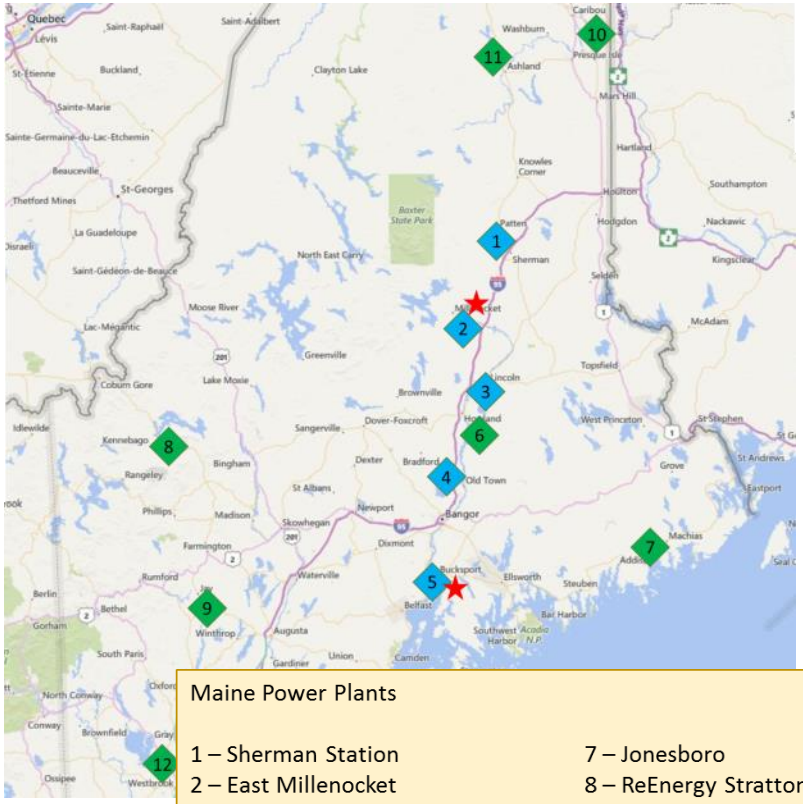
STORED SOLAR BIOECONOMY INITIATIVE

Maine - USA

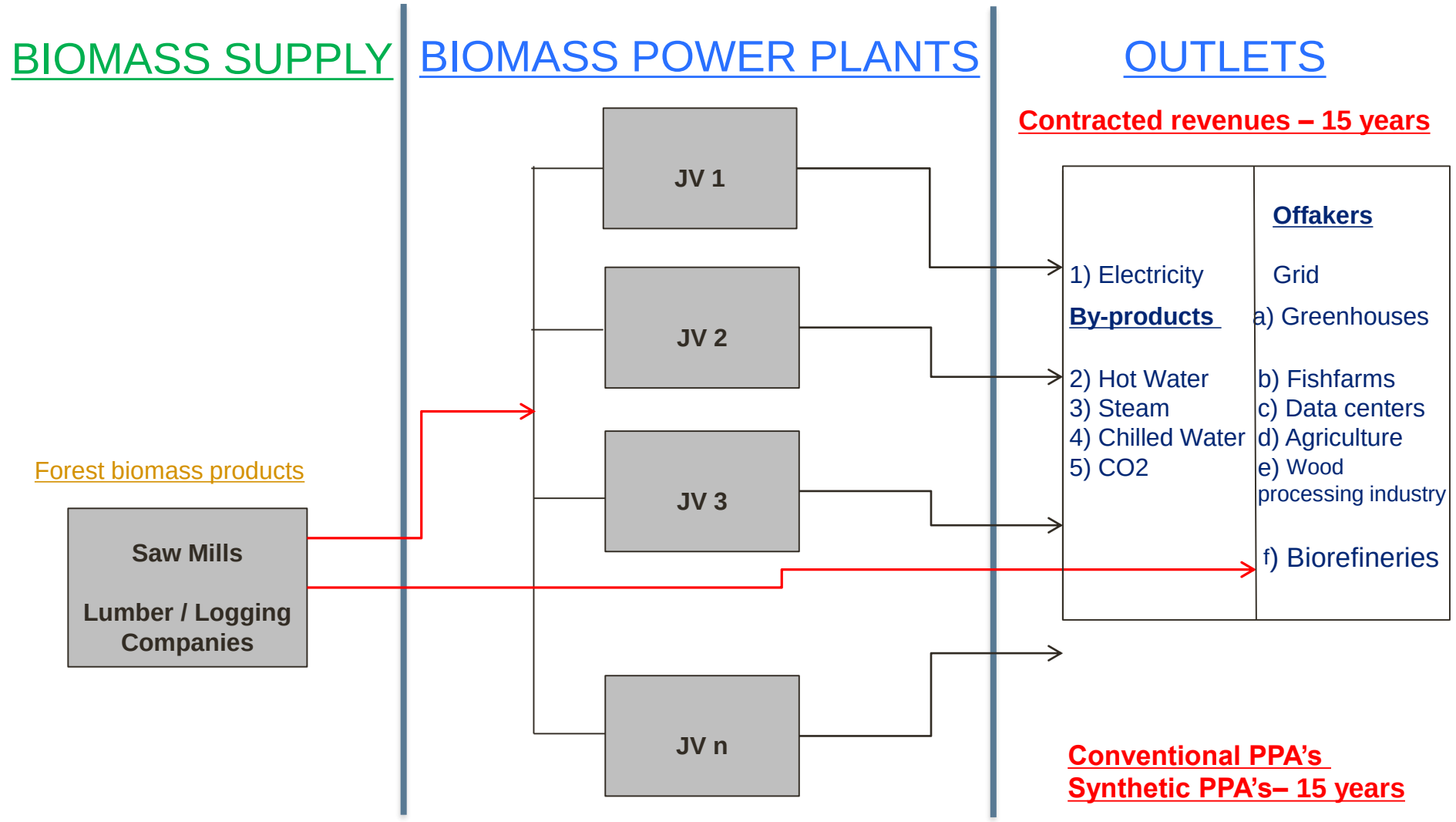
July 2016 – March 2017

What was our Road Map ?



1. acquiring idle power plants assets in Maine
2. re-purposing them into Energy Parks, re-powering the idle plants
3. activating and stabilizing the biomass supply channels
4. aligning the interests with the biomass community (equity in assets, biomass tolling agreements, …)
5. integrating co-hosts such greenhouses who will offtake heat and CO_2, or fish farms and Biorefineries, thus converting the power plants into CHP plants
6. benefiting from the existing infrastructure to avoid lengthy and expensive greenfield development (permitting, financing, etc.)
7. replicating successful co-hosts implementations

What was our Road Map ?

