

BioEnergy Opportunities

Woody Biomass Energy

Can help reduce dependence on foreign oil

Help provide outlet for thinnings from hazardous fuel treatments

Reduce cost for hazardous fuel treatments

Can be cost effective alternative

Electricity generally costs eight to ten times more per unit of energy than wood chips; oil and natural gas cost roughly two to two and one-half times as much as wood chips

Biomass Power

Combined heat and power
plant in St Paul, MN

25MW of power

District heating and cooling
to downtown

Fuel is urban wood waste
less than 25 miles

MN has two more 25MW plants (2007) Mandate = 125MW



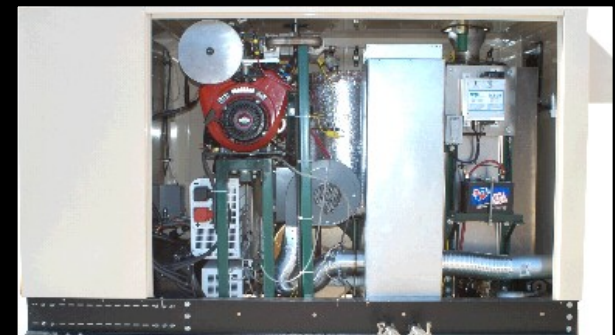
Biomass Power

Combined heat and
power

5KW of electrical power
Heat for space and water

That's 1/5000 the size of
St Paul

Today, the average house
uses less than 1kw (average)





Woody Biomass Energy

When it comes to making electricity,
What size is right for you?

Grinders, Chippers



**Initial cost vs.
maintenance**

Size and production



Advantages and disadvantages.....

Roll-Off Containers-

Whole tree processing at landing

Minimizes handling costs

Less Move-in cost for grinder



movie

f g





Wood Pellets

If transportation is more than 30-60 miles it can be cost effective to go through the expense of making pellets!



- Sawdust
- Large export market
- Shortage
- Hit 1 million tons production
- Bagged or bulk
- Pellet furnaces

	1 TPH	2.5 TPH	4 TPH
Hammermill & Feeder	\$40,644 (30 hp)	\$43,114 (75 hp)	\$56,007 (150 hp)
Air assist discharge system	\$20,373	\$21,480	\$23,804
Pellet Mill, Conditioner, Feeder	\$119,613 (100 hp)	\$178,570 (250 hp)	\$277,519 (400hp)
Cooler, Air system	\$45,949	\$45,949	\$45,949
Rotex Screener	\$7,831	\$9,554	\$13,999
TOTAL	\$234,410	\$298,667	\$441,082
Electrical cost (max)	\$9.70	\$24.25	\$41.00



2.5T x 24 hr x 7 day
x 50 weeks x \$150
= \$3 million

- \$200,000 electrical

(Free dry wood)

Pellet Systems

- Fuel more costly
- Storage smaller, cheaper
- Boiler smaller, cheaper



170 k btu system

Pellet stoves, efficient, automatic

Easier to burn clean because dry and controlled feed



Some Problems Now

Cold jacket & Low load = smolder



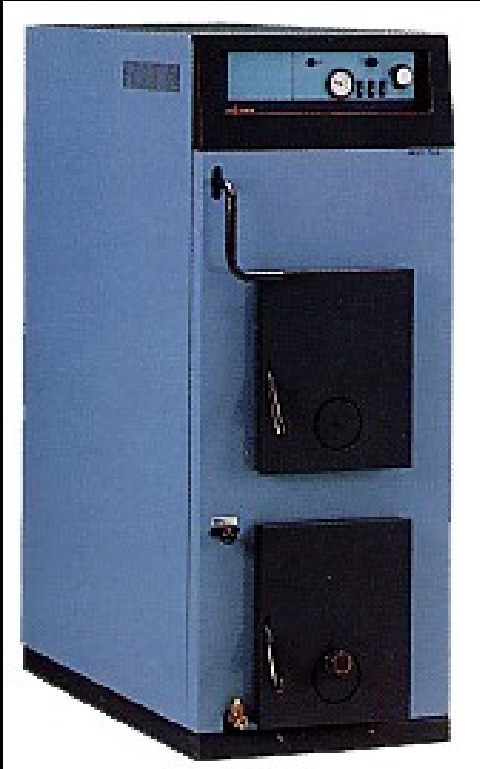
Incomplete Combustion
= Inefficient & Polluting

