

Mr. Arnold is currently the General Manager for RSE Pulp and Chemical in Old Town. He is directly responsible for coordination of all activities associated with the start-up of the Red Shield Environmental biomass boiler and the RSE Pulp & Chemical pulp mill. From 2003 to 2005, he was Vice President and Mill Manager for the Katahdin Operations of Katahdin Paper Company in Millinocket. He was voted Mill Manager of the Year in 2003 by the Paper Industry Management Association. Mr. Arnold has also held many technical and leadership positions with Fraser Papers (under its many name changes!). During the more than 25 years he spent with the company, he was everything from Area Engineer to Vice President and Mill Manager in the Madawaska Operations. Please welcome Dick Arnold.....

## *The Northeast Forest Bioproducts Puzzle*

**A STRATEGIC PLANNING SESSION**

October 18 & 19, 2007

Bangor, Maine

# *Red Shield*

## Environmental *Renewable Energy Development*



October 18, 2007

# Red Shield Environmental

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## Case Study

### Red Shield Operations &

### An Integrated Biorefinery in Old Town, Maine

# Red Shield Environmental

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- Background
  - Investment firm focused on the refinancing and start-up of Maine businesses , keeping operating jobs in Maine.
  - Owner Former GP Mill Assets in Old Town, Maine
  - Biomass Boiler Operations with 16 MW Turbine
  - Integrated into ISO-NE Markets
  - Industrial Site
    - Cost Effective Steam & Power
    - Extensive Warehouse/Manufacturing Space
    - Good Infrastructure – Water, Utilities, WWTP
    - Permitted – Air, Water

# Red Shield Environmental

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- RSE Objectives
  - Energy-related Campus
  - Focused on Renewable Energy Development
  - Prospective Projects
    - Cellulosic Ethanol >> Pulp Line
    - Wood Pellets
    - Industrial Heat Pumps
    - Commercialization ~ Technologies
    - Old Town Logistics

# Red Shield Environmental

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- 2006 Accomplishments
  - Purchased November 3<sup>rd</sup>
  - November 24<sup>th</sup> – First fire in boiler
  - November 26<sup>th</sup> - #6 turbine on line
  - December 2<sup>nd</sup> – Started burning CDW
  - December 14<sup>th</sup> – Interconnect agreement with ISO-NE
  - Rehired 55 employee
  - 80,000 tons of CDW & 100,000 tons of biomass
- 2007 Accomplishments
  - January 23<sup>rd</sup> – Integrated in ISO-NE Markets
  - RSE Pulp & Chemical ~ May 11<sup>th</sup>
  - Re-start Boiler May 23<sup>rd</sup> & Turbine May 24<sup>th</sup>
  - Pulp Line Start-up June 1<sup>st</sup>
  - CO Minimization August 1<sup>st</sup>
  - RSE Ethanol Project ~ DoE Grant Application August 14<sup>th</sup>
  - Rehired 125 employees
  - 600,000 tons of hardwood pulp chips
  - Forest Certification by year-end

# Red Shield Environmental

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- Re-Start of Fiber Line
  - Opportunity for Forest Products Biorefinery – Cellulosic Ethanol
  - Commercialized Ethanol Production Integrated with Kraft Pulping Process
    - Van Heiningen Ethanol Process Pilot Facility
      - Pulp Quality Not Affected
      - Yield Improvements
      - Emissions Benefits
  - Facility currently has 2 Digesters/Lines
    - Proforma based on 550 TPD Fiber Line
      - Single Digester
      - Utilize Hardwood
  - Competitive Cost Structure
    - Stable Energy Platform
    - Local Available Trained Labor
    - Fiber Available
  - Markets are Favorable – Both Ethanol and Pulp



