Future Prospects for USA Pulp and Paper Technology

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Student TAPPI Summit

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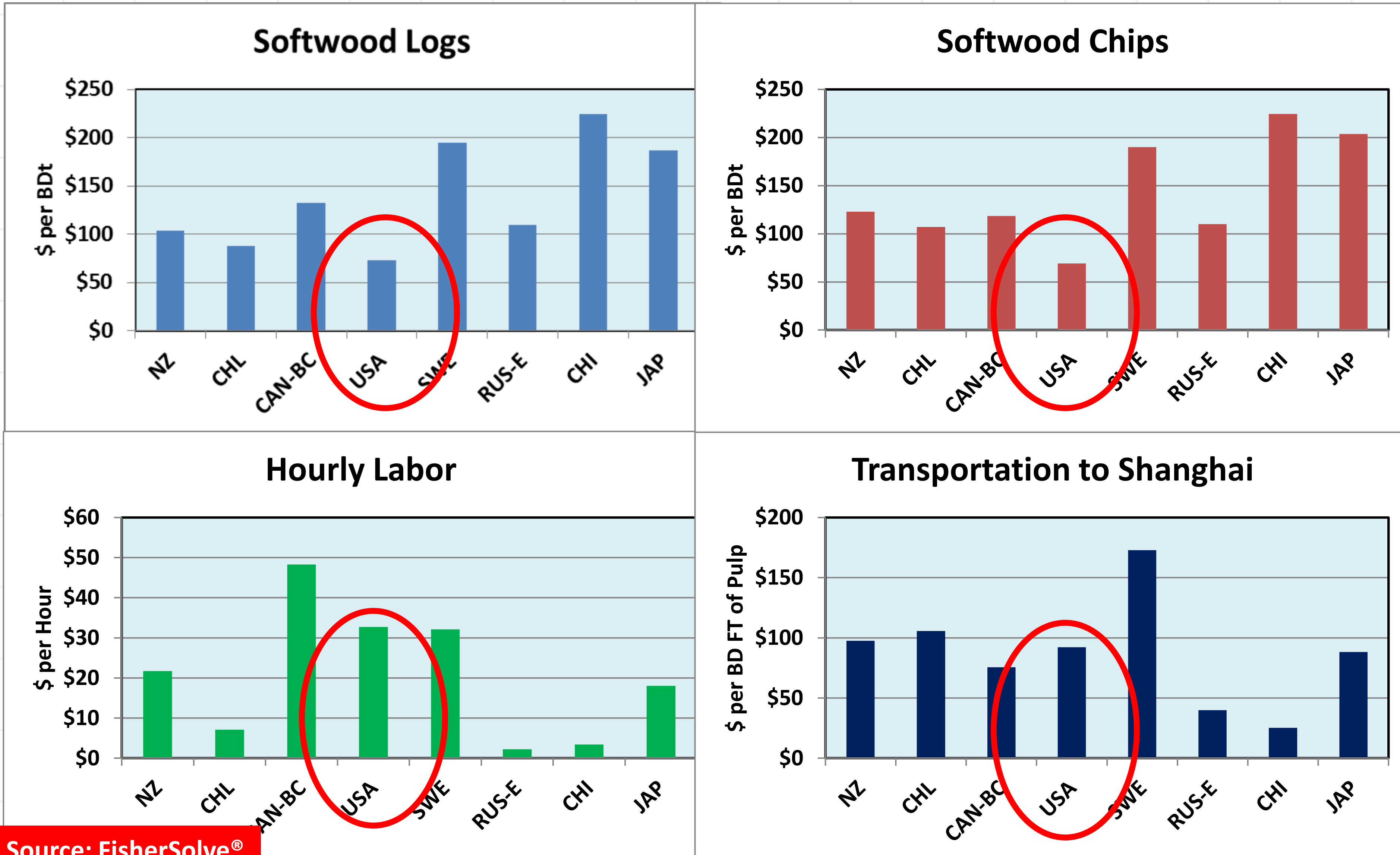
Main Points

1. **USA very competitive with Rest of the World in Pulp and Paper**
   – ***Both Cost and Profitability***
2. **Biggest issue for USA Paper and Board Industry is shrinking Demand**
   – ***We are becoming more export oriented***
3. **World will face shortage of softwood fiber for paper**
   – ***China's growth in packaging will require more virgin softwood fiber***
   – ***OCC supply will become tight***
   – ***Growth of absorbent pulps will divert softwood pulp supply from paper***
   – ***USA – Southeast well positioned to participate***
4. **What will be required for a new softwood mill to be built?**

