The Latest in Heating and Cooling Technology

ClimateWork Summit on Maine's Economy and Climate Change

May 19, 2023

Emerging Trends

- HVAC technologies are trending towards electric systems that can heat and cool
- Whole building solutions without supplemental heat are proving effective in Maine
- Some technology, like VRF systems, can maximize simultaneous heating and cooling with room-by-room control
- Heat pump systems are manufactured with different designs to accommodate building type
- Commercial HPWH - ≥ 80 gallon capacity
- Efficiency Maine offers a one-stop-shop for electric HVAC systems support

Heat Pump Mini-Splits

- Most common type of heat pumps in Maine

Caribou Nursing Center

Two Fat Cats Bakery

Norridgewock Fire Department

Variable Refrigerant Flow (VRF) Systems

- Heat pump technology that efficiently heats and cools large spaces

University of Maine Augusta Dorms

Fryeburg Academy Student Center

Presque Isle Community Building

Packaged Terminal Heat Pumps

- Alternative to lodging Packaged Terminal Air Conditioners. Includes vertical units

Katahdin Inn and Suites

Holiday Inn by the Bay

Fireside Inn Bangor

Vertical Unit Example

Other Emerging Technologies

- Heat Pump Rooftop Units (RTUs)
  - A new heat pump alternative to traditional RTUs
- Commercial Heat Pump Water Heating
  - A larger scale version of a typical residential heat pump water heater
  - Allows for a larger hot water load at a higher temperature
- Gas Heat Pumps
  - Similar to electric heat pumps, but use heat from gas combustion to help condition the incoming air

Commercial and Industrial Prescriptive Initiative

Solutions	Measure Types	Maximum Incentive	Cash Incentive	Instant Discount [1]
Agricultural	Production and Storage Equipment	$5,000	✓ [2]	
Compressed Air	Compressed Air Systems and Controls	$3,500	✓ [2]	
Electric Vehicle	NEW Battery Electric Car or Pickup (BEV)	$4,500	✓ [3]	✓
	NEW Plug-In Hybrid Electric Car or Pickup (PHEV)	$3,500		
	NEW Battery Electric Work Van (Cargo Van)	$8,000		
	NEW Battery Electric Work Van (Chassis Cab or Cutaway)	$5,000		
Heating	Boilers	$12,500	✓ [2]	
	Controls	$1,325	✓ [2]	
	ECM Circulator Pumps	$75 – $250		✓
Heating and Cooling	Heat Pump Rooftop Units (RTUs)	$130/MBH	✓ [2]	
	High-Performance Heat Pump Systems	$1,250		
	Packaged Terminal Heat Pumps	$480		
	Retrofit Heat Pump for Small Businesses	$4,800		
	Variable Refrigerant Flow Systems	$6.00 per sq. ft.		
Lighting	Interior and Exterior Lighting	$0.28 per kWh saved (first year savings)	✓ [2]	
	Tube LEDs	$110		✓
Multifamily Weatherization	Attic and Basement Insulation and Air Sealing	$5,000	✓ [2]	
Refrigeration	Compressors, Controls, and Door Equipment	$600	✓ [2]	
Water Heating	Heat Pump Water Heaters	$850 – $950		✓

efficiency MAINE

Getting Started

Qualified Partners

Qualified Partners, or QPs, are experienced vendors, suppliers, and installers of energy efficiency equipment that are registered with Efficiency Maine.

- You'll need a Qualified Partner to install your project.
- QP Locator: efficiencymaine.com/at-work/qualified-partners/
- Customer Consultations: efficiencymaine.com/business-customer-consultation/

QP Locator

Customer Consultations

efficiency MAINE QUALIFIED PARTNERS

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Virtual Customer Consultations

MITSUBISHI ELECTRIC
HEATING & AIR CONDITIONING

The path to decarbonization is lined with Heat Pumps

- More Air to Water
- Increasing performance
- New refrigerants will move us toward new configurations.