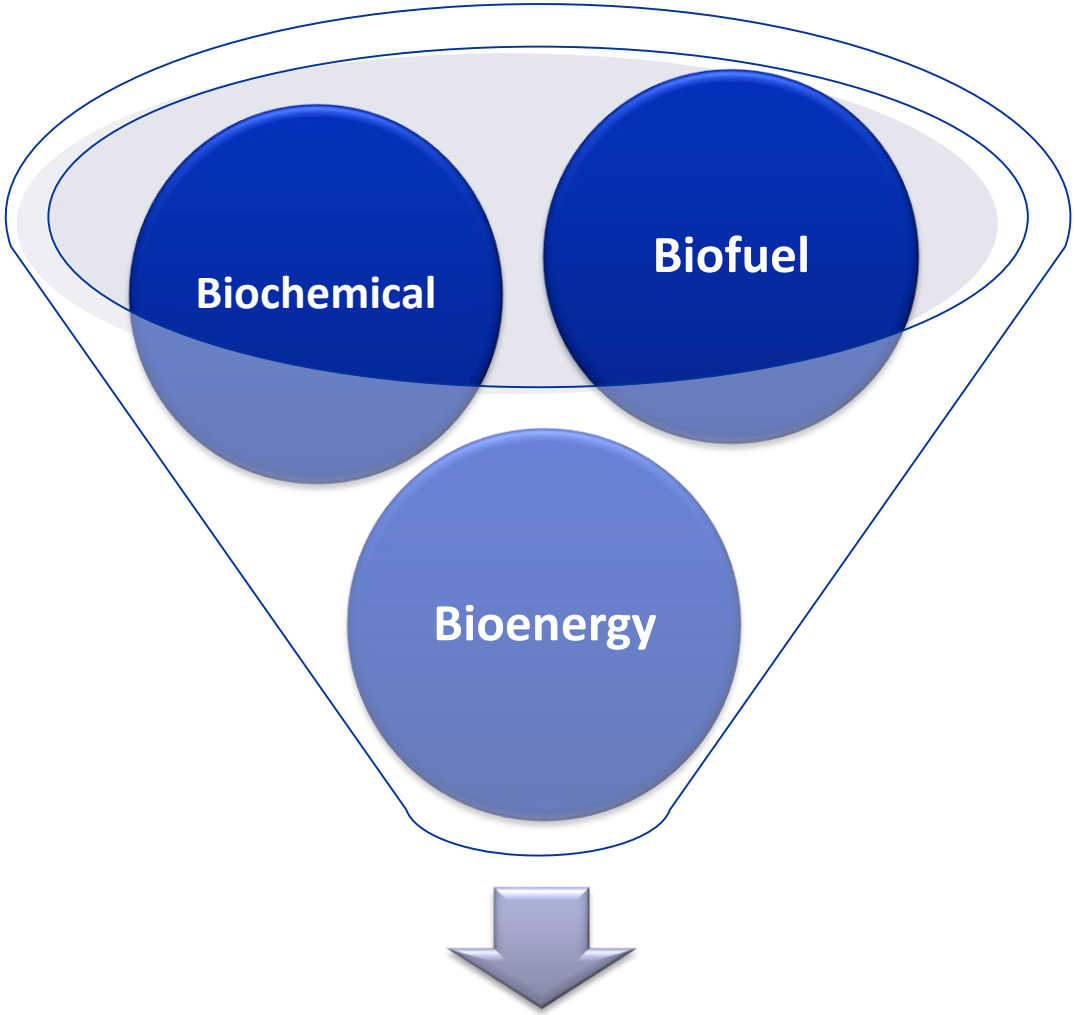


Biomass is stored solar energy - In harmony with nature

