure or use;

the costs associated with enforcing patents, confidentiality and invention assignment agreements or other intellectual property rights may make aggressive enforcement prohibitive;

we may not be aware of infringement or misappropriation of our intellectual property rights, or we may elect not to seek to prevent them;

our efforts to safeguard our trade secrets may be insufficient to prohibit the disclosure of our confidential information;

even if we enforce our rights aggressively, injunctions, fines and other penalties may be insufficient to deter violations of our intellectual property rights;

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if we seek to enforce our rights, we may be subject to claims that our intellectual property rights are invalid, anti-competitive, otherwise unenforceable, or are already licensed to the party against whom we are asserting the claim; and

other persons may independently develop proprietary technology, information and processes that are functionally equivalent or superior to our proprietary intellectual property and processes but do not infringe or conflict with our patented or unpatented proprietary rights, or may use their own proprietary intellectual property rights to block us from taking full advantage of the market.

Our patent rights may not protect us against competition.

An important part of our business strategy is to obtain patent protection in the United States and in other countries for patent applications that we own or in-license from others that cover certain technologies used in, or relating to, our products and processes. Interpreting the scope and validity of patents and success in prosecuting patent applications involves complex legal and factual questions, and the issuance, scope, validity, and enforceability of a patent cannot be predicted with any certainty. Patents issued or licensed to us may be challenged, invalidated or circumvented. Moreover, third parties could practice our inventions in secret and/or in territories where we do not have patent protection. Such third parties may then try to sell or import resulting products in and into the United States or other territories. We may be unable to prove that such products were made using our inventions or infringed our intellectual property rights. Additional uncertainty may result from recent changes in the U.S. patent laws under the America Invents Act, which was signed into law on September 16, 2011 and from legal precedent handed down by the U.S. Court of Appeals for the Federal Circuit, the U.S. Supreme Court and the courts of other countries, as they determine legal issues relating to the scope, validity and construction of patent claims. Because patent applications in the U.S. and in many foreign jurisdictions typically are not published until 18 months after filing, if at all, and because the publication of discoveries in the scientific literature often lags behind the actual discoveries, there is additional uncertainty as to the priority dates of our inventions compared to inventions by others, and uncertainty as to the patentability of the claims in our pending patent applications and the validity and enforceability of claims in our issued patents. Accordingly, we cannot be certain that any of our or our licensors patent applications will result in issued patents, or if issued, the validity and/or enforceability of the issued patents. Also, we cannot guarantee that a competing patent application will not be granted with claims that cover our proposed organism or processes, or that our or our licensors patent applications or patents will not be subject to an interference proceeding with a competing patent or patent application.

Moreover, we cannot be sure that any of our or our licensors patent rights will be broad enough in scope to provide commercial advantage and prevent circumvention. Furthermore, patents are enforceable only for a limited term, and some of the U.S. patents that we have in-licensed exclusively relating to our biocatalyst will start to expire in 2015.

We may be involved in lawsuits to protect or enforce our patents or the patents of our licensors, or lawsuits asserted by a third party, which could be expensive, time consuming and unsuccessful.

The success of our business is highly dependent on protecting our intellectual property rights. Unauthorized parties may attempt to copy or otherwise obtain and use our products and/or technology. Policing the unauthorized use of our intellectual property rights is difficult, expensive, time-consuming and unpredictable, as is enforcing these rights against unauthorized use by others. Identifying unauthorized use of our intellectual property rights is difficult because we may be unable to monitor the processes and/or materials being employed by other parties. In addition, in an infringement proceeding, a patent of ours or our licensors may be found invalid, unenforceable, anti-competitive or not infringed. An adverse result in any litigation or defense proceedings could put one or more of our patents at risk of being invalidated or interpreted narrowly and could put our patent applications at risk of not issuing.