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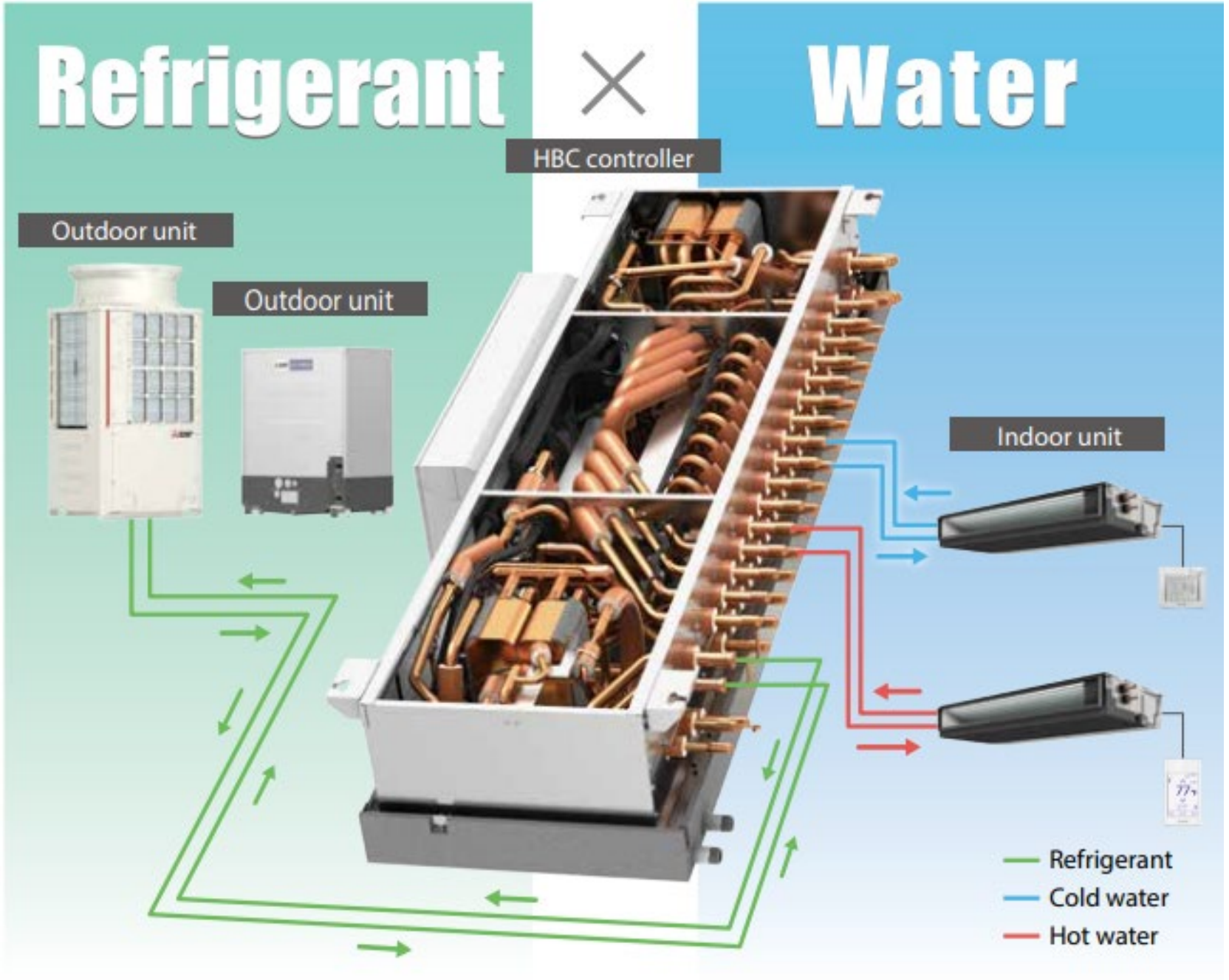
Hybrid VRF