New designs = better

Two efficient wood boilers

Tarm

100,000-200,000 BTU/hr



Garn

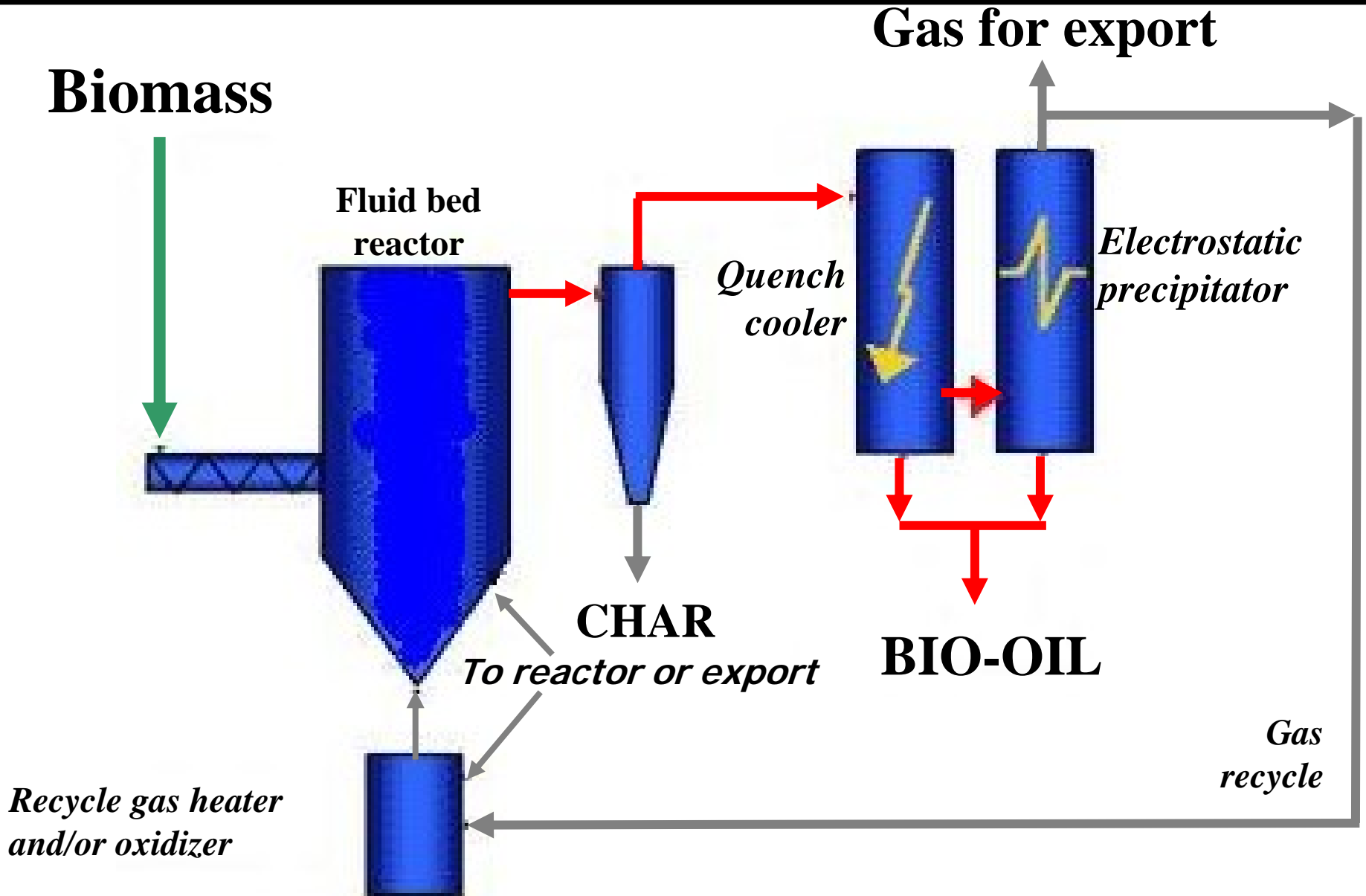
350,000 - 950,000 BTU/hr



Called gasification units although the time as a gas is very short

Fire at optimal intensity and heat up to 2000 gallons of water & then burn out, never smolder.