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Third parties may challenge our or our licensors patents via reexamination proceedings or inter partes review in the United States, opposition or cancellation proceedings in Europe, or similar proceedings in other jurisdictions. The outcome of these proceedings can be unpredictable and may result in the claims being substantially narrowed or cancelled altogether. As a result of changes in U.S. patent law under the America Invents Act, any U.S. patent that we or our licensors obtain having an effective filing date on or after March 16, 2013 could be challenged by a third party using the new post-grant review process, which could result in the claims of the challenged patents being narrowed or even cancelled. Furthermore, in the United States, patents with an effective filing date prior to March 16, 2013 are awarded to the first person to make an invention rather than to the first person to file a patent application, and therefore such patents could be subject to an interference proceeding conducted by the USPTO to determine which party was the first to create an invention. As result, interference proceedings provoked by third parties or brought by the USPTO may be necessary to determine the priority of inventions with respect to our patents or patent applications or those of our collaborators or licensors. An unfavorable outcome could require us to cease using the related technology or to attempt to license rights from the prevailing party. As a result, our business could be harmed if the prevailing party does not offer us a license on commercially reasonable terms. Litigation or interference proceedings may fail and, even if successful, may take several years to resolve, result in substantial costs, and distract our management and other employees, and otherwise interfere with the running of our business. We may be unable to prevent, alone or with our licensors, infringement or misappropriation of our proprietary rights, particularly in countries where the laws may not protect those rights as fully as in the U.S. Furthermore, because of the amount of discovery required in connection with intellectual property litigation, there is a risk that some of our confidential information could be compromised by disclosure during this type of litigation.

We may be unable to enforce our intellectual property rights throughout the world, which could negatively affect our rights, competitive position and business.

We may in the future decide to build, or partner with others in building manufacturing facilities using our technologies in countries other than the United States and Canada. We may not have sufficient patent or other intellectual property rights in those countries to prevent a competitor from using our or competing technologies. Furthermore, the laws of some foreign countries do not protect intellectual property rights to the same extent as federal, state and provincial laws in the United States and Canada. Many companies have encountered problems in protecting and enforcing intellectual property rights in certain foreign jurisdictions. The legal systems of certain countries do not favor the enforcement of patents and other intellectual property protection. This could make it difficult for us or our licensors to prevent or stop any infringement of our or our licensors patents or misappropriation of the subject matter of our other proprietary or intellectual property rights. Proceedings to enforce our and our licensors patents and other proprietary rights in foreign jurisdictions could result in substantial costs and divert our efforts and attention from other aspects of our business. Accordingly, our efforts to enforce our intellectual property rights in such countries may be inadequate to obtain a significant commercial advantage from the intellectual property that we develop or in-license.

We may be unable to operate our business without infringing the intellectual property rights of others, which could subject us to costly litigation or prevent us from offering certain products which could have a material adverse effect on our business.

Although we are currently unaware of any claims or threatened claims, our ability to manufacture and commercialize our proposed technologies, processes and products depends upon our and our licensors ability to develop, manufacture, market, license and/or sell such technologies, processes and products without violating the proprietary rights of third parties. Numerous U.S. and foreign patents and pending patent applications owned by third parties exist in fields that relate to our proposed technologies, processes and products and our underlying methodologies and discoveries. In addition, many companies actively police and enforce their intellectual property rights, including their patent rights, to gain a competitive advantage. Third parties may allege that our existing or proposed technologies,

processes and products or our methods infringe their intellectual property rights. It is possible that the number and frequency of law suits alleging infringement of intellectual property rights may increase as the number of products and competitors in our market increases. In addition, to the extent

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that we gain greater visibility and market exposure as a public company, we face a greater risk of being the subject of intellectual property infringement claims. We cannot be certain that the conduct of our business does not and will not infringe intellectual property or other proprietary rights of others. If the making, using, selling, offering for sale or importing of our proposed products or practice of our proprietary technologies or processes are found to infringe third party intellectual property rights, including patent rights, we could be prohibited from manufacturing and commercializing the infringing technology, process or product unless we obtain a license under the applicable third party patent and pay royalties or are able to design around such patent.

We may be unable to obtain a license on terms acceptable to us, if at all, and we may be unable to redesign our products, biocatalysts or processes to avoid infringement. Even if we are able to redesign our products, biocatalysts or processes to avoid an infringement claim, our efforts to design around the patent could require significant effort and expense and ultimately may lead to an inferior or more costly product and/or process. Any claim of infringement by a third party, even one without merit, could cause us to incur substantial costs defending against the claim, could distract our management and employees, and generally interfere with our business. Furthermore, if any such claim is successful, a court could order us to pay substantial damages, including compensatory damages for any infringement, plus prejudgment interest and could, in addition, treble the compensatory damages and award attorney fees. These damages could be substantial and could harm our reputation, business, financial condition and operating results. A court also could enter orders that temporarily, preliminarily or permanently prohibit us, our licensees and our customers from making, using, selling, offering to sell or importing one or more of our products or practicing our proprietary technologies or processes, or could enter an order requiring us to undertake certain remedial activities. Any of these events could seriously harm our business, operating results and financial condition.