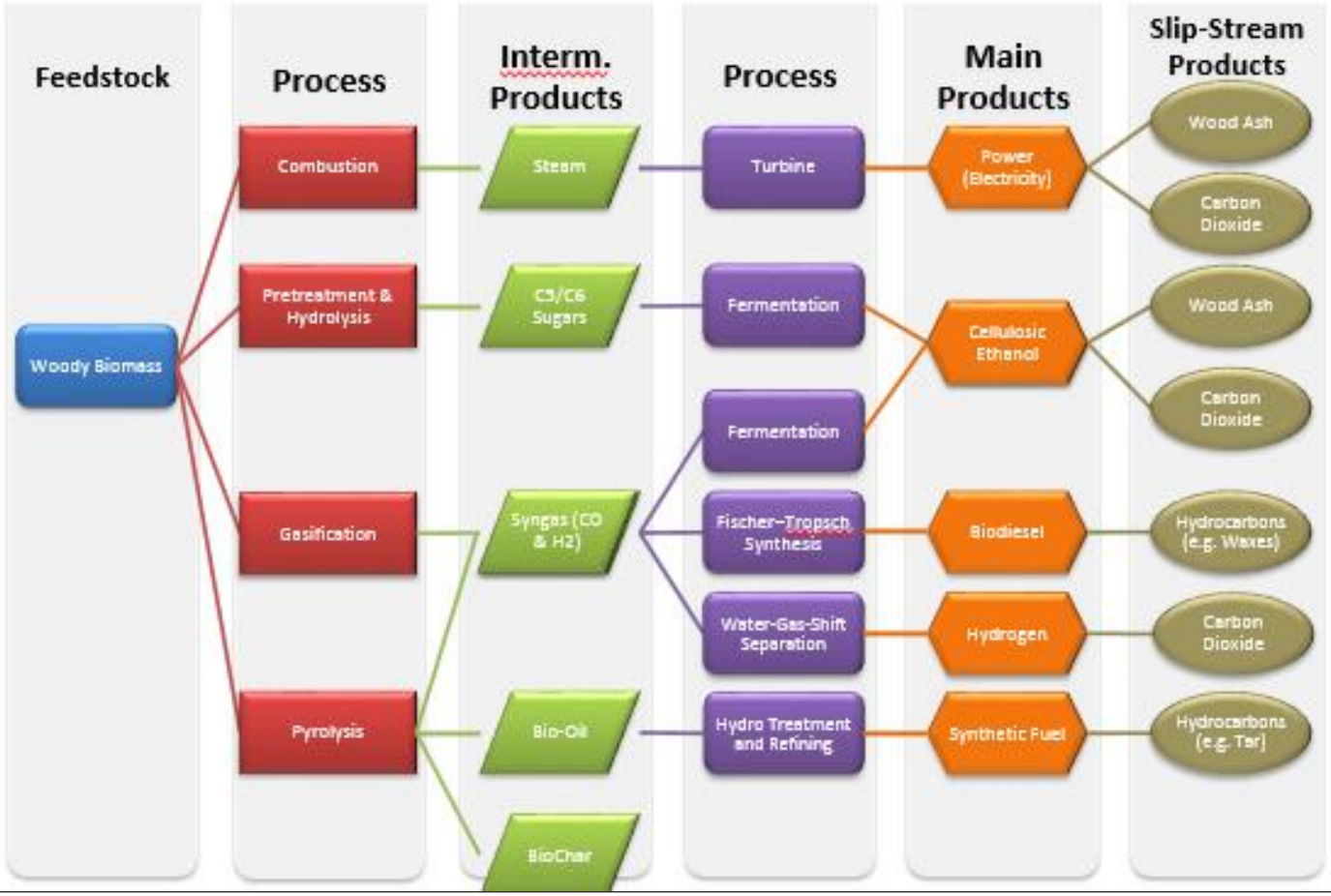
A WHOLE TREE APPROACH- INNOVATING HIGHER VALUE