Bio Oil



Useable Energy Forms

- Electricity
 - Heat (steam, exhaust gas, hot water)
 - Cooling (air-conditioning)
 - Producer (wood) gas (crop drying, dual-fuel)
 - Bio-fuels
 - Bio-ethanol
 - Bio-oil
 - Bio-methanol
 - Bio-diesel
 - Syn-fuels Breakdown to H_2 and CO and rebuild
- } Partial breakdown of wood

Liquid Fuel - Thermochemical

- Thermal treatment to produce a synthesis gas (mostly H₂ and CO)
- Fischer-Tropsch reaction with catalyst
- Convert low BTU gas into methanol, diesel, gasoline, etc
- Pilot plant stage in US

Ethanol - Fermentation

- Mostly made from corn
- Current yield 65 gallons/bone dry ton
- Steps include:
 - Pretreatment of chips
 - Enzymatic treatment
 - Fermentation
 - Distillation
- Yield to 80% with enzymes for 5-carbon sugars

Public Policy is Creating More Biomass

- Thin the Forests!
 - NFP,
 - HFI,
 - HFRA,
 - TFPA
 - DOE, USDA, USDI
 - Energy bill



What do we do with the biomass?

- » Burn It smoke?
- » Chip It paper?
- » Leave It methane?
- » Use It Best

Disposal Problem

We have a lot of
Forest biomass



Problem or Opportunity?