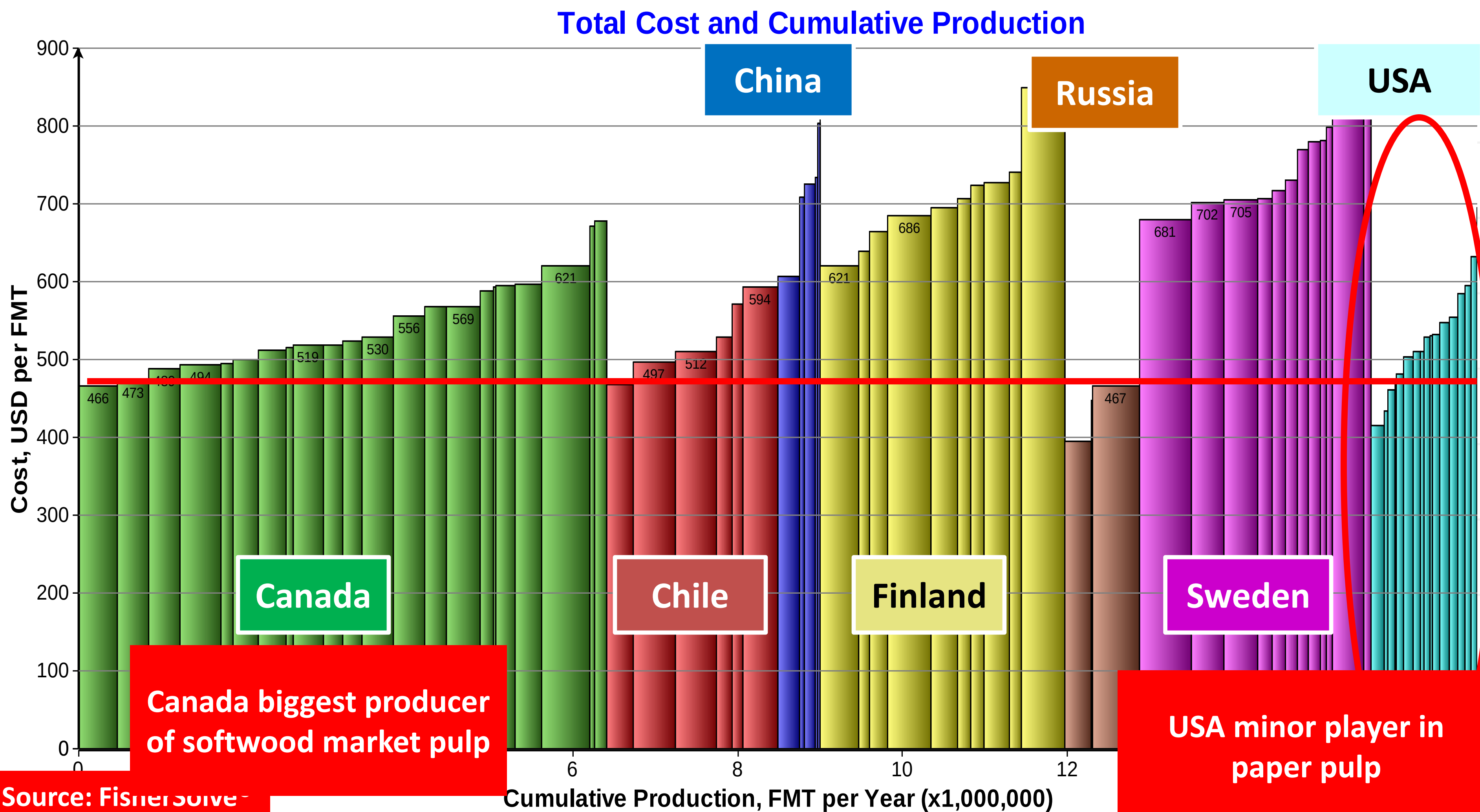
USA Competitive Costs



Source: FisherSolve®

Softwood Market Pulp

USA Cash Cost Delivered to Shanghai very competitive with all except Russia



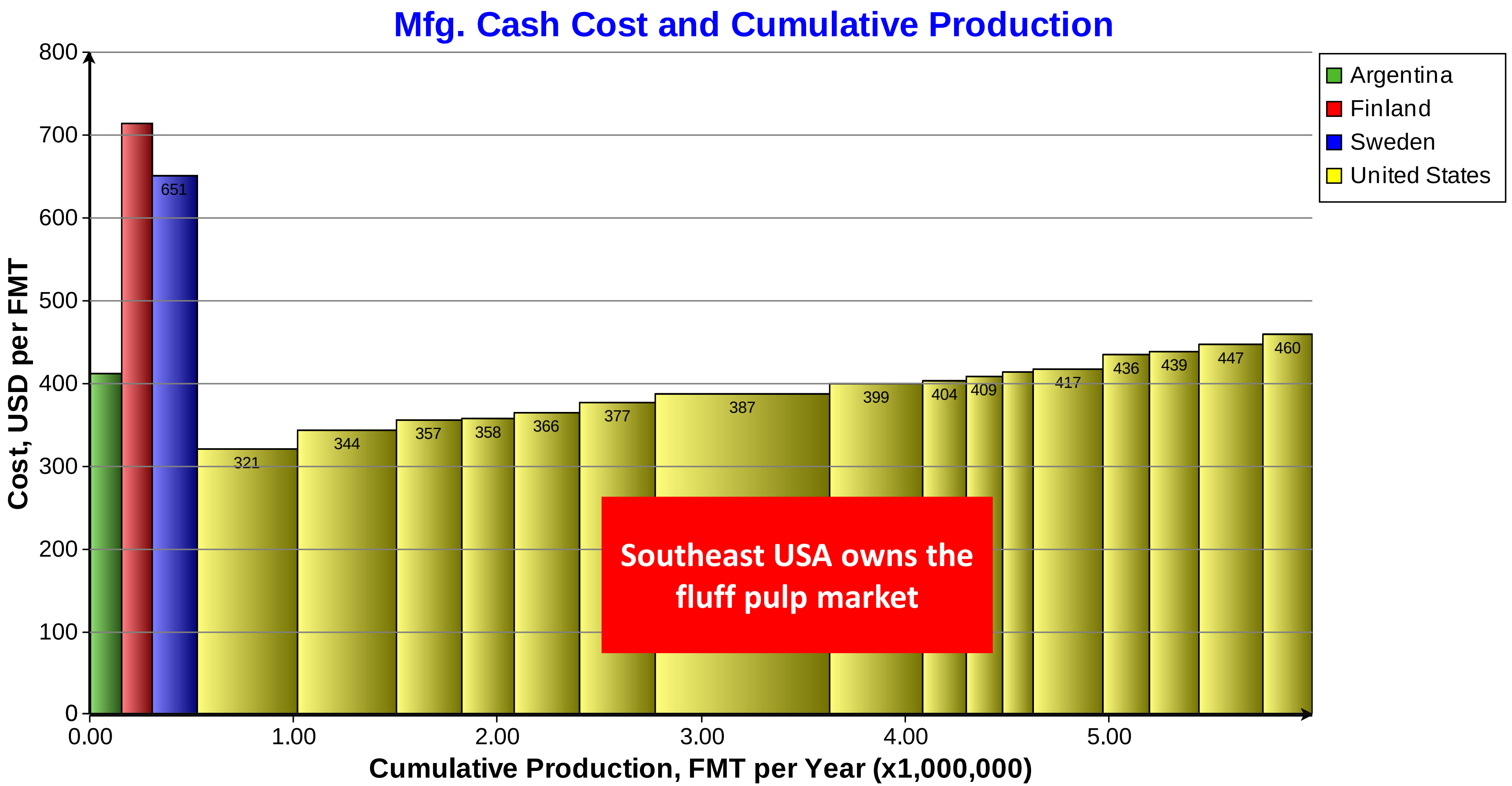
Canada biggest producer of softwood market pulp