BioEnergy Parks

Circular Zero-Waste Economics

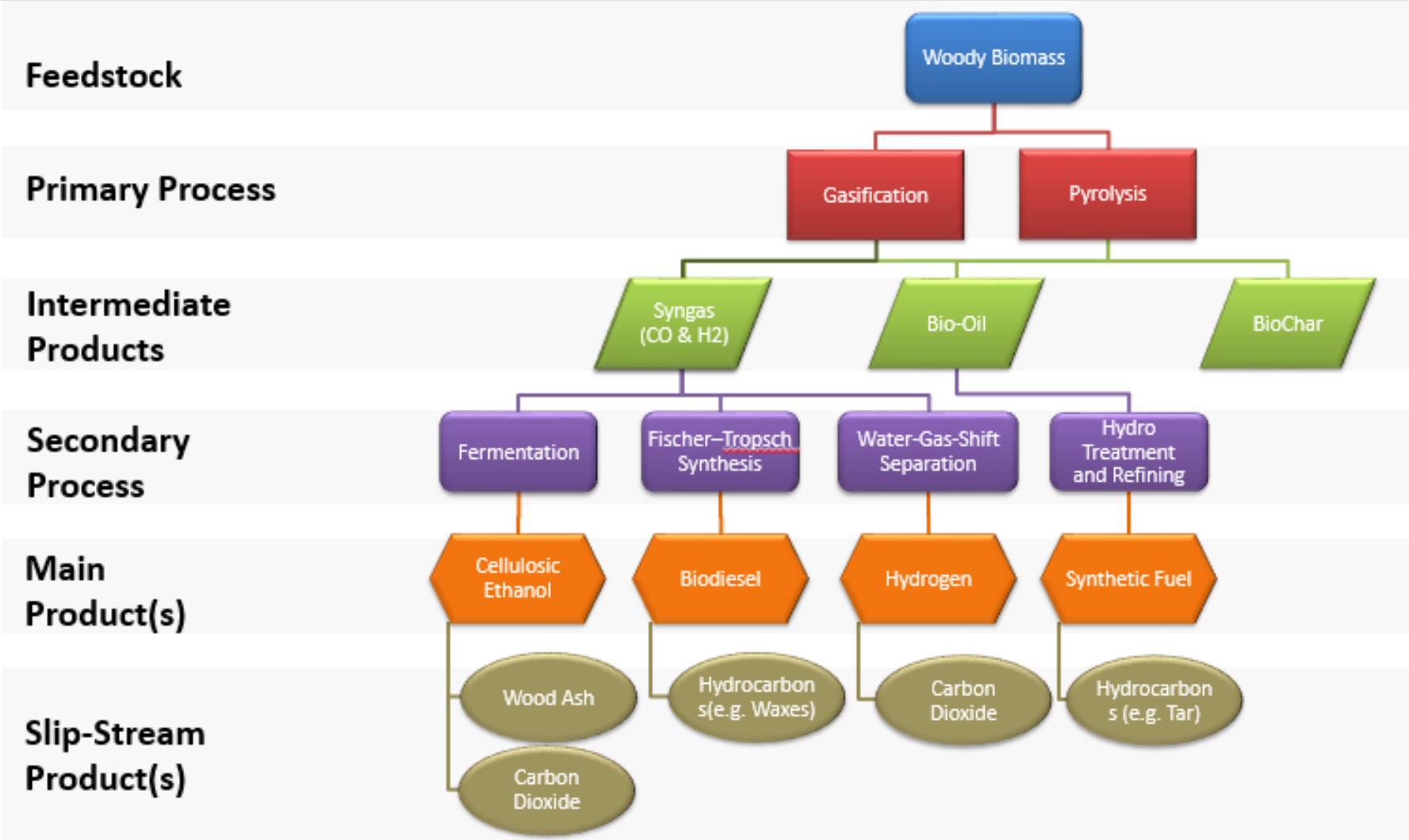


TYPICAL CONVERSION PROCESSES FOR WOODY BIOMASS



STORED SOLAR

BIG
BORN GLOBAL


Feedstock
Primary Process
Intermediate Products
Secondary Process
Main Product(s)
Slip-Stream Product(s)
Woody Biomass
Gasification
Pyrolysis
Syngas (CO & H2)
Bio-Oil
BioChar
Fermentation
Fischer–Tropsch Synthesis
Water-Gas-Shift Separation
Hydro Treatment and Refining
Cellulosic Ethanol
Biodiesel
Hydrogen
Synthetic Fuel
Wood Ash
Carbon Dioxide
Hydrocarbons(e.g. Waxes)
Carbon Dioxide
Hydrocarbons (e.g. Tar)