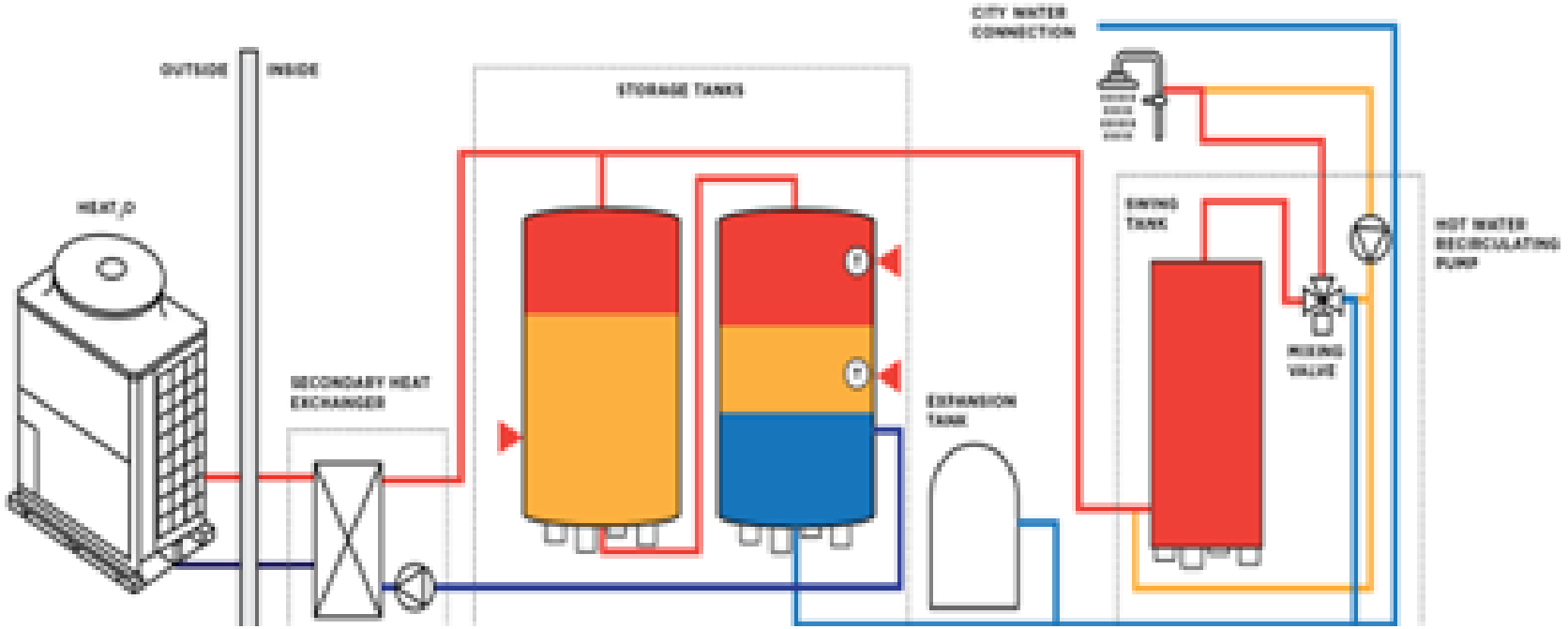
- Simultaneous heating and cooling with hydronics
- Less refrigerant
- Range of indoor styles soon



MITSUBISHI ELECTRIC
HEATING & AIR CONDITIONING

CO2 Water Heating

- Able to hit 176F even when -13F outside.
- Domestic water heating for commercial applications.
- R454C version coming



MITSUBISHI ELECTRIC
HEATING & AIR CONDITIONING

Even colder performance

(H2i SUMO) FS - series

- 100% capacity at -10F
- Operation to -30F

MITSUBISHI ELECTRIC
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Refrigerant Transition Coming

- Residential as of January 2025
- Commercial as of January 2026
- New Equipment will have A2L refrigerants with GWP less than 700 (R32 or R454B) (compare to R410A at ~2100)
- A2L are lightly flammable – but pretty hard to ignite and harder to keep burning.
- 410A will remain available for servicing existing equipment.
- Safety sensors and controls throughout.