USA minor player in paper pulp

Source: FisherSolve

Dominant in Fluff Pulp Market

Both Cost and Fiber Properties

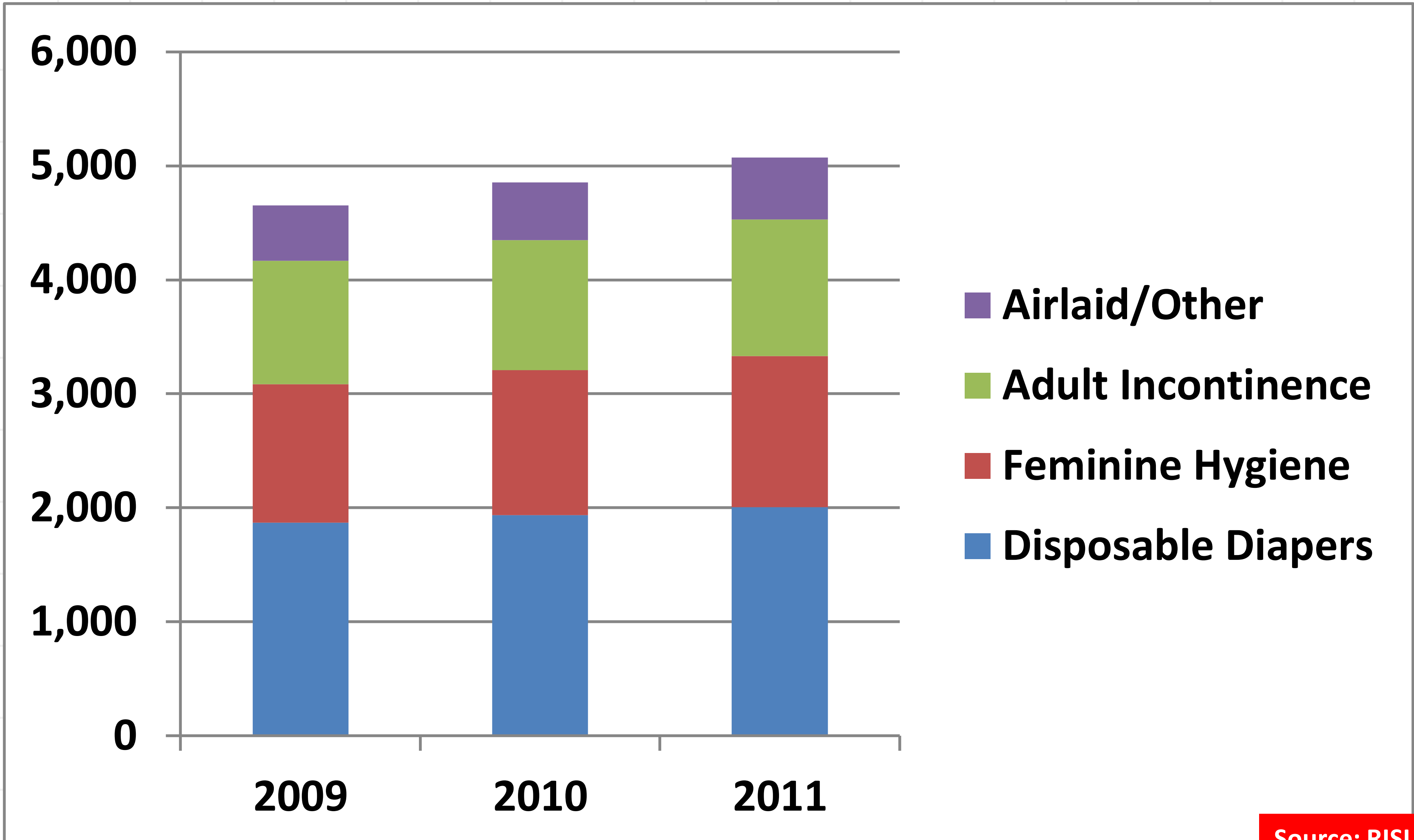


Source: FisherSolve™

Source: FisherSolve®

Fluff Pulp Demand Growth to Continue

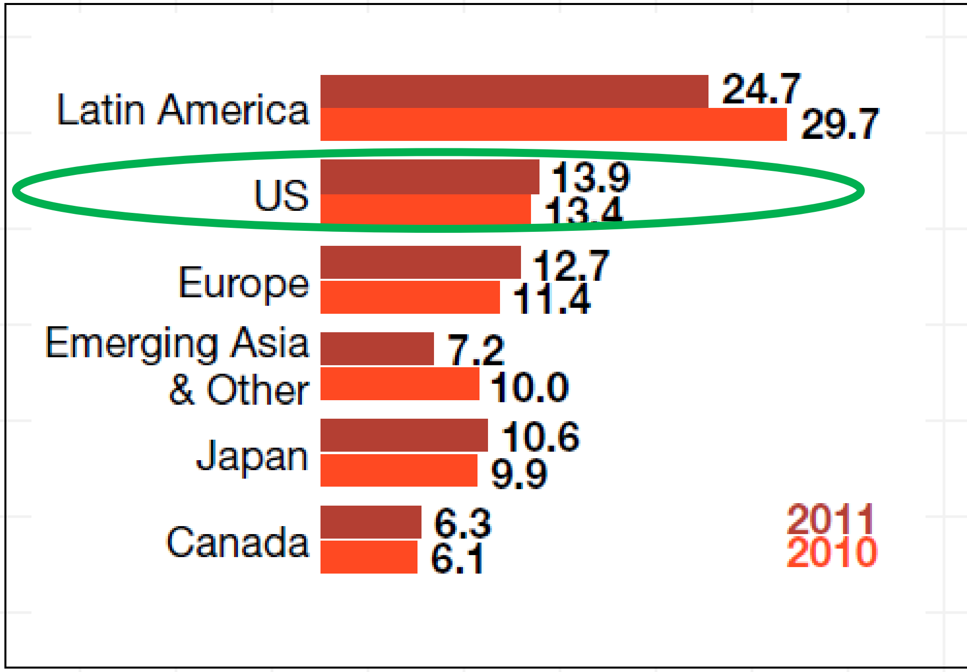
Mothers want their babies in disposable diapers