BORN GLOBAL SLIP-STREAM CHALLENGE

BIOCHAR

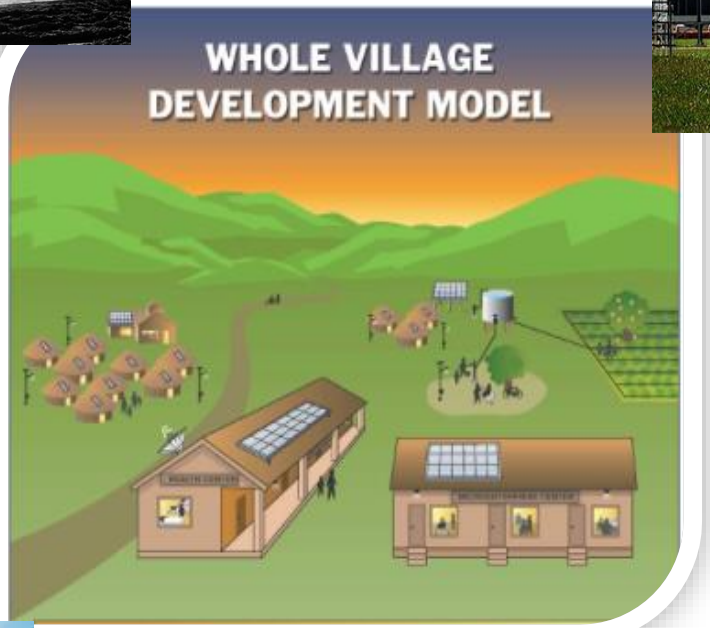
LIGNIN

CARBON CAPTURE

C5 C6 SUGARS

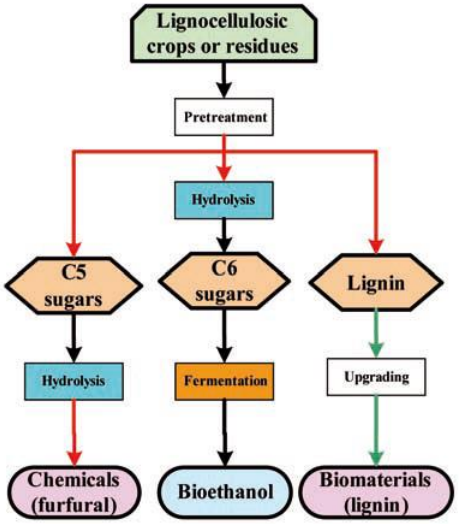
STORED SOLAR Biomass Energy Parks

Aquaculture
Fish Farms



Biorefineries
Drop-in fuels
Biodiesel, biogasoline, Biojet fuel

Biorefineries
Sugar and lignin extraction
Biochemicals sub-processes



Agriculture
Hi-Tech Greenhouses

Idled plants back in operation

STORED SOLAR WEST ENFIELD:

24.5MW capacity
Scheduled operation: 8000h /year
Scheduled biomass consumption: 245 000 tons/year

STORED SOLAR JONESBORO

24.5MW capacity
Scheduled operation: 8000h /year
Scheduled biomass consumption: 245 000 tons/year

The opportunity is with the perspective of repowering idle plants, activating the biomass supply networks, and most of all, integrating to the contemplated plants complementary activities to benefit from the marginal thermal heat that can be recovered to supply heat to greenhouses or fish farms to be implemented, or to extract CO_2 from flue gas and sell it on the market.

Kathadin Shrimp Farming Project

Summary of the Project

Project Key Metrics

- Locations : West Enfield, Jonesboro, East Millinocket, & other sites in Maine
- Design: Modular.
- Module size: 10,000 lbs production per year
- Required Area per module: 16,000 ft²
- Number of tanks per module: 16
- Annual Gross Revenues per module: $150,000
- Capital Investment per module: $175,000
- Logistics access to the site: Rail access, close to (I-95)
- Utilities: Renewable energy available on site for heat and power. Fresh Water available on site from wells or adjacent river
- Technology: Farming in controlled environment tanks
- Construction:
  - Light wooden or existing metallic structure
  - Tanks are laid out in rows so the floors can be easily cleaned and sterilized
  - Heating and fresh air from the ceiling and walls
- Energy consumption:
  - I) 400,000 BTU/hr at 85°F (available from waste heat recovery of biomass power plant)
  - II) 150 MWh per module per year

Key features

Operator

- Is a very experienced shrimp farmer since in 2004
- Crafted state-of-the art process
- scaled up the operation over 10 years in 3 different expansions
- worked with multiple researchers and utilized a variety of technologies, both proven and untested
- focuses on best designs and technologies improvements
- Finalized proprietary software and operating procedures
- Finalized proprietary tanks design
  - to maintain biosecurity
  - to maintain all the conditions for the growth of the shrimp, including DO, pH, SS and Temperature
  - to provide aeration and oxygen for the animals and mixing of the water
  - to provide salt water medium for farming - Artificial Salt Water (ASW) with salt mixes and fresh water or from natural sources
  - To ensure water reuse: Zero Exchange Aerobic Heterotrophic (ZEAH) System