# RSE Pulp & Chemical

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- Background Work ~ Ethanol
  - Forest Products Focus
    - Corn In Short Supply / Wood Fiber Plentiful in Maine
  - University of Maine R&D Work (van Heiningen)
    - NSF Grant
    - Moving Bench and Pilot Scale Work to Commercialization
- Partnership – RSE and UMaine
  - Wood Cost for Ethanol Production Alone = Not Viable
    - Use of Fiber for Ethanol and Pulp Makes Ethanol Production Viable.
  - Potential Environmental Benefits - Combined Process
    - Reduction of Methanol During Wash Cycle
    - Reduction of TRS

# RSE Pulp & Chemical

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- Compliance Schedule EPA – Clean Air Act
- Subpart S Deadline HAP Emissions - HVLC
  - 12 month extension
    - Research & Development Period
    - Evaluate “Extraction & Evaporation” Processes (Lab & Pilot)
  - Enforceable Agreement Regarding Process and Deadlines for Meeting HAP Emission Limits or Determination of Non-Applicability
  - Coordination Regarding
    - Air Regulation
    - Research & Technology

# RSE Pulp & Chemical

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- Move from proven Bench Scale Trials
  - >>>> Batch Pilot Plant Trials
    - >>>>Commercialized Continuous Trial
      - >>>>Commercialized Production Run
        - >>>>On-going operations
- Timing:
  - Opportunity With RSE Is Now
  - Market Driven Opportunity
- Importance to State Economy
- Crucial to the Future of Forest Products Industry in New England / USA

# *RSE* Pulp & Chemical

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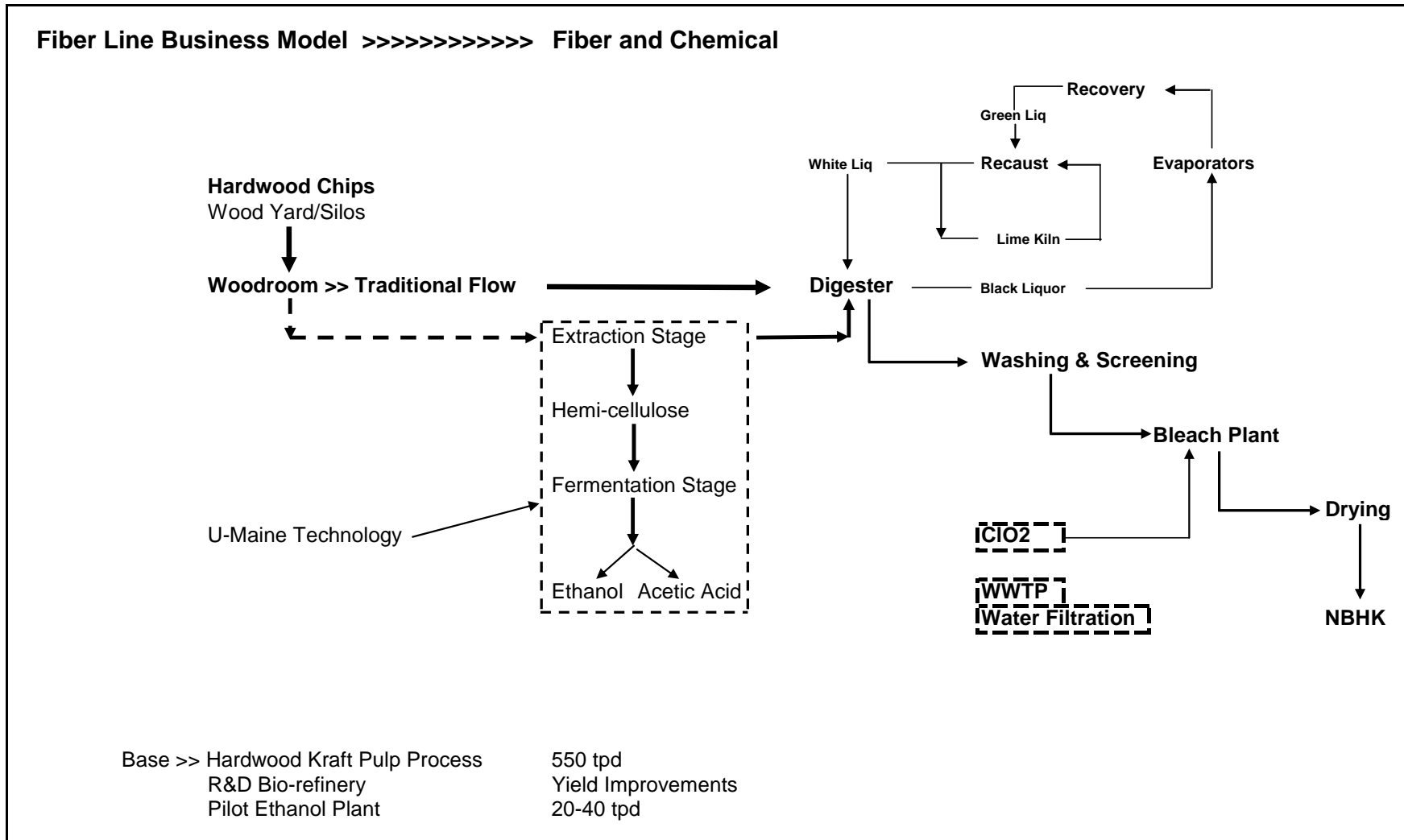
- Advantages of RSE Site
  - Equipment Configuration
  - Capital requirements
  - Timeline
  - Proximity to University
  - Digester Configuration
  - Availability & Space
  - Infrastructure (WWTP & Utilities)
  - Permitted Site (Air & Water)