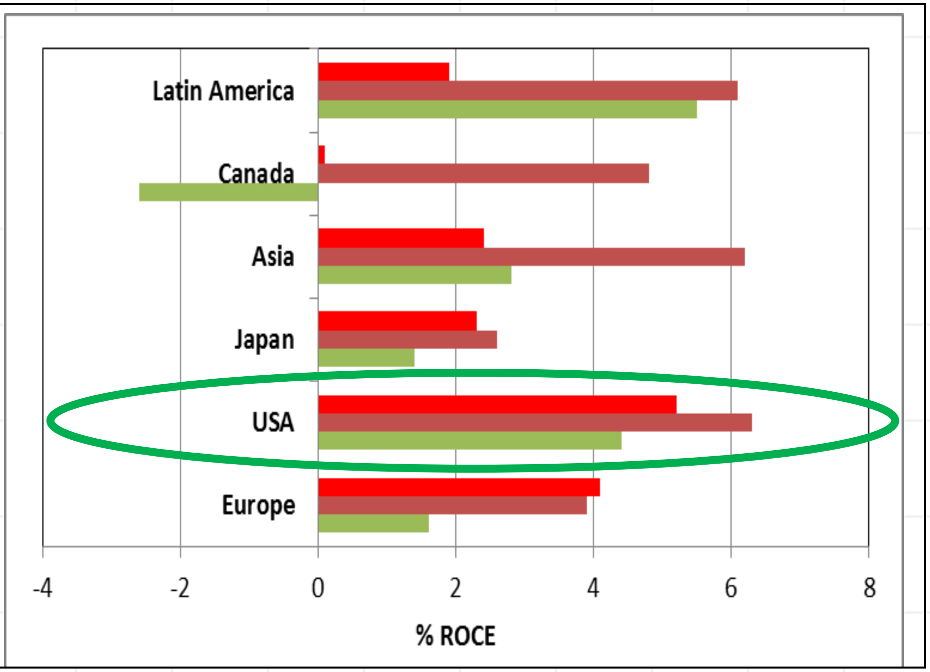
Source: RISI

USA Corporate Returns competitive with Latin America and superior to ROW

% EBITDA Margin



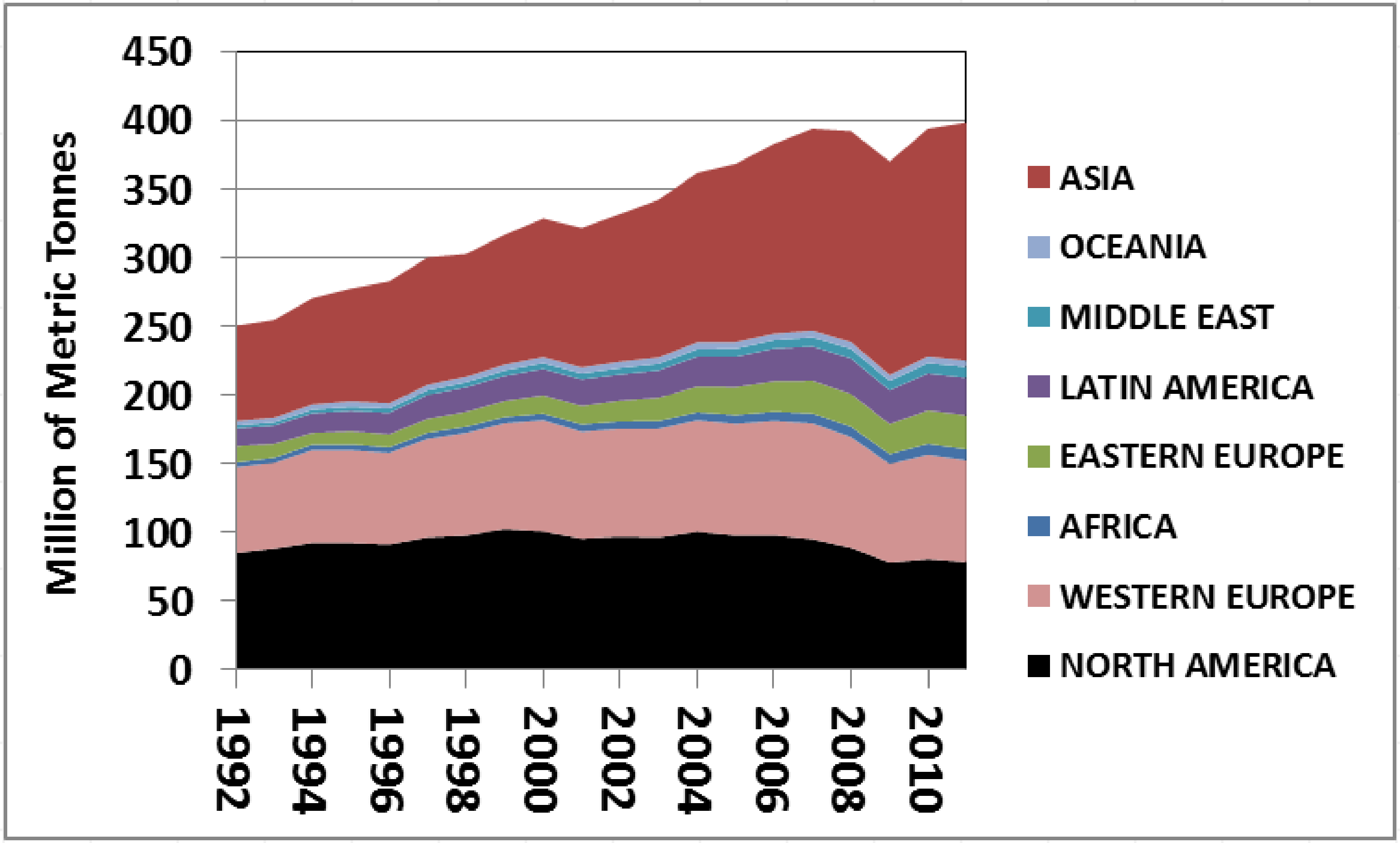
% Return on Capital Employed



Source: PriceWaterhouseCoopers "Global Forest, Paper and Packaging Survey", 2012