Penobscot Greenhouse Project

Summary of the Project

Project Key Metrics

TOMATOES ON THE VINE

BEEFSTEAK TOMATOES

- Location : West Enfield, Maine
- Total Area: 58 acres in 3 phases, over 3 years
- Logistics access to the site: 10 miles from Rail access, 7 miles from (I-95)
- Utilities: Renewable energy available on site for heat and power. Water available on site from wells
- Technology: Glass Greenhouse
- Produces: Organic Tomato on the Vine and Beefsteak varieties
- Annual production volume: 2,5 million lbs.
- Annual Gross Revenues: $31,000,000
- Total Capital Investment: $75,000,000 for all phases
- Construction: greenhouse setup with horticultural area as well as all required service areas for heating and irrigation installations, a packing area, lunchroom and offices

Key features

- Operator is a "Build and Sell" greenhouse designer, manufacturer, and builder, since 1999, with over 130 acres in Canada and 45 acres in the United States in portfolio and is investing equity on the project
- Operator is largest independent vertically integrated greenhouse produce growers in Canada, largest greenhouse bell pepper growers in North America
- Expertise in state-of-the-art greenhouses that guarantees quality, with over 2000 acres of greenhouses built in the U.S. and Canada
- Extensive use of:
  - automation for cost control,
  - technology for increased crop yield,
  - varietal & flavor profile advancements for consumer appreciation
- 0% nutrient water discharge to maximizes water efficiency by recycling the excess irrigation water that the plants do not utilize
- Integrated Pest Management systems that use good bugs such as Lady Bugs and many others to reduce the need of pesticides
- Bright friendly packaging that is the most environmentally responsible. All packaging is 100% recyclable
- utilization of verified non-GMO seeds for all our tomato, bell pepper and cucumber varieties.

STORED SOLAR EAST MILLINOCKET (30MW)

Penobscot Biorefinery Project

Summary of the Project

Project Key Metrics

- Location : East Millinocket, Maine
- Available surface area: 230 acres owned by a subsidiary of Capergy
- Required surface area for the Project: 80 acres
- Logistics access to the site: Rail, road (I-95) and waterway (Penobscot River to coast)
- Feedstock: Forest biomass, Slash, hard & soft woodchips, bark, branches, saw mill waste, etc.
- Feedstock volume: 365,000 dry metric tons of forest biomass per year, 1000 dry metric tons per day
- Capacity: 92,000 gallons per day of biofuel liquids
- Primary Products: Bio fuel liquids: biodiesel and gasoline
- Bio-Diesel: Meets ASTM D975-15c - EN 590
- Bio-Gasoline : Meets ASTM D4814-16d - EN 228
- Secondary products: Bio-Char, Biogenic CO2, Bio-LPG, NH3 Fertilizer, Concentrate, S Fertilizer
- GHG Reduction: Up to 95% reduction versus fossil product for biodiesel liquids, based on Life Cycle Assessment report by MICHIGAN TECHNOLOGICAL UNIVERSITY
- Project, process and products qualify for D3/D7 RINs, Carbon Credits under CA LCFS and Renewable Diesel Blending Credits