# *RSE* Pulp & Chemical

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- Capital Requirements
  - Phase I – Extraction >> \$ 2 million
    - Process Development
    - Engineering
    - Modifications
    - MTI Funding
  - Phase II – Full Scale Pilot Plant >> \$ 70 million
    - R&D and Process Development
    - Engineering
    - DOE Funding
    - Equipment & Installation
    - Environmental/Regulatory

# RSE Pulp & Chemical



# RSE Pulp & Chemical

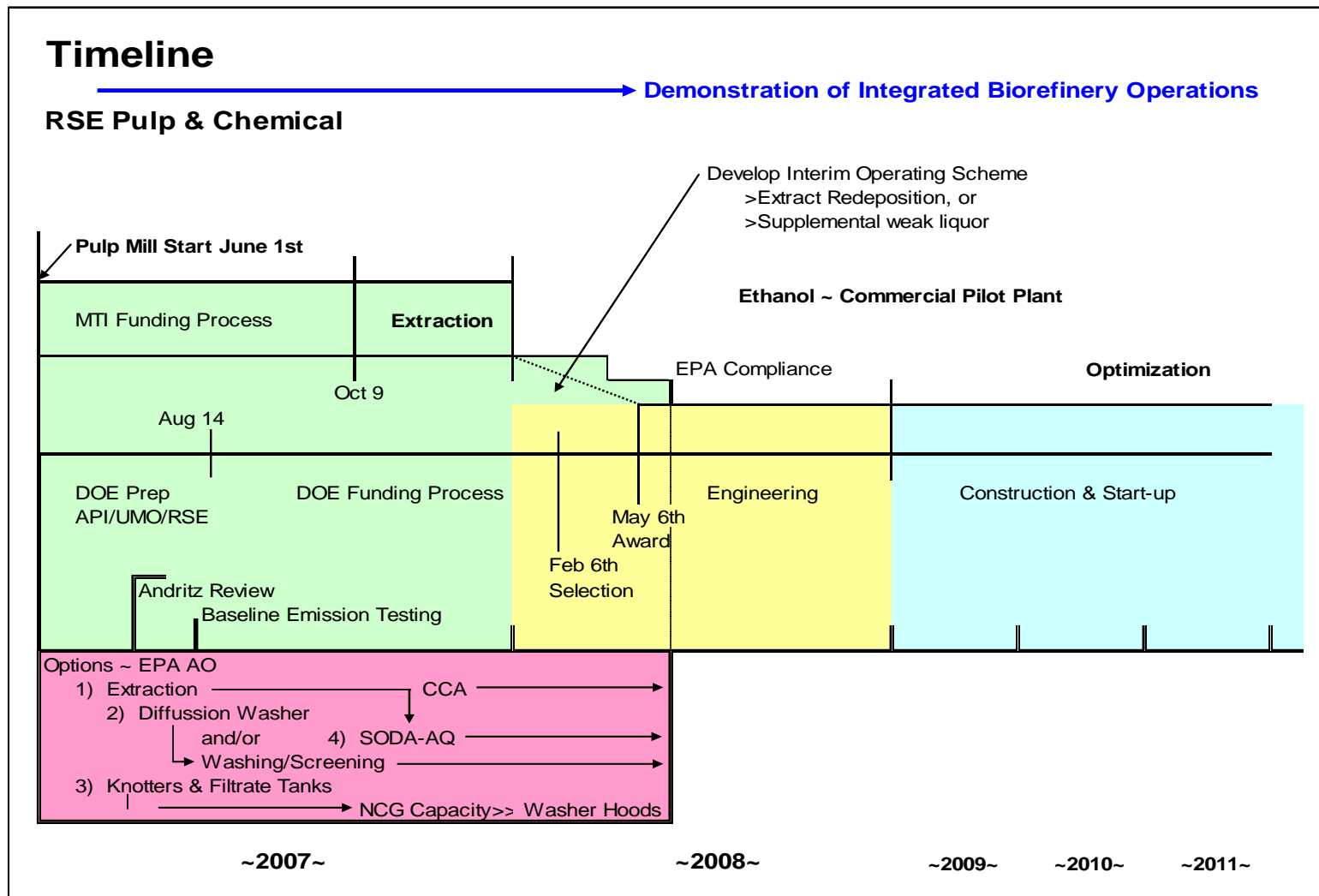
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Snapshot - current state of cellulosic ethanol production.

