FBRI

FOREST BIOPRODUCTS RESEARCH INITIATIVE

Making of a Forest Biorefinery – The Maine Difference

Discovering a Sustainable Bio-Economy

Hemant Pendse
Prof. & Chair

NSF EPSCoR

THE UNIVERSITY OF MAINE 1865

Plan with a Purpose: Lead!

Science & Technology Research Infrastructure

NSF EPSCoR

DOE EPSCoR
$13 M
Research Personnel
Bench/Lab Scale
Analytical
Batch Processes

Technology Center

State R&D Bond

& Private Funds
$10 – 20 M

* Large Scale Processing
* Hemi Extraction
* Biological and Thermochemical Converstion of Ag & Forest Biomass

Technology Cluster
Private Funds/Govt Grants
$50 - $200 M

Integrated Ag & Forest Biorefinery
Co-located at:
•Pulp mill
•Co-Gen site
•OSB/OSL Plant
•Saw Mill/Chip Mill
•Potato Processing Plants

Forest and Ag Bioproducts
Technology Development Continuum

Technology Asset Fund

Technology Center Renovation Grant Award Expected ($4.7 million over 4 years)

Technology Center

CONSTRUCTION

OPERATION >>>>>>>>>>>>>>>>>>>>>

DOE Small-Scale Biorefinery Grant Award Expected ($4.0 million over 4 years)

DOE Old Town biorefinery

CONSTRUCTION >>>>>>

OPERATION >>>>>>>>>>>>>

DOE EPSCoR Implementation Grant Awarded ($1.9 million over 3 years)

DOE Implementation Award

DOE Implementation Continuation Award

NSF EPSCoR Research Infrastructure Improvement Grant Awarded ($6.9 million over 3 years