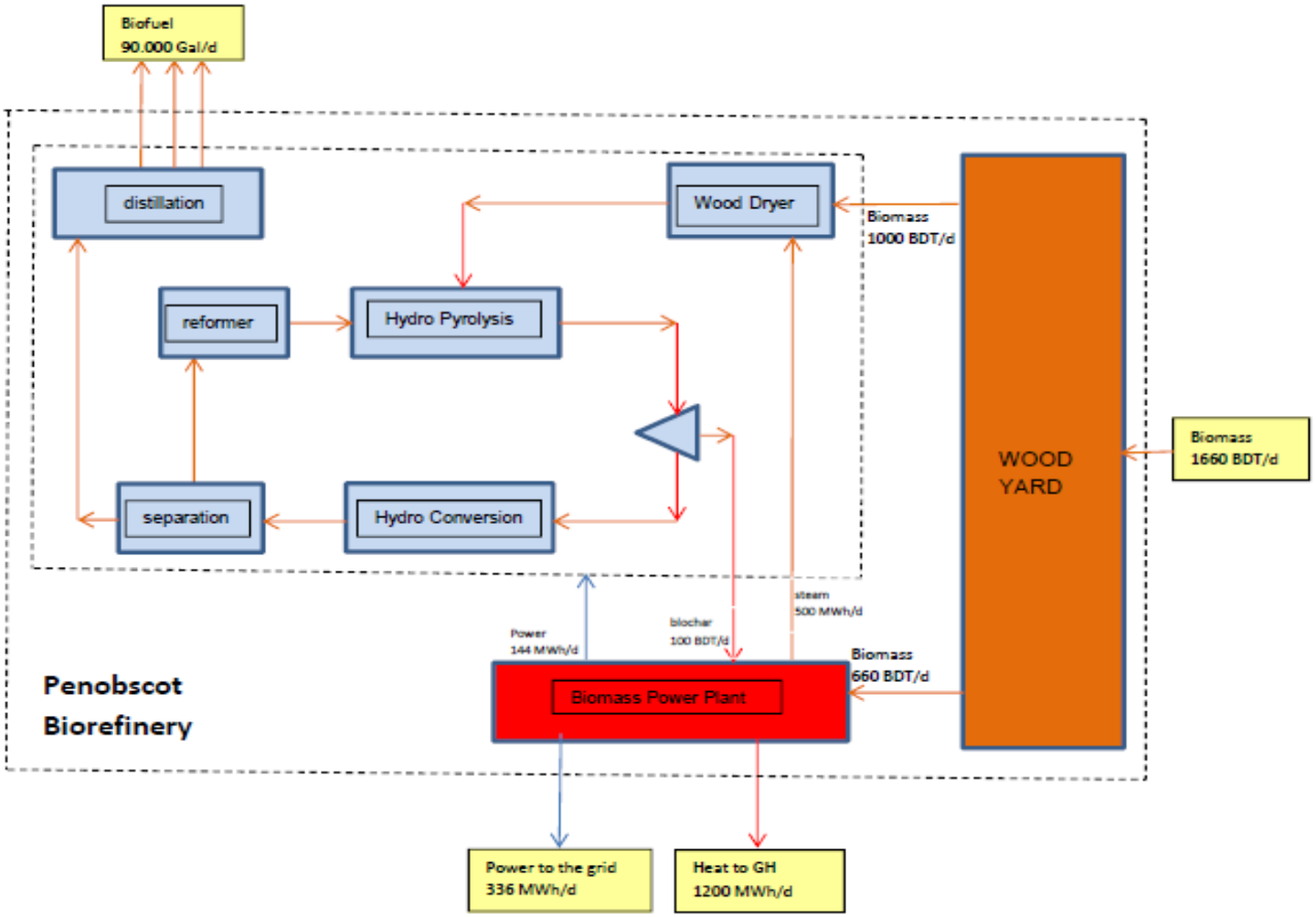
Key figures

- Total Investment : $ 240,000,000
- Engineering, license and development costs: $ 18,000,000
- Construction cost : $ 222,000,000
- Loan from DOE : $ 148,000,000 - Loan period: 15 years
- Equity: $92,000,000 including contribution from CAPERGY (30MW Power and Steam Plant + site infrastructure)
- Based on market price of biodiesel and electricity with 50% of the eligible RINs:
  - Annual Revenues[1] $142,000,000
  - EBITDA[1]: $ 56,000,000
  - EBIT[1]: $ 46,000,000
  - Net Income[1]: $ 17,000,000
  - Levered Project IRR[1]: >16%

(Note 1) average calculated from first year till last year of loan repayment with only the sale of hydrocarbon biofuel, heat and electricity taken into account in the revenues. DS revenue on the secondary byproducts. Only 50% of the eligible RINs on the biofuel have been considered

PENOBSCOT BIOREFINERY

Overall Project Concept



Feedstock	Woody Biomass
Primary Process	Combustion / Pretreatment & Hydrolysis
Intermediate Products	Steam / C5/C6 Sugars
Secondary Process	Turbine / Fermentation
Main Product(s)	Power (Electricity) / Cellulosic Ethanol
Slip-Stream Product(s)	Wood Ash, Carbon Dioxide / Lignin, Carbon Dioxide