We also rely in part on trade secret laws, confidentiality agreements, and security procedures, which can be difficult to protect and enforce, and which may not adequately prevent disclosures of trade secrets and other proprietary information; our failure to obtain or maintain such protections could adversely affect our competitive position.

We rely in part on trade secret laws and contractual agreements to protect some of our confidential and proprietary information, technology and processes, particularly where we do not believe patent protection is appropriate or obtainable. We have taken various measures to protect our trade secrets and other confidential or proprietary information, including requiring new employees and consultants to execute confidentiality agreements upon the commencement of employment or consulting engagement with us. However, trade secrets are difficult to maintain and protect and our security procedures may be insufficient to prevent disclosure of our trade secrets. In addition, discussions with our business partners, including our licensors, may require us to share confidential and proprietary information with them and other third parties. Our business partners employees, consultants, contractors or scientific and other business advisers may unintentionally or willfully breach their confidentiality and/or non-use obligations, including by disclosing our confidential or proprietary information to our competitors. Such agreements may be deemed unenforceable, fail to provide adequate remedies, or become subject to disputes that may not be resolved in our favor. Enforcement of claims that a third party has illegally obtained and is using trade secrets is expensive, time consuming and uncertain. In addition, foreign courts are sometimes less willing than U.S. courts to protect trade secrets. Our failure to obtain or maintain trade secret protection could adversely affect our competitive business position. Furthermore, trade secret laws do not prevent our competitors from independently developing equivalent knowledge, methods and know-how that could be used to compete with us and our products.

We may lose our competitive advantage if our competitors develop similar, analogous or alternative organisms that produce bio-succinic acid or other competing chemical products.

We currently use proprietary microorganisms (biocatalysts) in our production of bio-succinic acid and other cellular metabolites such as C6 compounds. If our organisms are stolen, or misappropriated, they could be used by third parties for their own commercial gain, even though they may be in breach of our intellectual property rights. Furthermore, third parties may use similar or analogous organisms in jurisdictions where we or our licensors do not

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have patent protection. Third parties may also independently develop similar, analogous or alternative organisms that can also produce bio-succinic acid or other metabolites without infringing our intellectual property rights. If any of these were to occur, it could be difficult for us to discover, challenge or prevent the third party from using their organisms and competing with us in the production of bio-succinic acid or other metabolites.

Our rights to key intellectual property are in-licensed from third parties, and the limitation or termination of these and related agreements would be highly detrimental to us and our business.

We are a party to certain license agreements that provide us with the right to practice key technology used in our business. For example, we have entered into license agreements with UT-Battelle, LLC, or UT-Batelle, and UChicago Argonne, LLC, or UChicago Argonne, for the *E. coli* bacteria we use currently to produce bio-succinic acid, Cargill for our yeast that is being developed to produce bio-succinic acid, DuPont for catalysts and methods for converting our bio-succinic acid into bio-based 1,4 BDO, and Celexion for a procedure to make C6 compounds, such as adipic acid. All of these license agreements impose various obligations on us, including royalty payments and, in certain instances, milestone payments. If we fail to comply with these or other obligations, certain agreements provide that the licensors may have the right to terminate the license or convert the exclusive license to a nonexclusive license, in which case our competitors may gain access to these important licensed technologies, and we may be unable to develop or market products, technologies or processes covered by the licensed intellectual property. Often our licensors have the right to control the filing, prosecution, maintenance and defense of the licensed intellectual property and, if a third party infringes any of the licensed intellectual property, some of our licensors may control the resulting a legal or other proceeding against that third party to stop or prevent such infringement. As a result, our licensors may take actions or make decisions relating to these matters that could harm our business or impact our rights.

Certain key inventions in-licensed by us were made with funding received from U.S. government agencies, which could negatively impact our rights.