NSF Infrastructure Improvement Award

2004 2005 2006 2007 2008 2009 2010 2011 2012

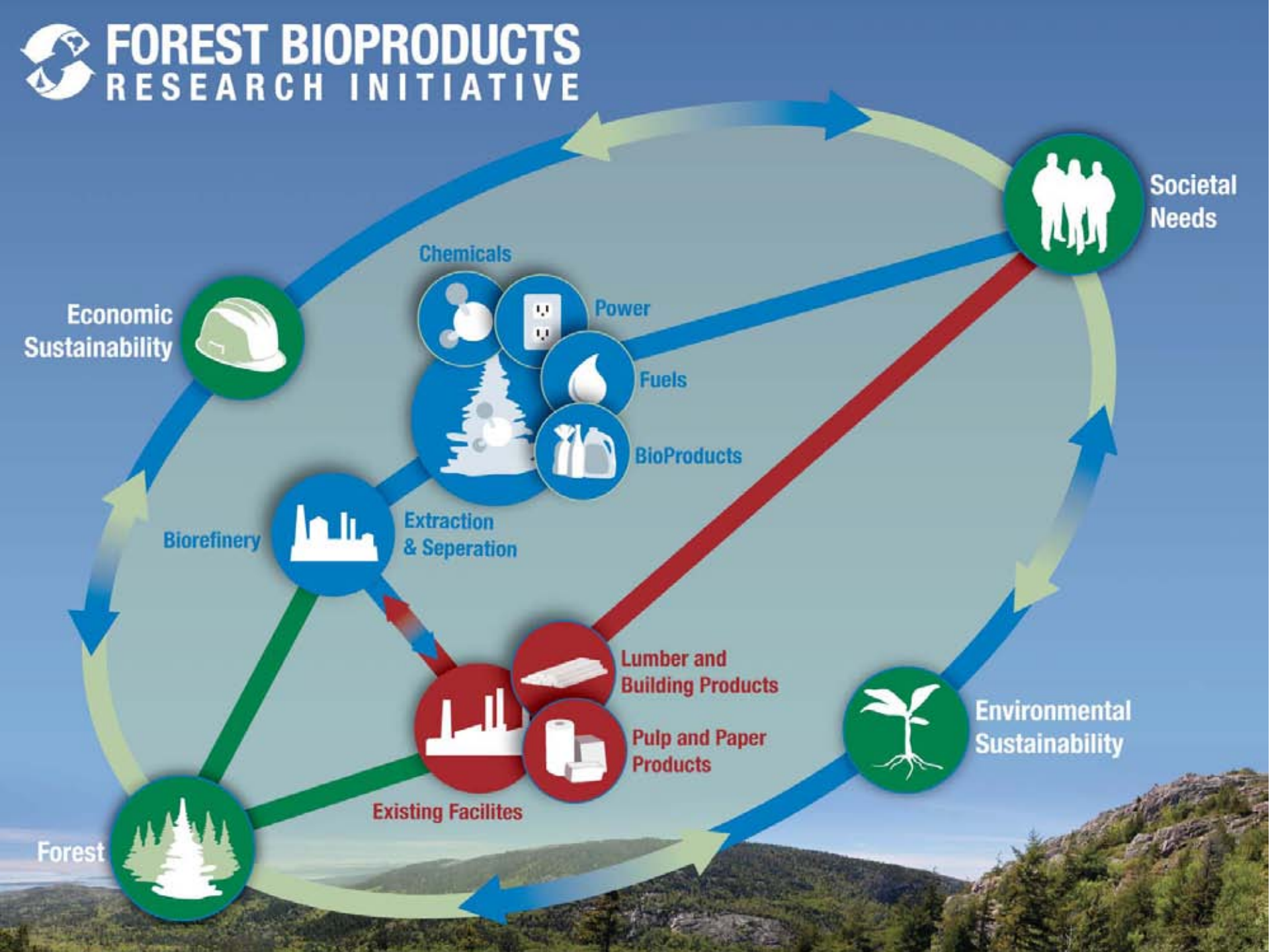
FBRI Planning Initiated

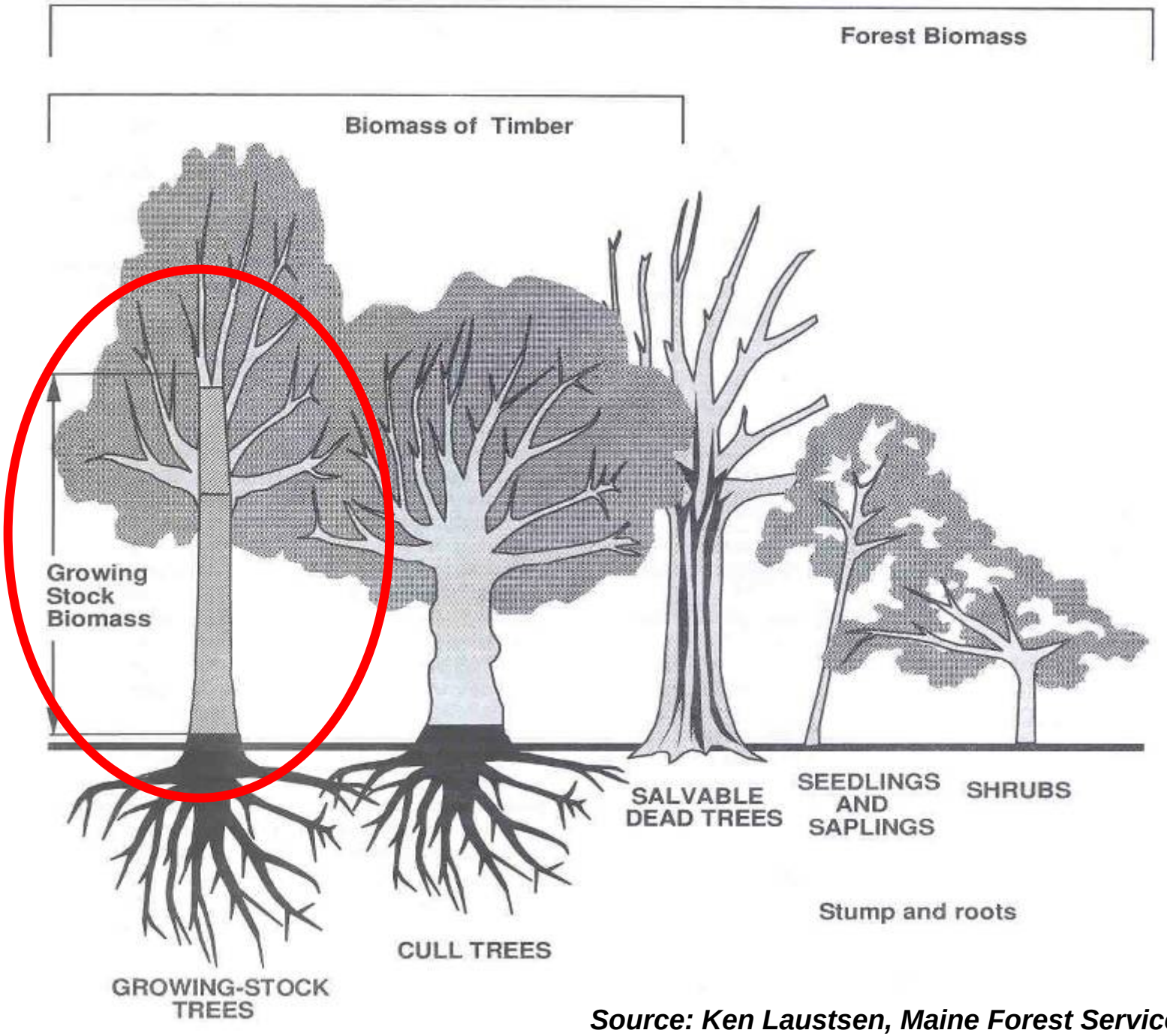
FBRI -NSF Proposal Submitted

FBRI -DOE Proposal Submitted

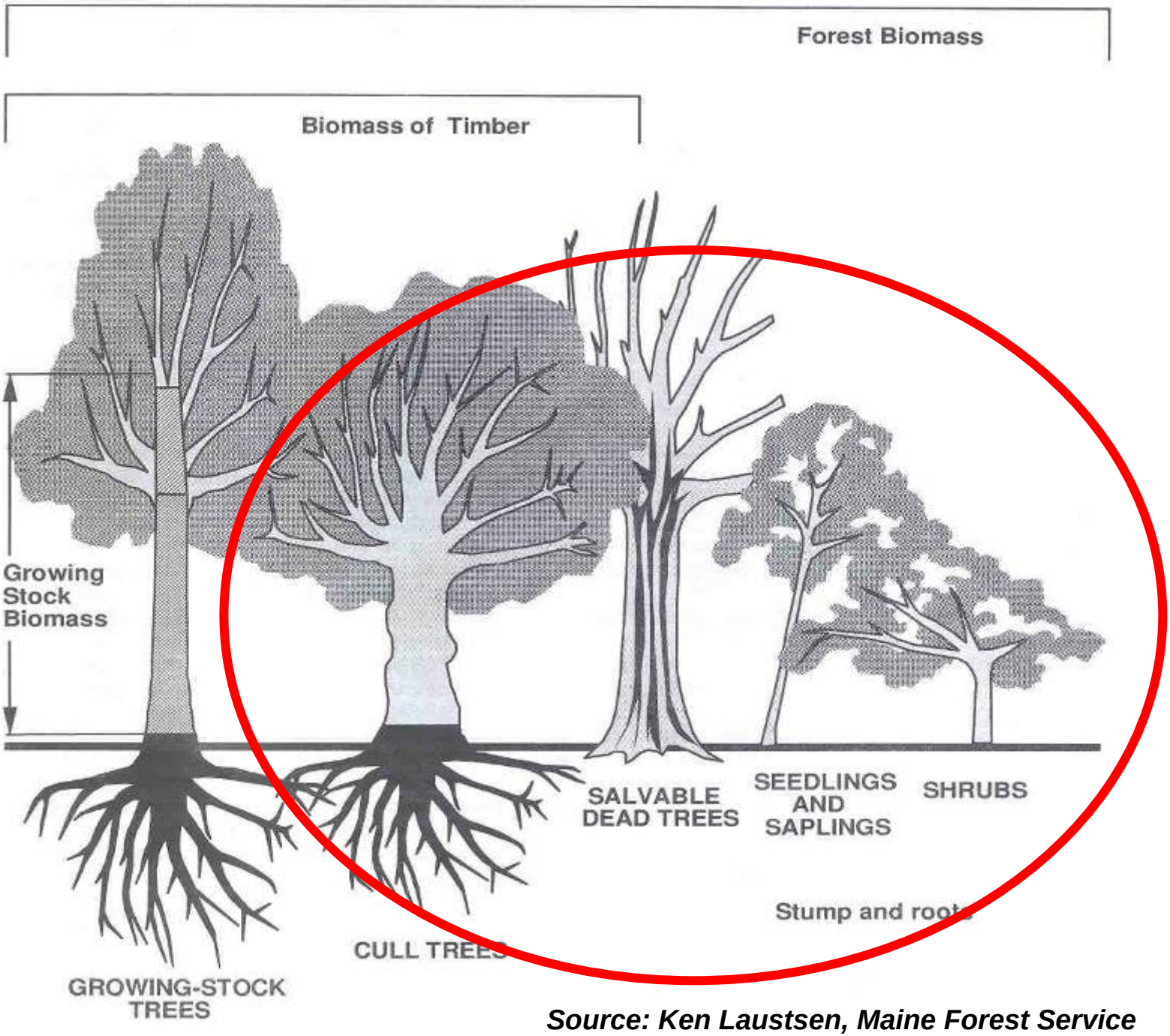