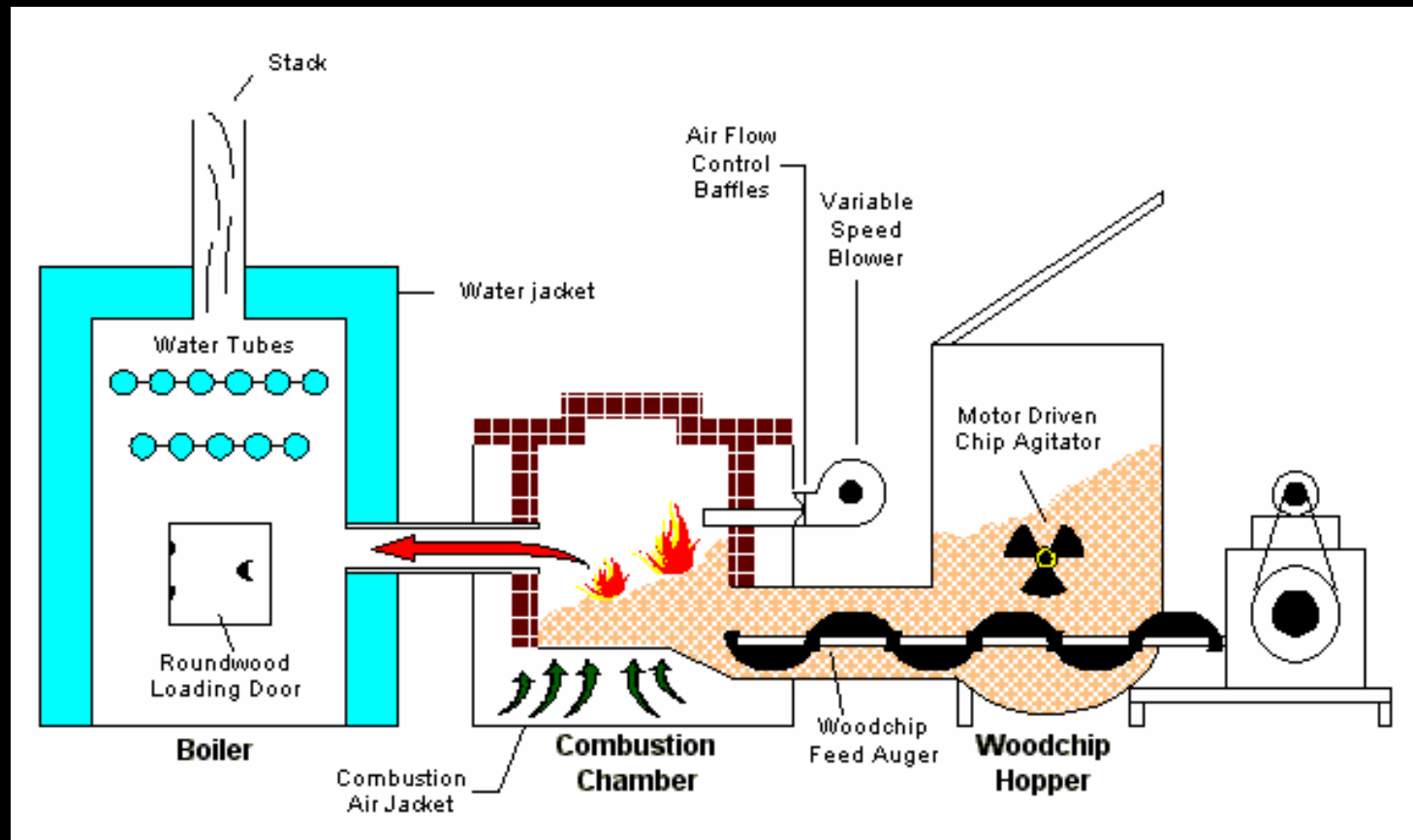
– USDA-DOE **Billion Ton Report**

- 368 mill dry tons of forest biomass
- 998 mill dry tons of ag biomass
- Equivalent of >30% of USA oil use

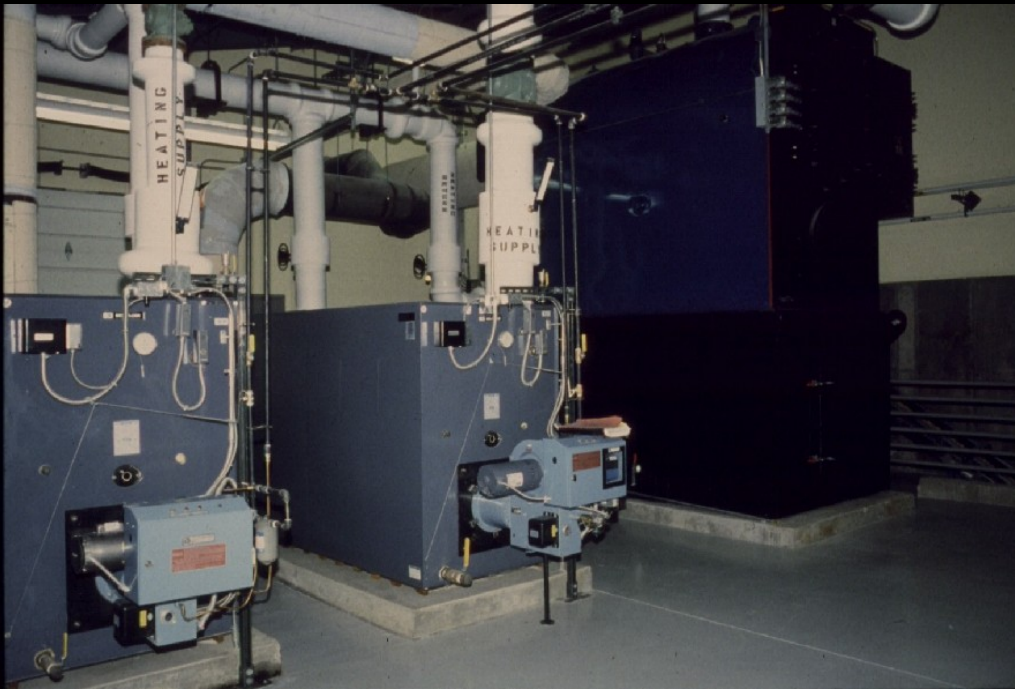
Why “Use It”?

- Reduce smoke from disposal burning
 - Human/Enviro Health – SO_x , NO_x , GHG
 - Airshed Aesthetics – “Smokey Air”
 - Airshed space for Prescribed Burns
- Reduce cost to treat land
- Save on heat & power bills
- Energy independence - Renewable
- Engage communities in solutions
 - » Create jobs
 - » Small business opportunities

Small Commercial Bioenergy System



School Heating System



Hot and not O₂ starved



Who are the Partners?

- USDA Forest Service
Regions 1 & 4
- 6 State Foresters
- RC&D's
- State Agencies –
 - DEQ
 - Commerce
 - Energy
- Private profit & NGO's

Public Investment-A Catalyst

Three Phase Implementation

I. Demonstration

II. Expansion

III. Private Sector

Existing Systems

Chadron State College – 14 yr



University of Idaho -20+ yr



2004 4 13

10.9.2003

Wood Products
Industry

Darby, MT

What does the FFS team do?

