

A Plausible Ten-Year Scenario for Development of Biobased Manufacturing in Maine

NEW MANUFACTURING of Renewable Chemicals & Biofuels		ECONOMIC BENEFITS		CLIMATE BENEFITS Reductions in Tons Per Year (TPY)	
# Plants	FACILITY TYPE: BIOPRODUCTS	NEW CAPITAL INVESTMENT	JOBS CREATED & RETAINED	FOSSIL RESOURCE USAGE	GREENHOUSE GAS EMISSIONS
3	Demonstration scale plants: Renewable chemicals, e.g. levulinic acid & derivatives	\$ 150 million	60	- 40,000	- 106,000
2	Commercial scale plants: Renewable chemicals, e.g. cellulosic ethanol	\$ 100 million	50	- 82,000	- 384,000
1	Biopolymer (bioplastics) plant: e.g. polylactic acid (PLA)	\$ 222 million	50	- 55,000	- 78,000
1	Integrated Biorefinery: TDO (for biofuel) & furfural	\$ 550 million	40	- 76,000	- 244,000
Subtotal JOBS:			200 Direct Jobs	in New Manufacturing	
			600 Indirect Jobs	in Logging, Transport & Supplies	
			400 Retained Jobs	at existing Pulp & Paper Mills	
7	Biobased Manufacturing Plants for a TOTAL of:	\$ 1.02 Billion Invested	1,200 Jobs Created/Saved	253,000 TPY Fossil Carbon Use Reduced	812,000 TPY Greenhouse Gases Slashed

Analysis by Environmental Health Strategy Center with Biobased Maine, May 2019. See other side for basis and assumptions.

Basis and Assumptions in Support of Plausible Ten-Year Development Scenario for Biobased Manufacturing

1. **BIOMASS AVAILABILITY.** The availability and cost of woody biomass sufficient to supply raw material for biobased manufacturing in Maine under this development scenarios was documented in an expert consultant's report: Innovative Natural Resource Solutions LLC, **Wood Feedstock Supply for Biobased Materials in Maine**, October 2017.
2. **TECHNOLOGY DEVELOPMENT.** The commercialization of new technology to convert woody biomass to renewable chemicals and advanced biofuels is documented in an expert consultant's report, which also profiles 13 technology companies and their strategic fit for Maine: Ascendant Partners, Inc., **BioBased Maine: Advancing Sustainable Manufacturing: Sugar Study Findings**, May 16, 2017.
3. **RENEWABLE CHEMICALS MARKET.** Growing demand and market opportunities in specific renewable chemical markets was documented in an expert consultants report: Ascendant Partners, Inc., **BioBased Maine: Advancing Sustainable Manufacturing: Renewable Chemicals Study Findings**, November 30, 2017.
4. **DEMONSTRATION SCALE, Renewable Chemicals Plants**, assumes 100 ton per day production of levulinic acid from woody biomass using the Biofine technology, and applied these expert analyses:
Economic Benefits: Mike Cassata, Chief Development Officer, Biofine Developments Northeast, Inc. Email: February 15, 2019.
Climate Benefits: Earth Shift, Comparison of Ethyl Levulinate with Gasoline and Diesel: Wheel to Wheel Analysis, May 2009.
5. **COMMERCIAL SCALE, Renewable Chemicals Plants**, assumes 14.5 million gallons per year production of cellulosic ethanol from woody biomass based on the development proposal of the former Old Town Fuel & Fiber LLC:
Economic Benefits: Darrel Waite, Red Shield Acquisition LLC, Demonstration of an Integrated Biorefinery, Annual Plants to Products Forum: Growing Biobased Manufacturing Jobs in Rural Maine, October 17, 2013.
Climate Benefits: Displacement of 10% of gasoline as a fuel additive and emission factors from U.S. Environmental Protection Agency
6. **BIOPOLYMERS PLANT**, assumes 50,000 metric tons per year production of polylactic acid from polymer grade lactic acid, cellulosic sugar and woody biomass:
Economic Benefits: Environmental Health Strategy Center/Jim Lunt & Associates, LLC, The Business Case for Commercial Production of the Bioplastics in Maine, A Preliminary Report submitted to Maine Technology Institute, October 2010.
Climate Benefits: Spierling S, Knüpfner E, Behnsen H, Mudersbach M, Krieg H, Springer S, Albrecht S, Herrmann C, Endres H-J (2018) Bio-based plastics – A review of environmental, social and economic impact assessments. *Journal of Cleaner Production* 185:476-491.
7. **INTEGRATED BIOREFINERY**, assumes production of TDO oil, further refined to aviation and diesel fuel, and furfural from consumption of 2,000 dry metric tonnes of woody biomass per day:
Economic Benefits: Crandall MS, Anderson JL, Rubin J (2017) Impacts of Recent Mill Closures and Potential Biofuels Development on Maine Forest Products Industry. *Maine Policy Review* 26(1):15-22.
Climate Benefits: Based on displacement of diesel fuel and emission factors from U.S. Environmental Protection Agency and Univ. Maine