Old Town Biorefinery Proposal Submitted

FBRI Technology Center Proposal Submitted


FOREST BIOPRODUCTS
RESEARCH INITIATIVE
Societal Needs
Chemicals
Power
Fuels
BioProducts
Economic Sustainability
Biorefinery
Extraction & Seperation
Lumber and Building Products
Pulp and Paper Products
Existing Facilites
Environmental Sustainability
Forest



Source: Ken Laustsen, Maine Forest Service



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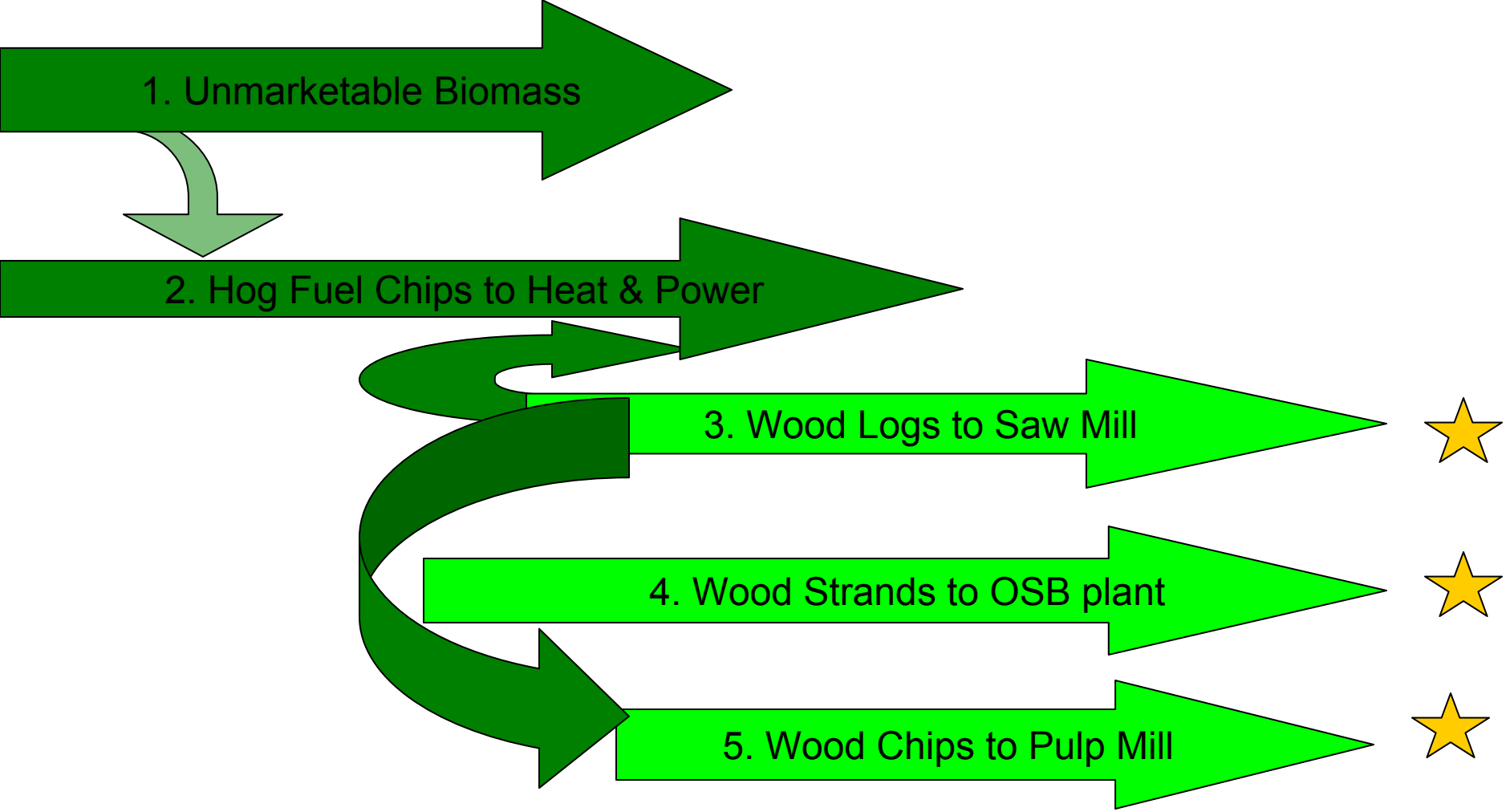
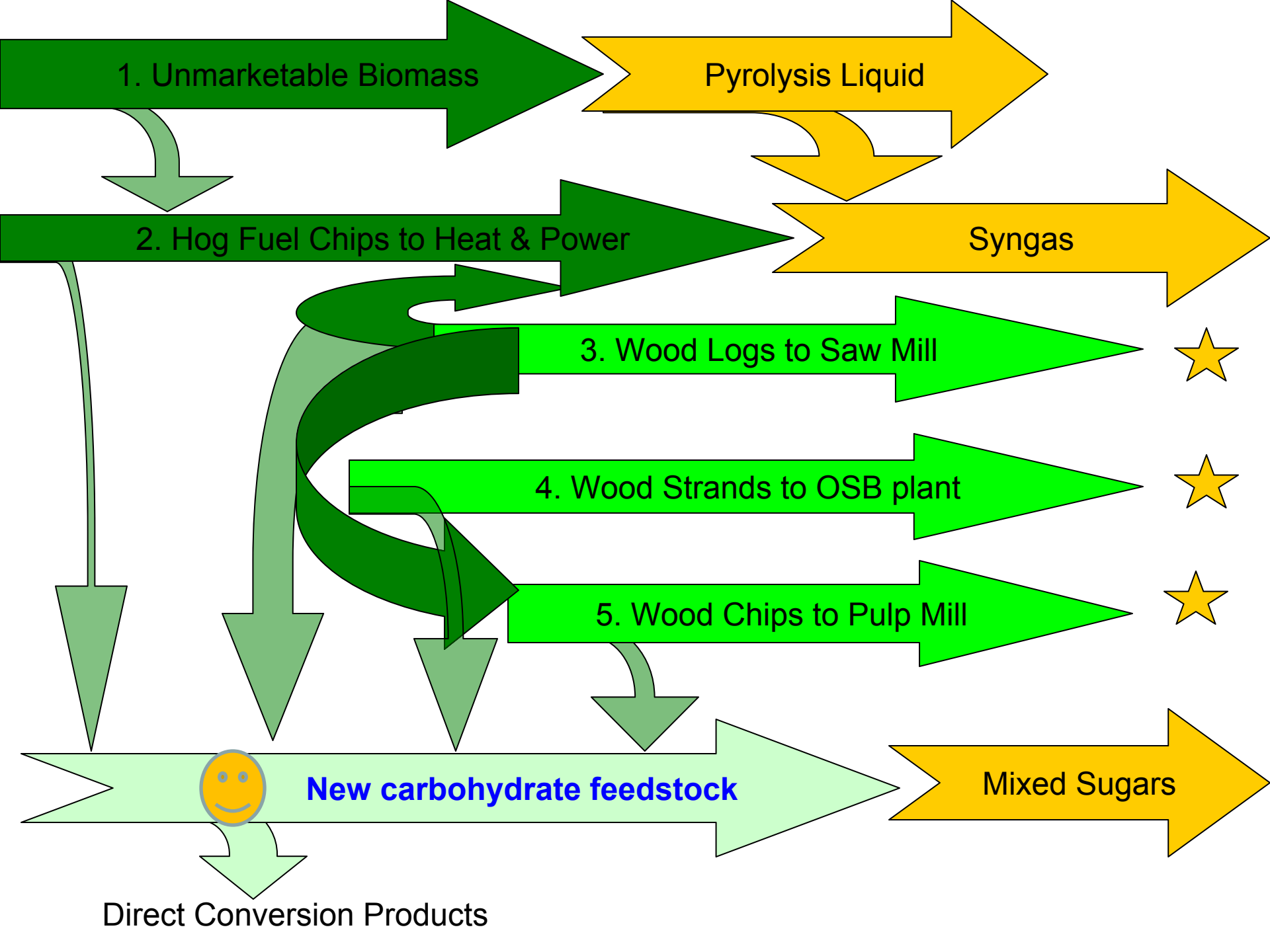