- Integration of Tech Assistance
- Fund/conduct Preliminary Engineering Assessments
 - Two-page Form on Web site
 - Engineer for a day
 - Cost/Savings calculation
- Grants & other financial help
- Supply Issues – suppliers
- Air Quality

Technical Assistance

- Supply of chips
 - Develop contractors
 - Sources of material
 - Wood manufacturers
 - Haz fuel reduction
 - Stewardship and Timber sale contracts
 - Transportation issues
 - “Canned Wood”

Heating With Wood:

Three Options:

- Fully automated – large facilities
- Surge Bin – small facilities
- Pellet systems

Combined Heat and Power

Thompson Falls

Surge - bin
System
(2-5 days)



Smaller,
Simpler,
Cheaper

Large Facility



Darby, MT

Darby school 3rd year

Source	Tons	Price	Cost
Soil Tech, Inc. (original chip stockpile contractor. Usage terminated due to composting of stockpile and other problems.)	274	\$24.00	\$6,576
Hayes Creek donation (\$10 cost due to requiring contractor to chip slash rather than grind, as original agreement called for.)	192	\$10.00	\$1,920
Bass siding DF/L tops (Thomas)	56	\$41.00	\$2,296
Porterbilt Post and Pole (combined cost of material, hauling, and some chipping.)	103	\$29.16	\$3,003
Pine Products, Inc. (mostly clean DF/LPP chips)	135	\$32.41	\$4,375
TOTALS	760	23.91	\$18,171

Darby school 3rd year

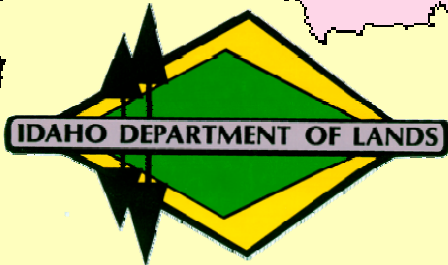
Cost of wood chips (760 tons)	\$18,170.00
Cost of operating boiler and participating in fuels study (approximately \$9.00 per ton of fuel used)	\$4,700.00
Supplemental fuel oil	\$1,935.00
2005/6 Cost	\$24,805.00

Comparison of projected cost had the school heated with fuel oil: Historic usage cost of fuel oil (50,000 gal @ \$2.30/gal, avg. cost winter 2005/6) \$115,000.00

Estimated 2005-2006 cost savings **\$90,195.00**

Complex, 3 buildings, retrofit...\$900k installation = 10 yr payback

New construction – boiler 300k, building 130k, fees 40k, gas backup 60k



- 6 systems built.
- 11 more funded.
- 150+ facilities w/ completed PEA's.
- Commercialization Studies.
- 20-35 facilities to be assessed in 2006.



Financing

- Grants
 - Federal, State, Foundations
- USDA Rural Development
 - Rural Economic Development Loans and Grants (REDLG)
 - Community Facilities
 - Rural Business Enterprise Grants (RBEG)
- Carbon Trading
- Municipal Leases
- Fuel SAVINGS

Project Viability Factors

- Community Enthusiasm and Support
- Proximity to Biomass Fuel
- Processing and Delivery Infrastructure
- Fuel type/volume, Use Profile, and Unit Costs
- Site Access and space
- Existing System Age, Condition, Adequacy
- Construction and Integration Costs
- Air Quality Permitting

Expansion Beyond

Schools

*10% of nations needs or
30% of transportation fuels*

Commercialization

- MT Assessment
 - State boiler data base - >7300
 - Age, size, fuel type
 - Distance to forests
 - 3100 in the .5-5 mill BTU
- Economic analysis
 - 2,567 boilers < 15 yr payback
 - 367 > 30 yr old
- Available at www.fuelsforschools.org

Growth Potential

- Many small bites vs. a few large bites i.e. school vs. pulp mill
- UT – >14,000 boilers 0 pulp mills
- N. Dakota – over 6,000 boilers
- College campus, prison or hospital
- Need an “Anchor Tenant”
- UI = 42,000 tons Darby=750 tons