Biggest issue for USA is declining demand

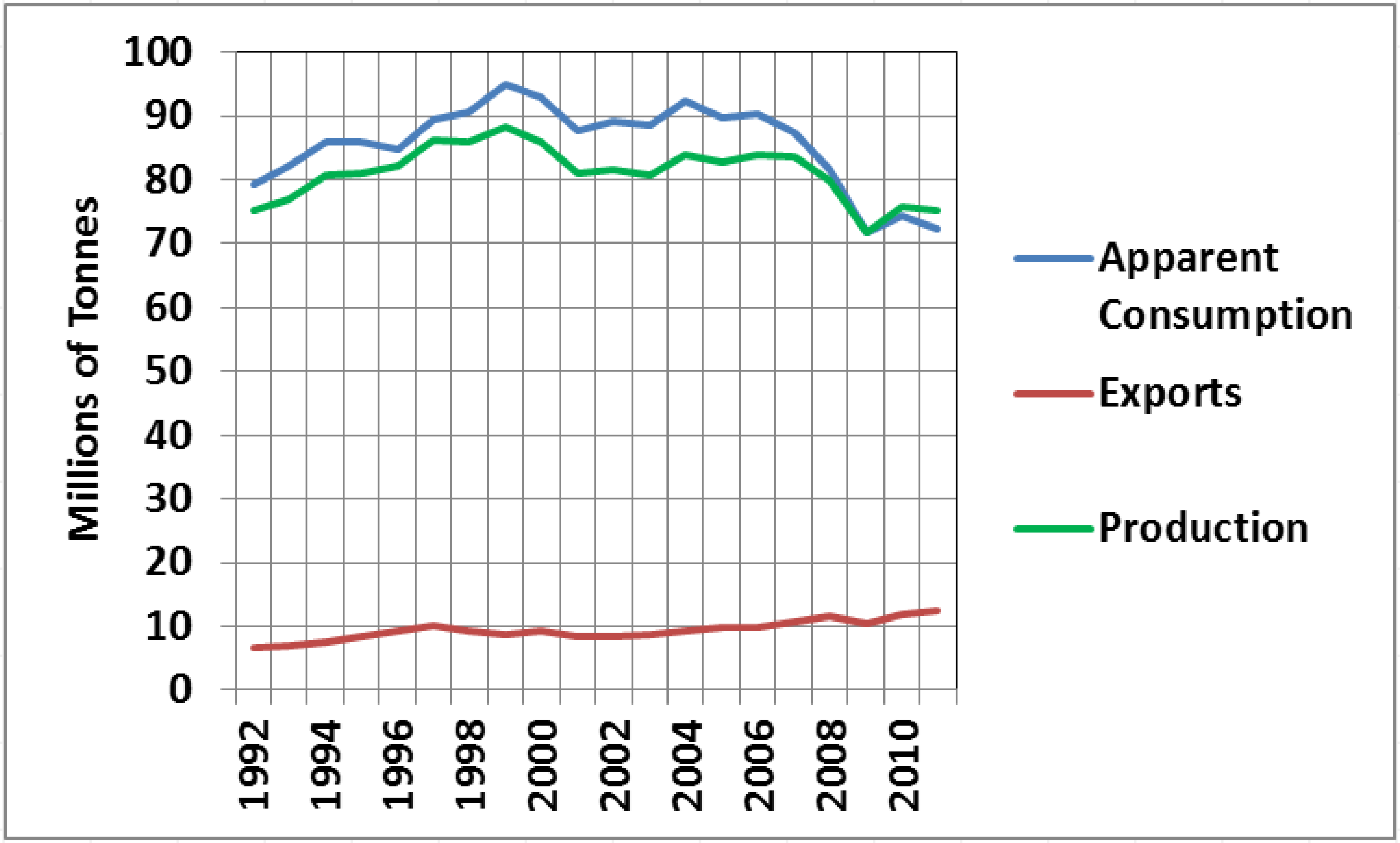
Consumption of Paper and Board increasing in Asia and stagnant to declining in the West



Asia account for ~ 50% of world Consumption

Source: RISI

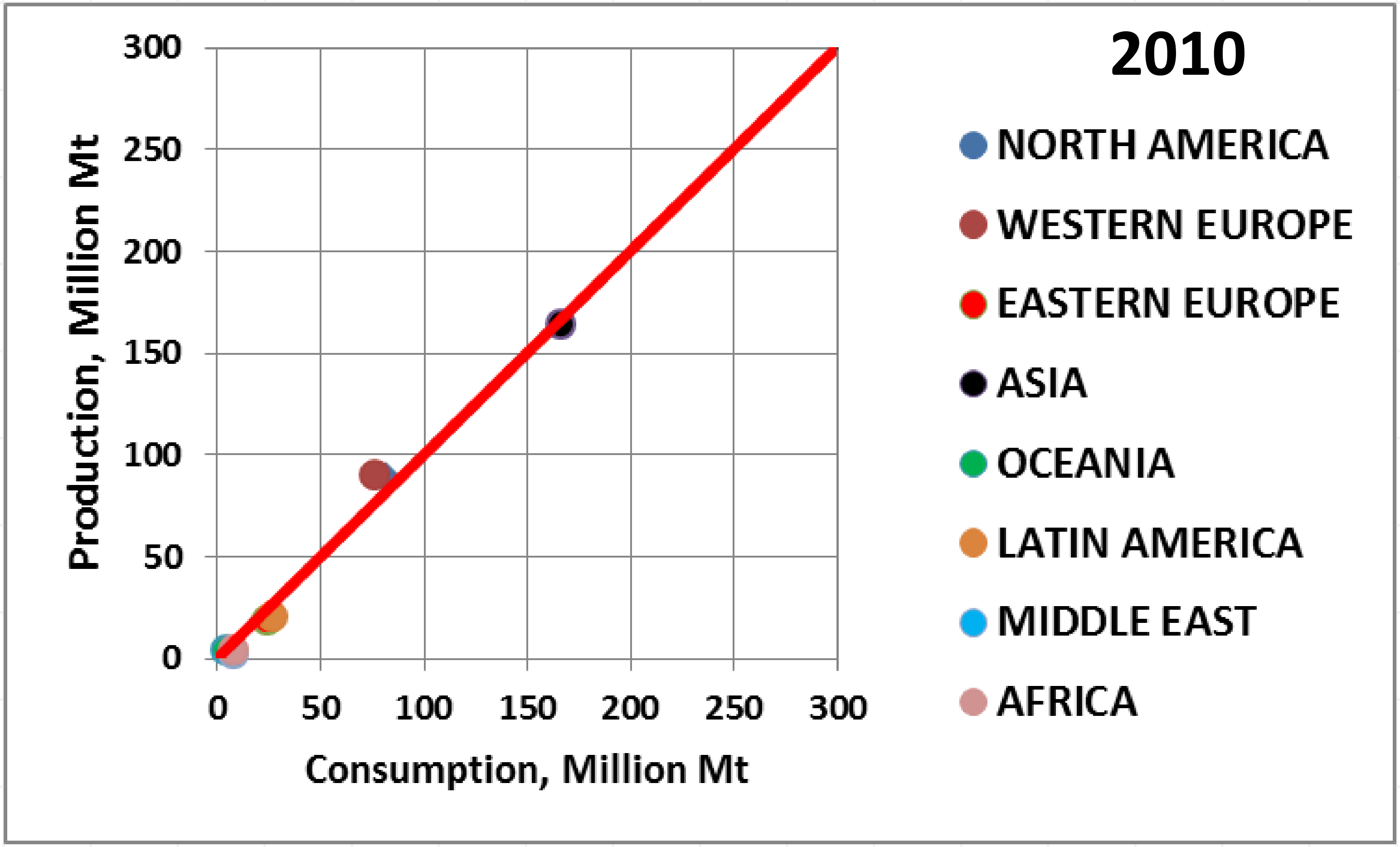
Exports have not been a major factor for USA but they will be