1. Unmarketable Biomass
2. Hog Fuel Chips to Heat & Power
3. Wood Logs to Saw Mill
4. Wood Strands to OSB plant
5. Wood Chips to Pulp Mill

Wood Flows …


1. Unmarketable Biomass
Pyrolysis Liquid
2. Hog Fuel Chips to Heat & Power
Syngas
3. Wood Logs to Saw Mill
4. Wood Strands to OSB plant
5. Wood Chips to Pulp Mill
New carbohydrate feedstock
Mixed Sugars
Direct Conversion Products

Fuels, Chemicals, and Materials from Woody Biomass

Various forest bioproducts being pursued by Maine's FBRI include:

(1) ethanol,
(2) butanol,
(3) green synthetic diesel/jetfuel,
(4) green synthetic gasoline,
(5) green heating oil,
(6) bio-crude,
(7) acetic acid,
(8) levulinic acid,
(9) functional substitutes (e.g. dry strength additives used in papermaking or additives used in sheet molding compounds),
(10) bioplastics,
(11) advanced wood-plastic composites, and
(12) cellulosic nano-composites.

This bioproducts portfolio is well balanced in utilization of extracts from biomass as well as cellulosic solids.

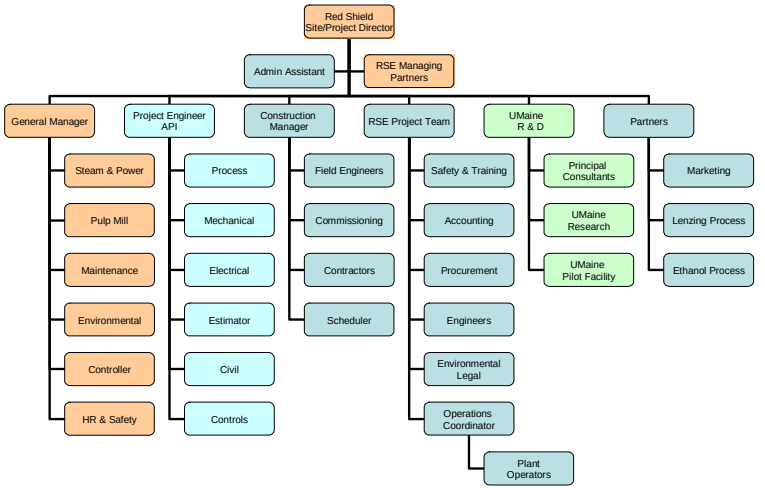
RSE Pulp & Chemical

Old Town, Maine

AMERICAN PROCESS

1865 THE UNIVERSITY OF MAINE

Organizational Chart



Demonstration of an Integrated Biorefinery at Old Town, Maine

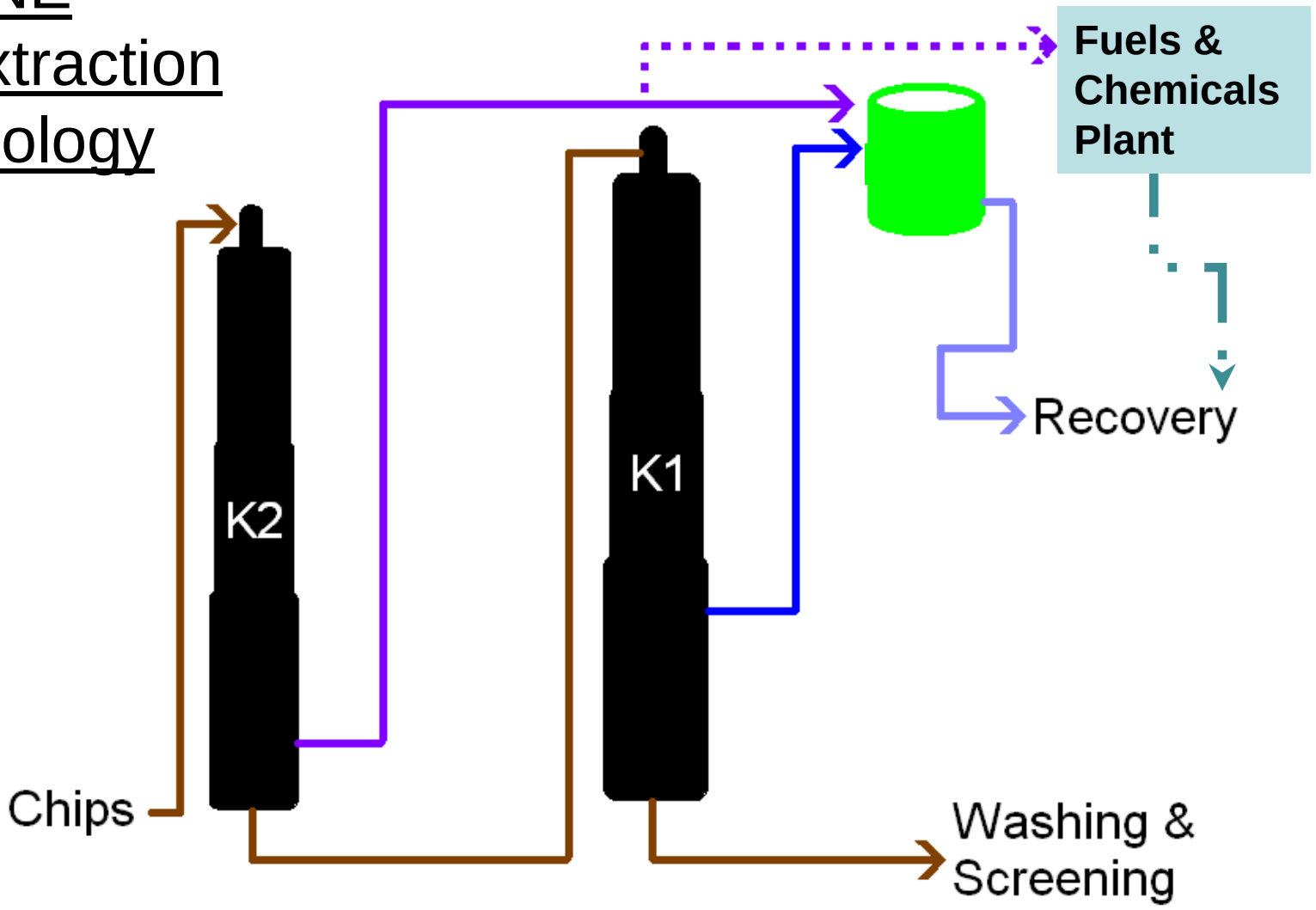
(DE-PS36-07GO97003)

$30 million grant award

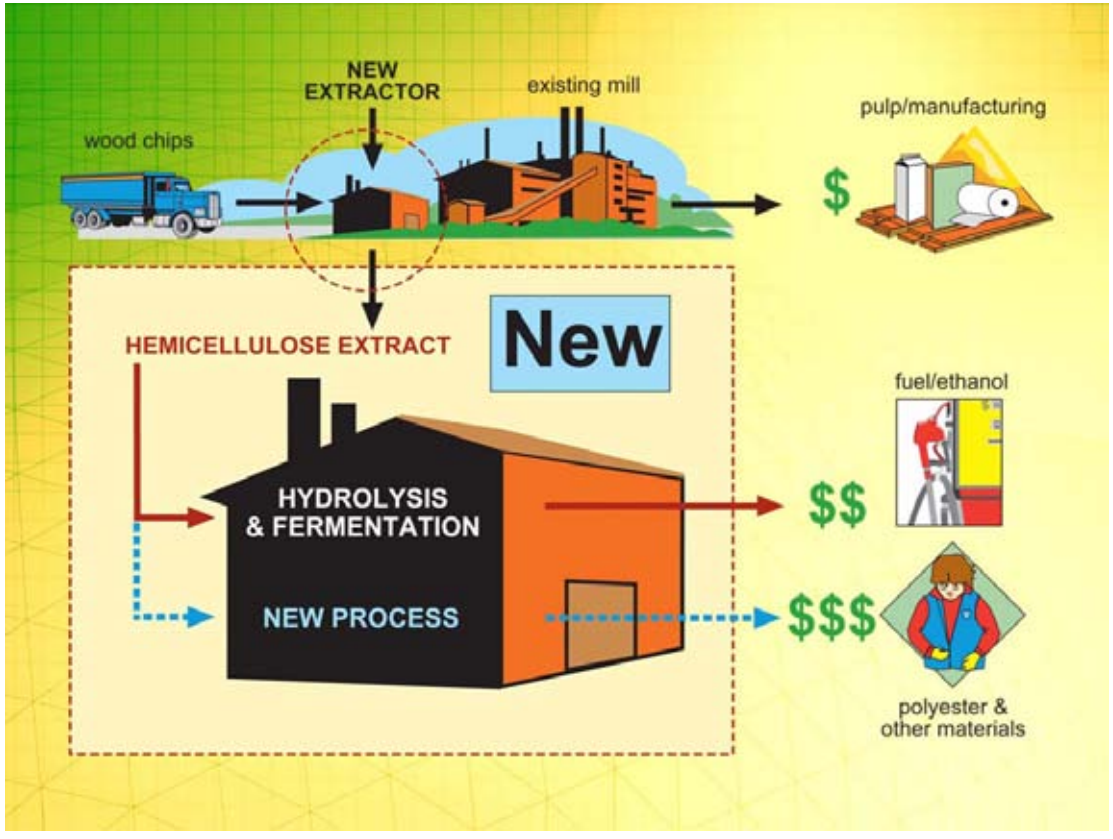
DOE small-scale biorefinery

Old Town Pulp & Chemical

UMAINE
Pre-extraction
Technology



From Lab to Mill – wood extract conversion



•Old spare pulp digester is already being converted to a new extractor

• With pre-extraction integrated with pulping operations we can produce 80 dry metric tons per day of new carbohydrate feedstock for the fuels and chemicals plant.