Fuel Supply Considerations

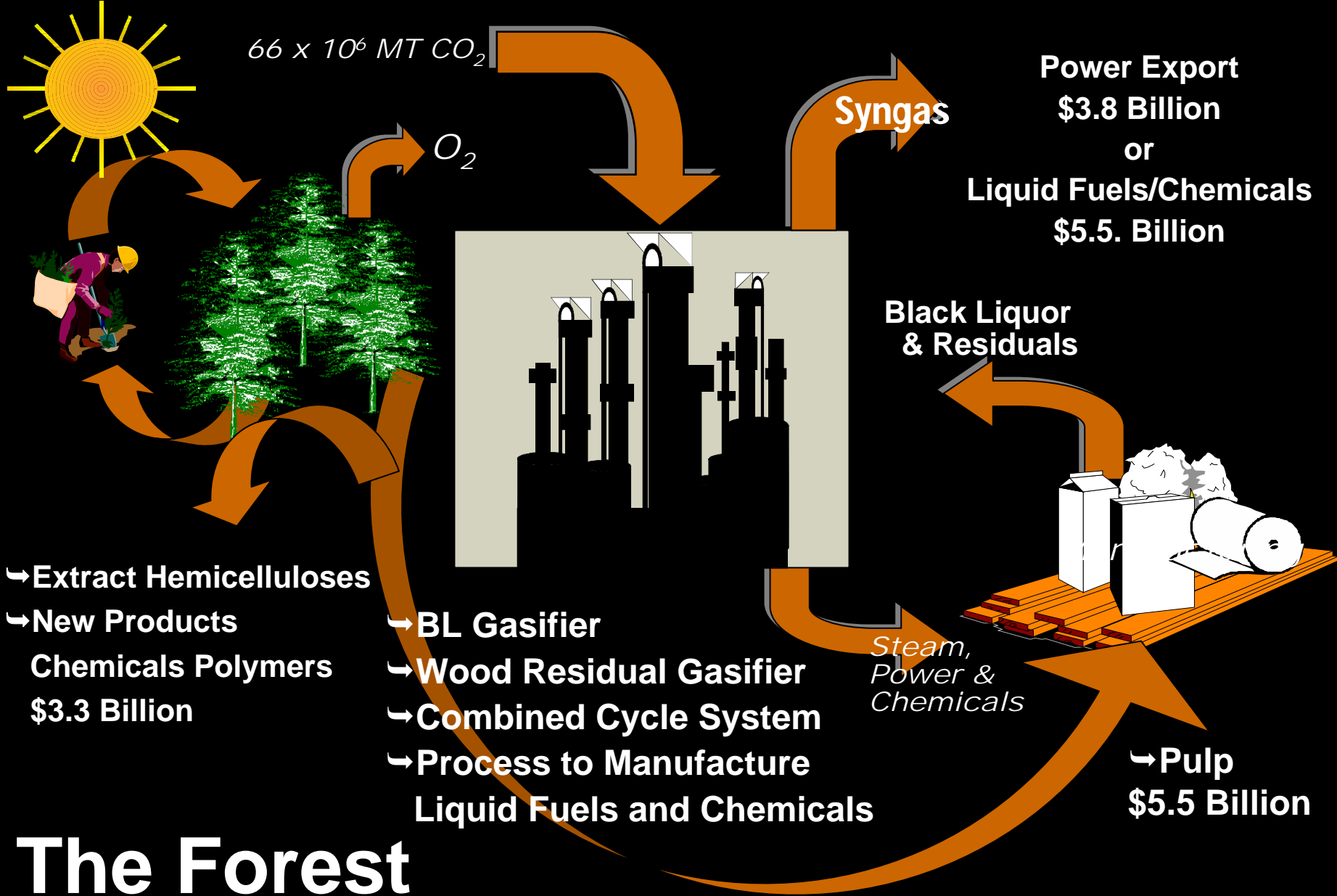
- Sources
- Processing, Delivery and Storage
 - Clustering
- Fuel Quality
 - Moisture Management
 - Ash – clinkers management
- Chips vs. pellets

Sources of Fuel

- Slash from forest management
- Local landfill?
- Residues from manufacturers
 - Post and Pole
 - Sawmills
 - House logs
 - Secondary manufacturers
- Power line clearing

Where can I get more Info

- www.fuelsforschools.org links to:
 - Manufacturers - consultants;
 - Biomass Energy Resource Center –
BERC's publication:
Wood-Chip Heating Systems
- Monitoring reports
- Pre-Assessment form



The Forest Biorefinery

Net Revenue Assumptions:

Acetic Acid - \$1.73/gallon	Purchased Electricity - \$43.16/MWH
Ethanol - \$1.15/gallon	Exported Electricity - \$40.44/MWH
Pulp - \$100/ton net profit	Renewable Fisher Tropsch Fuel - \$57/bbl

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