Exports are 17% of Production

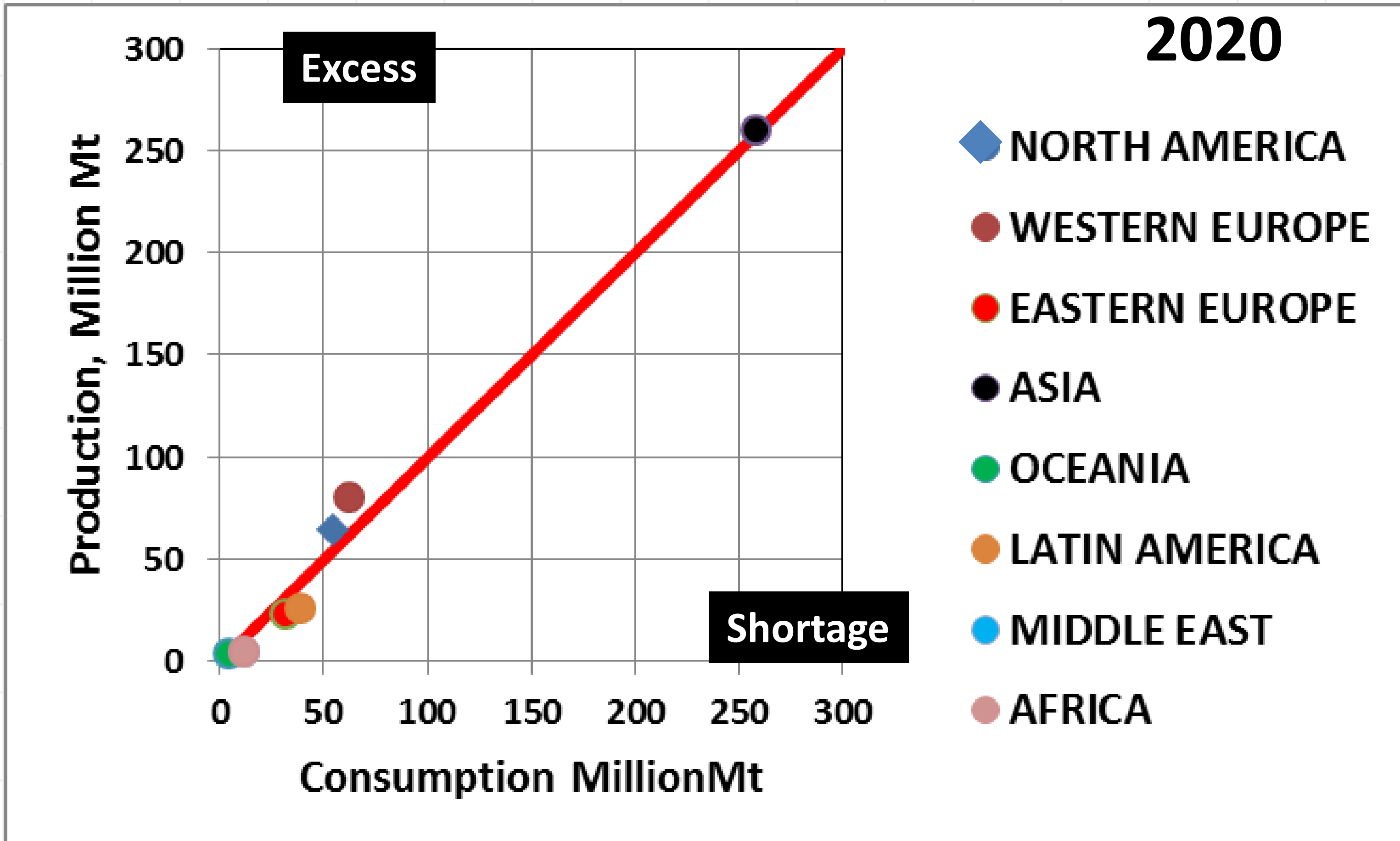
Source: RISI

Production of Paper and Board is Local …



Relatively good Regional Balance

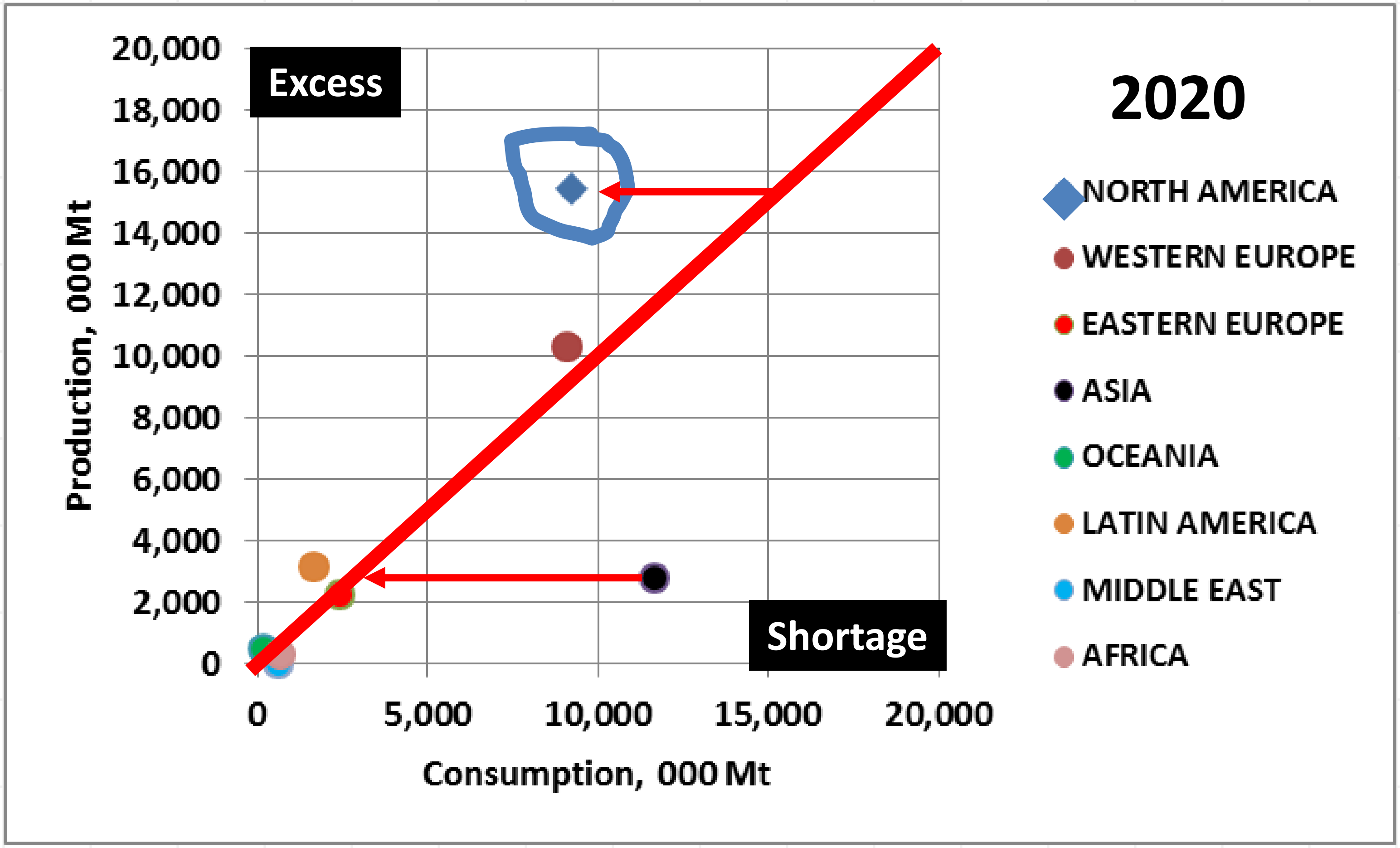