By the end of the decade, we may see another transition… to A3 refrigerants e.g. – Propane (GWP 3)

MITSUBISHI ELECTRIC
HEATING & AIR CONDITIONING

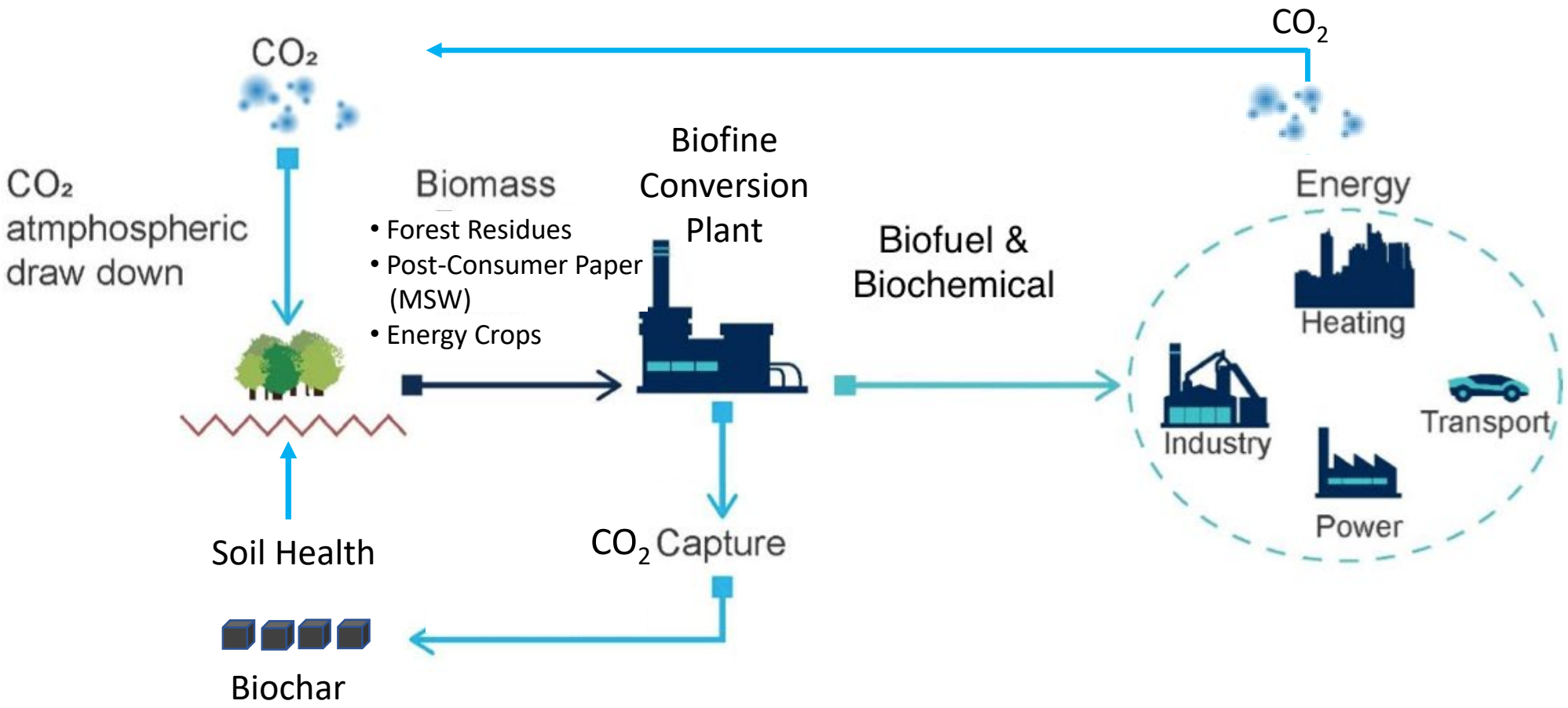
Changes for the Better

Biofine Developments Northeast Inc.