Van Heiningen Process: From Lab to Mill Floor –
Success of DOE FC36-04GO14306 (2003-08)
Forest Products Industry of the Future
Drew Ronneberg, DOE Headquarters

A RESEARCH ROADMAP FOR MAKING
LIGNOCELLULOSIC BIOFUELS
A PRACTICAL REALITY

Breaking the Chemical and Engineering Barriers to Lignocellulosic Biofuels:

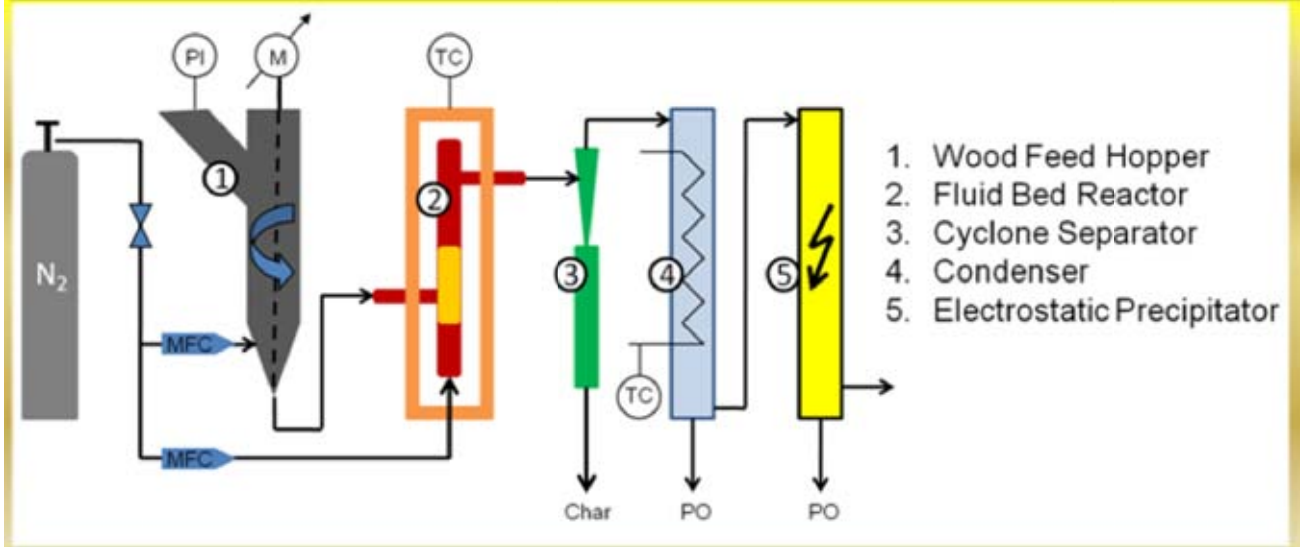
Next Generation Hydrocarbon Biorefineries

SPONSORED BY:

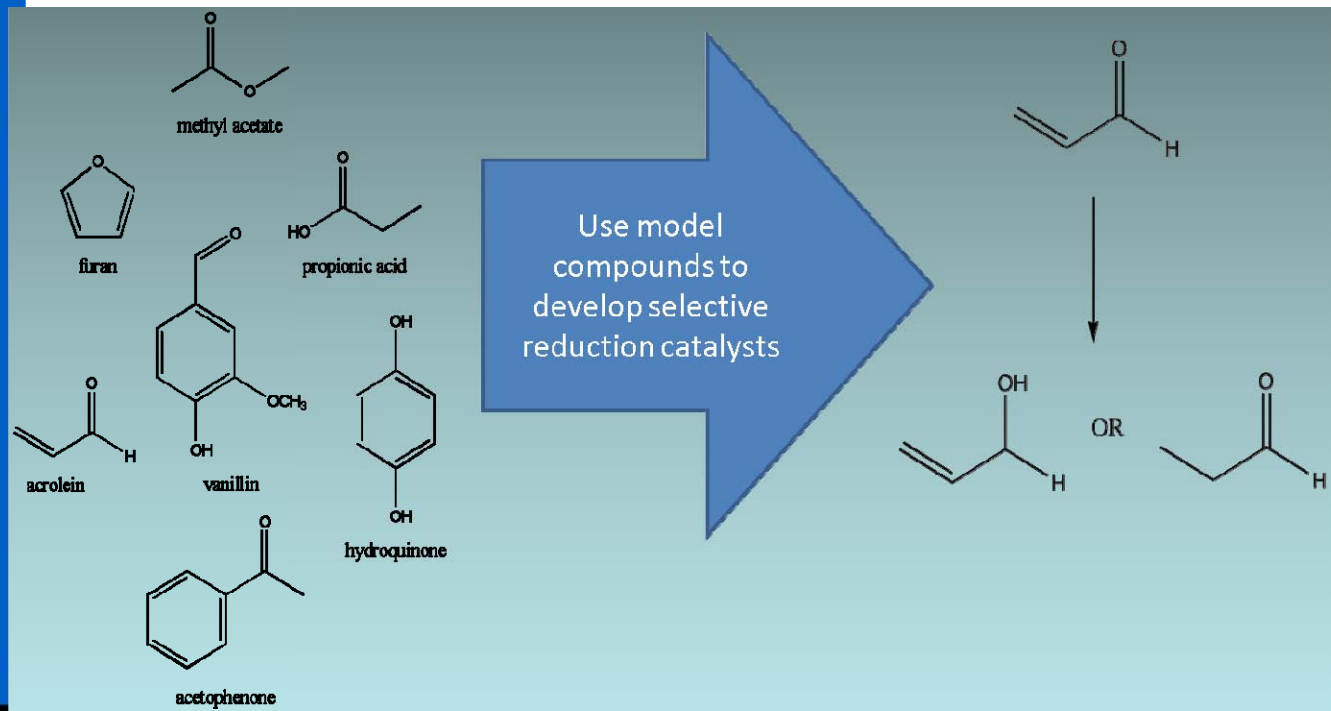
THE NATIONAL SCIENCE FOUNDATION

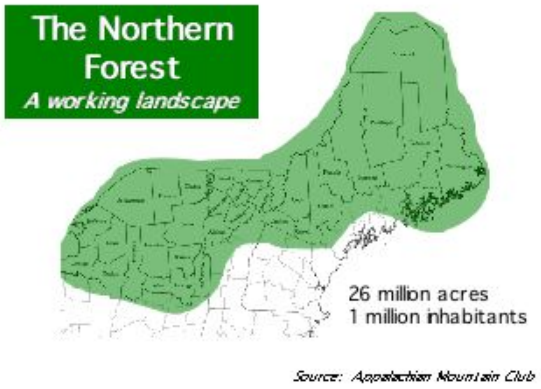
AMERICAN CHEMICAL SOCIETY

THE DEPARTMENT OF ENERGY



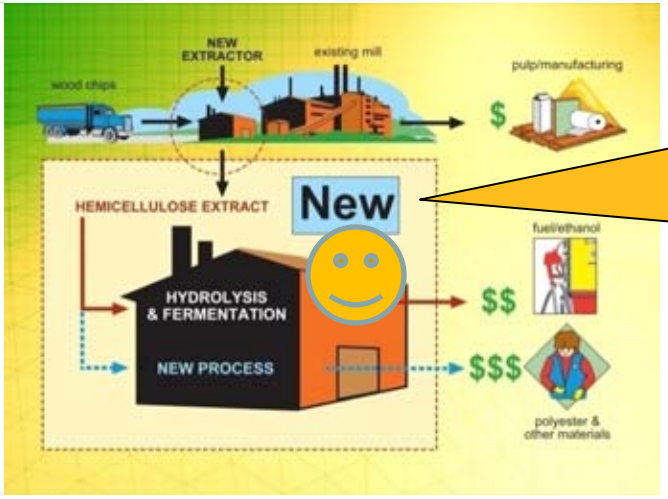
Thermochemical Conversion of Woody Biomass





Building on forest product industrial sites and UMaine's research infrastructure Maine is changing the way business is done.

- Feedstock Interface
  - Forest Landowners
  - Sawmill & Chip plant operators
  - Potato Processing
  - Opportunities for new feedstocks



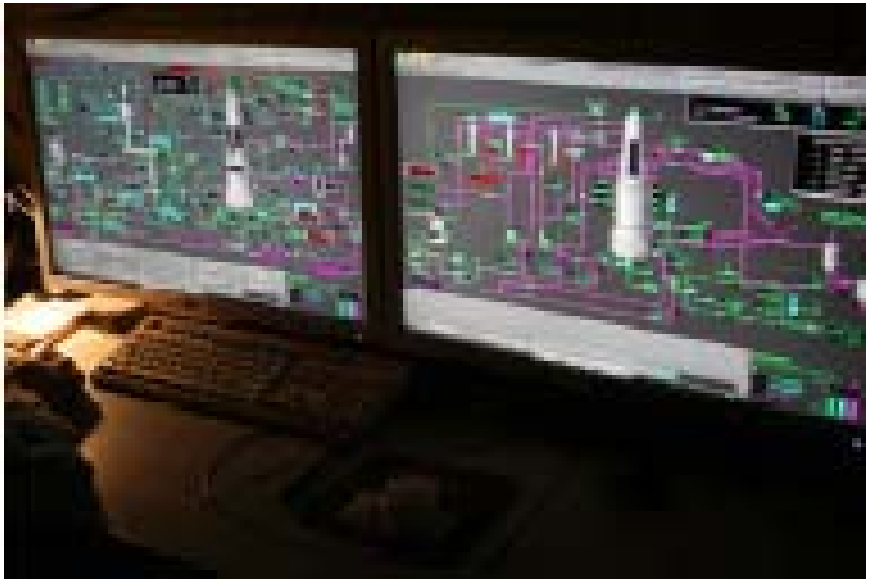
Northern Forest serving New England and beyond