… And will remain so in 2020



North America and Western Europe will become larger exporters

Purchased Softwood Pulp Must Grow

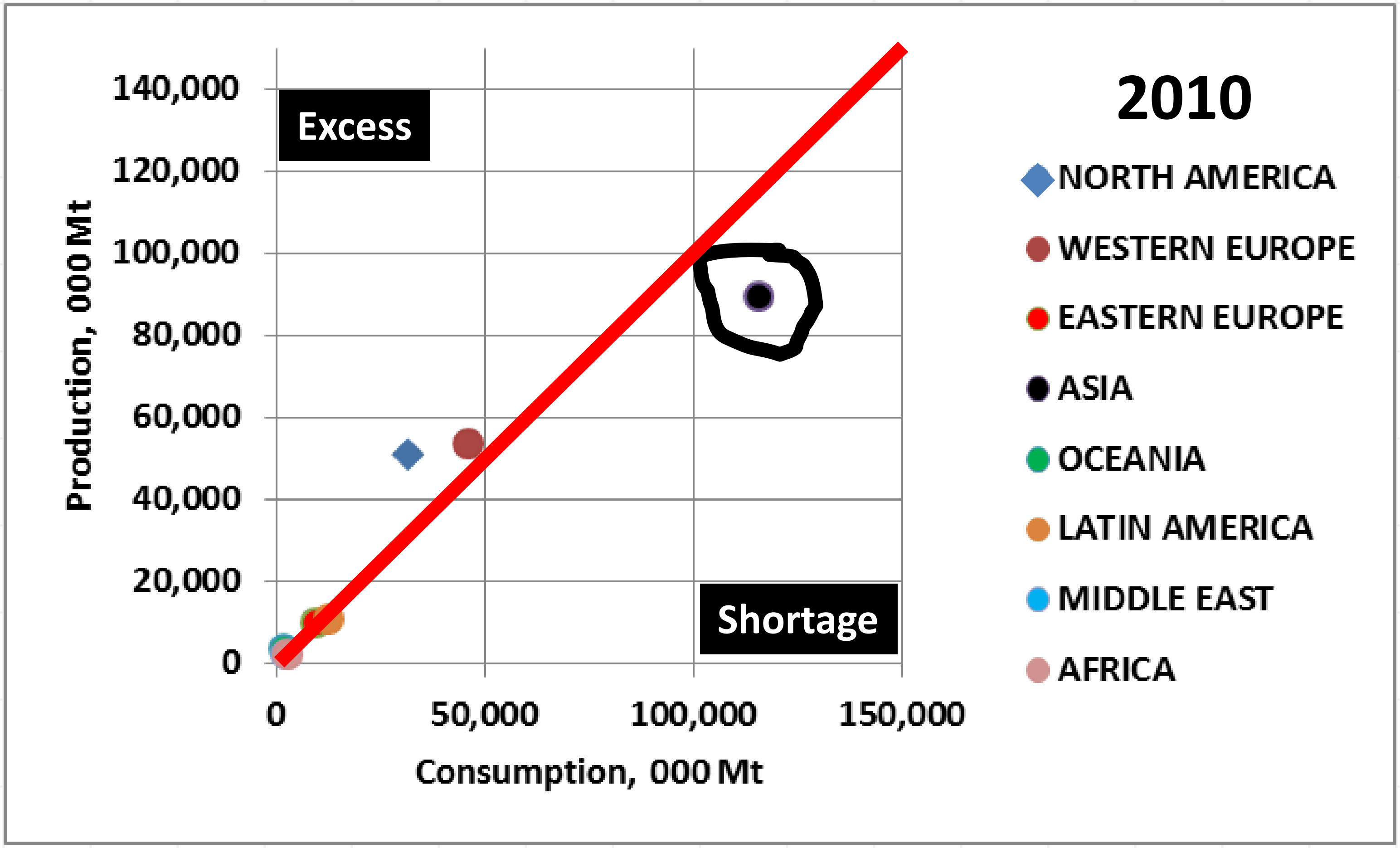
Softwood Pulp will likely be in significant shortfall