Presents:

A Solution to Climate Change via Circular Carbon Economy Development in Maine

CIRCULAR CARBON BIOECONOMY IN MAINE



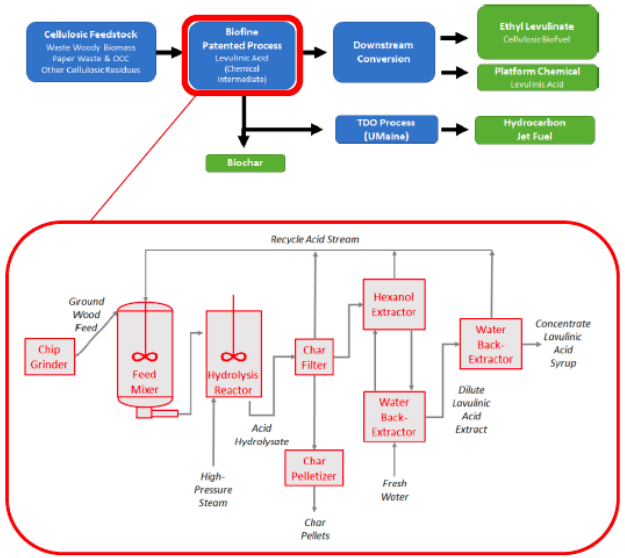
INTRODUCTION

Proprietary Biofine Technology	Enabling economic production of third-party verified GHG-negative biofuels, biochemicals, and biochar.1 Developed over 20+ years B2P2 Pilot Plant – Operating University of Maine – FBRI - TRC 1. EarthShift Labs – Argonne GREET 2.0 Lifecycle Analysis
Target Feedstocks	Forestry Residuals (Slash, Precommercial Thinnings) Municipal Solid Waste (MSW) Agricultural Residues Energy Crops
Target Markets	Initial target: Heating Fuels Future Targets: Aviation, Heavy Transport, Marine

BIOFUEL DEVELOPMENT & COMMERCIALIZATION

Multi-Phase Technology & IP Development

1999 – Presidential Green Chemistry Award. Dr. Stephen W. Fitzpatrick
2000's – Pilot Plant 1.0 and initial biofuel/biochemical development
2012– 2018 –Technology R&D and IP Issued
2016 - 2018 – EL Lab Testing – National Oilheat Research Alliance, MEMA
2018 – 2021 – EL Field Testing – Residential, Commercial



Commercial Development

2020 – Biofuels Digest - Next 50 Companies to Disrupt the World
2021 – Fuel Offtake Partner Announced – Sprague Energy
2022 – BDNE Qualifies Maine Biomass for RIN Credits (EPA)
2022 – Site Agreement – Town of Lincoln (Former Depot Street Mill)
2023 – Biorefinery Development Underway