	<b>Corn Based</b>	<b>Cellulosic Today?-- Illustrative</b>	<b>Cellulosic 2010-12— DOE target</b>
Feedstock	\$1.17 @\$3.22/bu 2.75g/bu	\$1.00 @\$60/dt 60g/dt	\$0.33 @\$30/dt 90g/dt
By-Product	-\$0.38	-\$0.10	-\$0.09
Enzymes	\$0.04	\$0.40	\$0.10
Other Costs**	\$0.62	\$0.80	\$0.22
Capital Cost	\$0.20	\$0.55	\$0.54
Total	\$1.65	\$2.65	\$1.10
g = gallon, dt = dry ton. ** (includes preprocessing, fermentation, labor)			

Ref: Chief Economist, USDA, March 2007

# RSE Pulp & Chemical





# *RSE* Pulp & Chemical

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- DOE Goal >> Bring down the overall production cost to produce cellulosic ethanol to \$1.07 a gallon by 2012, lower than the current cost of corn-based ethanol.
- **Competitive advantage** >> RSE Pulp & Chemical and the University of Maine have an advantage over many other proposed projects. This advantage involves available assets, expedited timing in terms of execution and market penetration, and expertise in technology that has been pilot tested in the laboratory.

# Assessment of Current State

## NE Forest Bioproducts

### Strengths

- Operations and industry knowledge
- Diverse product capabilities
- Technology & expertise
- Low cost producer
- Ample fiber or feedstock supply
- Carbon neutral or better

### Opportunities

- Augment pulp mill revenue stream
- Process integration & energy enhancement
- Weakening of US \$ versus Euro & Cdn \$
- Market penetration & timing
- Synergistic with operating facilities
- Boost to Maine Economy

### Threats

- Product substitution
- Competing technology
- Additional capacity – new start-ups
- Increases in non-controllable costs
- R&D funding need & associated risk
- Environmentalists

### Weaknesses

- Market perception ~ non-competitive Maine
- Few process development opportunities
- Equipment ~ capital intensive in nature
- Shortfall in biomass & wood harvesting
- Regulatory bureaucracy
- Wood Costs