•Product Distribution and Marketing Interface

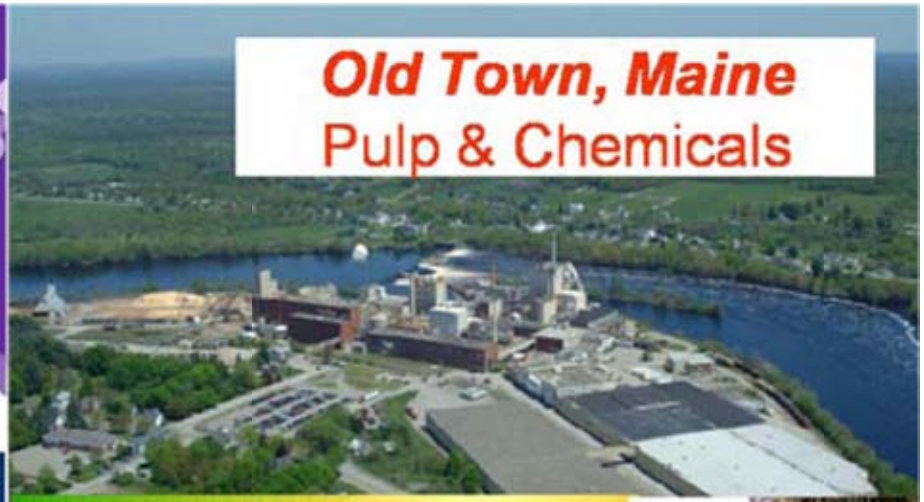
•Water Barge, Portland, ME

•Safe Handling Inc., Auburn, ME

•Biofine Renewables Pilot Plant, Gorham, ME



CHEMICAL & BIOLOGICAL ENGINEERING



FBRI
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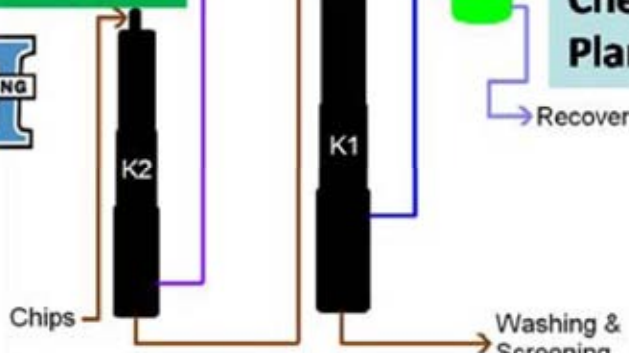
UMAINE
Pre-extraction
Technology

ENGINEERING



Fuels & Chemicals Plant

Recovery

THE UNIVERSITY OF MAINE

AMERICAN PROCESS

RSE Pulp & Chemical

2. Proposed Technology Center

1. New Biorefinery

Pulp Mill

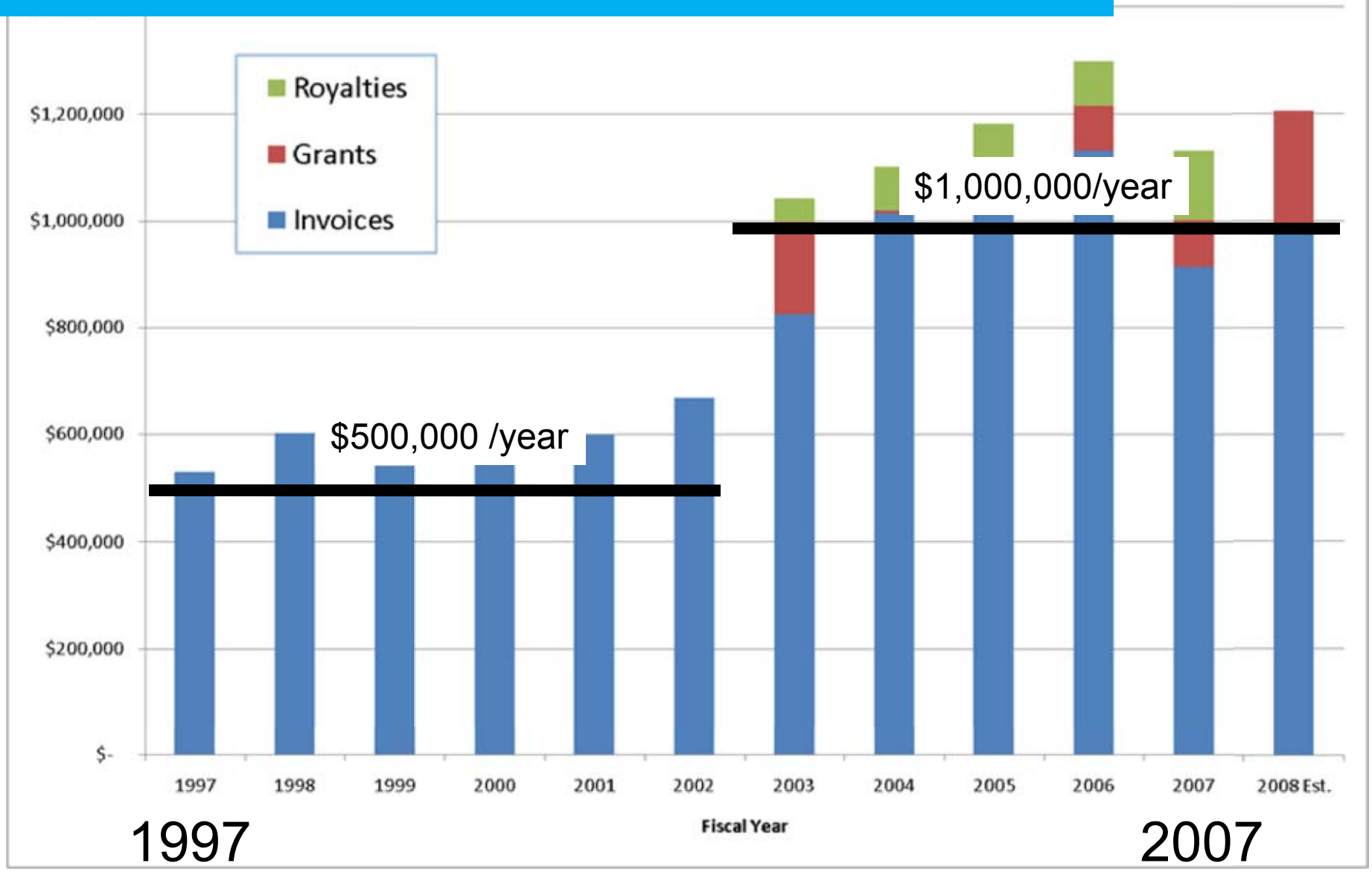
the city of Old Town, Maine

Tech Center Site Profile

- Industrial Zone
- On-site Steam and Power Generation
- Truck Access
- Environmental Permits in place
- Easy Access to R&D Labs on UMaine Campus

UMaine Process Development Center Track Record

$1,500,000/year
NEXT >>>>>>>



PROJECT GOALS:

- **Target $5,000,000 Total Project Cost.**
- **Program flexibility**
- **Plan efficiency**
- **LEED Certification**
- **Prefabricated modular components**

WBRC ARCHITECTS • ENGINEERS
EXPERIENCE INTEGRITY RESULTS
Bangor and Portland, Maine • Sarasota, Florida

Aerial Perspective

UMaine FBRI Technology Center

Old Town, Maine

drawn by:
SMD & PFB

March 31, 2008

EXTERIOR FEATURES

- New 2-story wood and glass “entry tower beacon”
- Transparency extending into open central space
- Day lighting and internal views

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Entry Perspective

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- UMaine FBRI Tech Center

  40,000 sq. ft. … coming soon