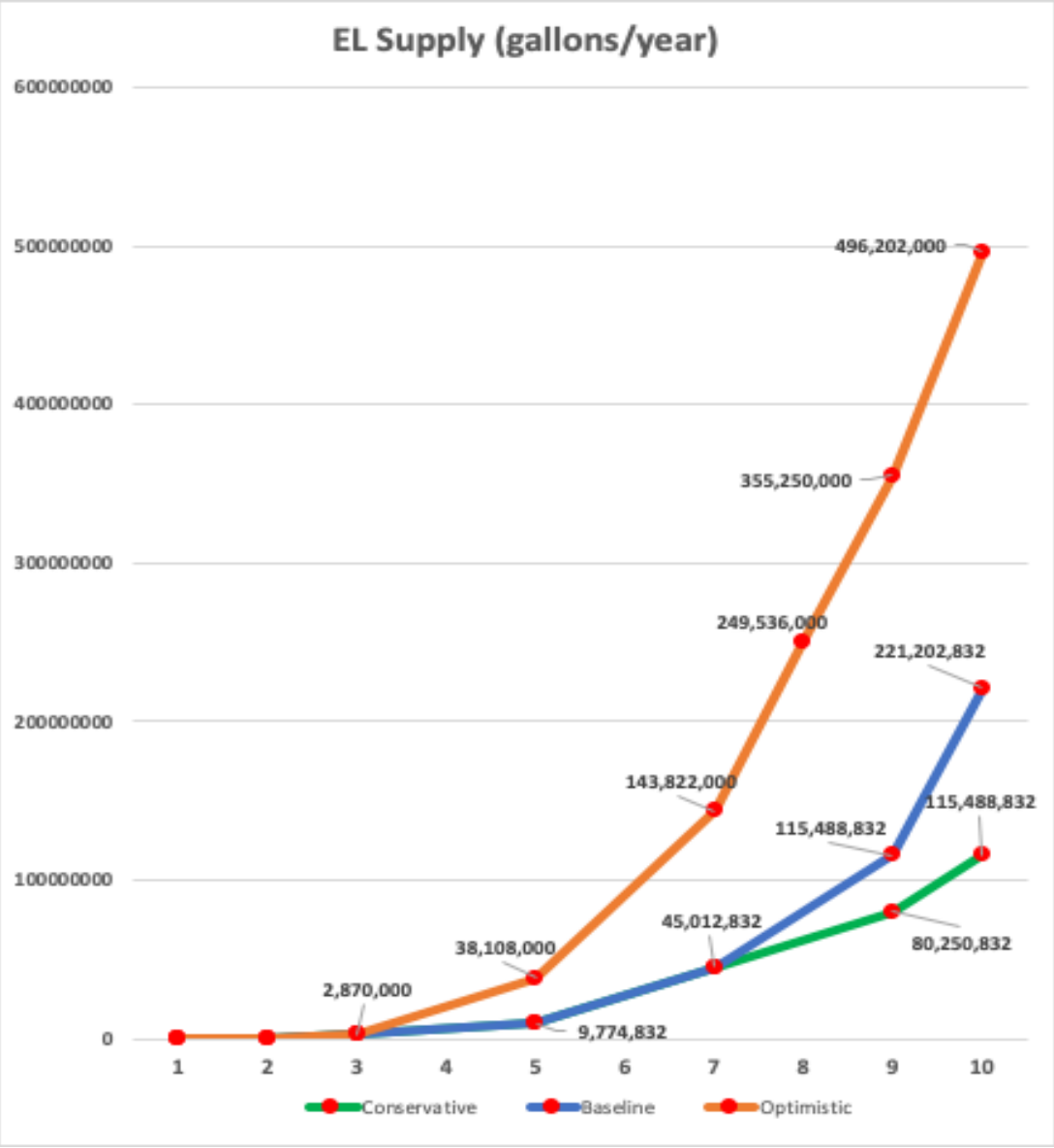
- Feedstock – RINS Qualified Woody Biomass

Lincoln Biorefinery Economic & Environmental Benefits

Input: ~35k dry tons forest residues
Annual Output: ~3 million gallons of EL, ~16k mt biochar
Estimated Jobs Created: 160
CO_2e Emissions Eliminated 73 million lbs.

- 8,129 gasoline-powered passenger vehicles
- 4,604 homes' energy use for one year
- 84,494 barrels of oil consumed
- 43,564 acres of US forests in one year

LONG TERM DEVELOPMENT BENEFITS



Development Scenario	Conservative	Baseline	Aggressive
Fuel Output (million gal/yr)	115	221	496
GHG Savings (million tons /yr)	1.3	2.9	6.6
Barrels of Oil (equivalency/year)	2.9m	6.2m	14m
Homes' Energy Use (equivalency/year)	162k	339k	761k
Cars Off the Road (equivalency/year)	287k	600k	1.3m
Wind Turbines (equivalency/year)	360	750	1,680
Acres of Forest (equivalency/year)	1.5m	3.2m	7.2m

Data Sources:

1. EPA GHG Equivalencies Calculator
2. EarthShift Labs – Biofine EL GREET 2.0 LCA

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