Some of the research undertaken on *E. coli* bacteria we have in-licensed from entities funded by the DOE was funded by grants from certain U.S. government agencies. As a result of U.S. government funding, the government obtained certain rights in any resulting patents and technical data, generally including, at a minimum, a nonexclusive license authorizing the government to practice or have practiced the invention or technical data pertaining to microbial production of bio-succinic acid using *E. coli* for or on behalf of the U.S. government. In the United States, government funding must be disclosed in any resulting patent applications, and our rights in such inventions are and will be subject to government license rights, periodic progress reporting, foreign manufacturing restrictions and march-in rights. March-in rights refer to the right of the U.S. government, under certain limited circumstances, to require us to grant a license to technology developed under a government grant to a responsible applicant, or, if we refuse, to grant such a license itself. March-in rights can be triggered if the government determines that we have failed to work sufficiently towards achieving practical application of a technology or if action is necessary to alleviate health or safety needs, to meet requirements of federal regulations or to give preference to U.S. industry. If the terms of a funding agreement are breached, the government may gain rights to the intellectual property developed in related research.

Furthermore, the terms of a research grant from a U.S. government agency may prohibit the use of new technologies developed using those grants in non-U.S. manufacturing plants, which could adversely affect our business. Under the Bayh-Dole Act of 1980, a party that acquires an exclusive license for an invention that was funded in whole or in part by a federal research grant is subject to the following government rights:

products using the invention that are sold in the United States are to be manufactured substantially in the United States, unless a waiver is obtained;

the U.S. government may force the granting of a license to a third party who will make and sell the needed product if the licensee does not pursue reasonable commercialization of a needed product using the invention; and

the U.S. government may use the invention for its own needs.

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If we fail to meet these guidelines, we could lose our exclusive rights to patents and patent applications in-licensed from UT-Battelle and UChicago Argonne that are directed to the *E. coli* organism currently used in our process for manufacturing bio-succinic acid. Loss of these exclusive rights could be detrimental to our business because we may be required to convert our bio-succinic acid production process to a yeast-based, or other, process for manufacturing bio-succinic acid, and such conversion may interrupt our ability to manufacture bio-succinic acid and require further capital expenditures to adapt our planned manufacturing facility. We believe that our proposed manufacture and sale of bio-succinic acid using the in-licensed *E. coli* organism will be in compliance with requirements of the Bayh-Dole Act. In particular, we have received a waiver from the DOE, as to requirements to manufacture products in the United States, for our planned facility in Sarnia, Ontario. We may need to request additional waivers from the DOE as we expand our manufacturing capabilities.

Future sales of shares by existing stockholders could cause our stock price to decline.

If our existing stockholders sell, or indicate an intent to sell, substantial amounts of our common stock or warrants in the public market the trading price of our common stock or warrants could decline significantly. We cannot predict the effect, if any, that future public sales of these securities or the availability of these securities for sale will have on the market price of our securities. Holders of 8,488,213 shares of our common stock, including the shares of common stock issuable upon exercise of warrants in existence prior to our initial public offering, have the right to require us to register these shares under the Securities Act pursuant to a shareholders agreement. If our existing stockholders sell substantial amounts of our common stock or warrants in the public market, or if the public perceives that such sales could occur, this could have an adverse impact on the market price of our securities, even if there is no relationship between such sales and the performance of our business.

Our financial results could vary significantly from quarter to quarter and are difficult to predict.

Our quarterly operating results may fluctuate significantly in the future. As a result of these fluctuations, we may fail to meet or exceed the expectations of research analysts covering the company or of investors, which could cause the market price of our securities to decline. Future quarterly fluctuations, many of which are beyond our control, may result from a number of factors, including but not limited to:

- the timing and cost associated with the completion of our planned manufacturing facilities;
- the level and timing of expenses for product development and sales, general and administrative expenses;
- delays or greater than anticipated expenses associated with the scale-up and the commercialization of chemicals produced using our processes;
- our ability to successfully enter into or maintain partnering arrangements, and the terms of those relationships;
- commercial success with our existing product and success in identifying and sourcing new product opportunities;

the development of new competitive technologies or products by others and competitive pricing pressures

fluctuations in the prices or availability of the feedstocks required to produce chemicals using our processes or those of our competitors;