Shortage in Asia not balanced by Excess produced elsewhere

Asia currently imports 25 Million Tonnes of waste

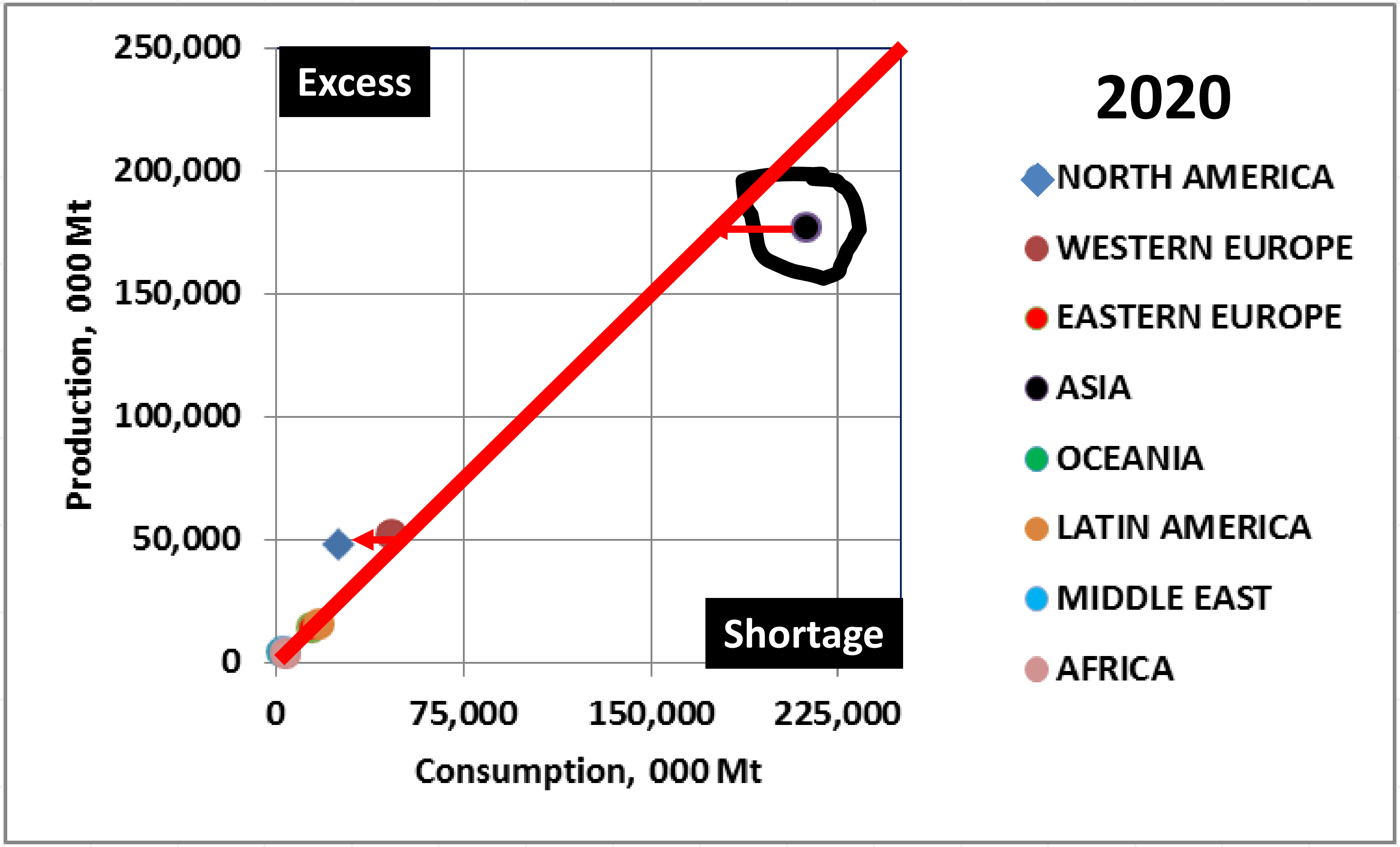
Current collection rate of ~50%



Waste for Asia comes principally from North America and Western Europe

Shortage grows to 35 Million Tonnes in 2020

If recovery rate grows to 64%



Waste availability from North America and Western Europe cannot grow because local consumption of P&B declines

Main Points

- USA very competitive with Rest of the World in Pulp and Paper
  - *Both Cost and Profitability*
- Biggest issue for USA is shrinking Demand
  - *We are becoming more export oriented*
- World will face shortage of softwood fiber for paper
  - *China's growth in packaging will require more*
  - *OCC supply will become tight*
  - *Growth of absorbent pulps*
- **What will be required for new softwood pulp capacity to be built?**
  - ***Economics do not favor construction of new softwood capacity***
  - ***But prospects could change by incorporating biomaterials and bioenergy into scope of new mill***

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Abundant Softwood available in SE USA

30 Million Hectares

3.4 M3 / Ha / Year

Annual Growth ~ 100 mm M3 per Year

Annual Removals ~ 80 mm M3 per Year

90% of harvest takes place on 10% of the forest

Timber

Logs

Export

Wood Products

Pulp and Paper

Fuel Wood

Wood Pellets

Saw logs	31,446,920
Veneer logs	4,721,578
Pulpwood	30,842,966
Composite products	4,133,231
Fuelwood	582,053
Posts, poles, and pilings	799,650
Miscellaneous products	703,356
	73,229,755

All USA Forest Products Domestic Demand Falling Except wood pellets

Source: USDA FS RPA 2007

Modern Kraft Mill

1 **Woodyard**
- Roundwood
- Sawmill Chips

2 **Pulp Mill**
- Kraft Cooking
- Low Energy

3 **Power Plant**
- High Pressure
- 50% Excess Power
- Black Liquor > 85%
- Hog Fuel 15%

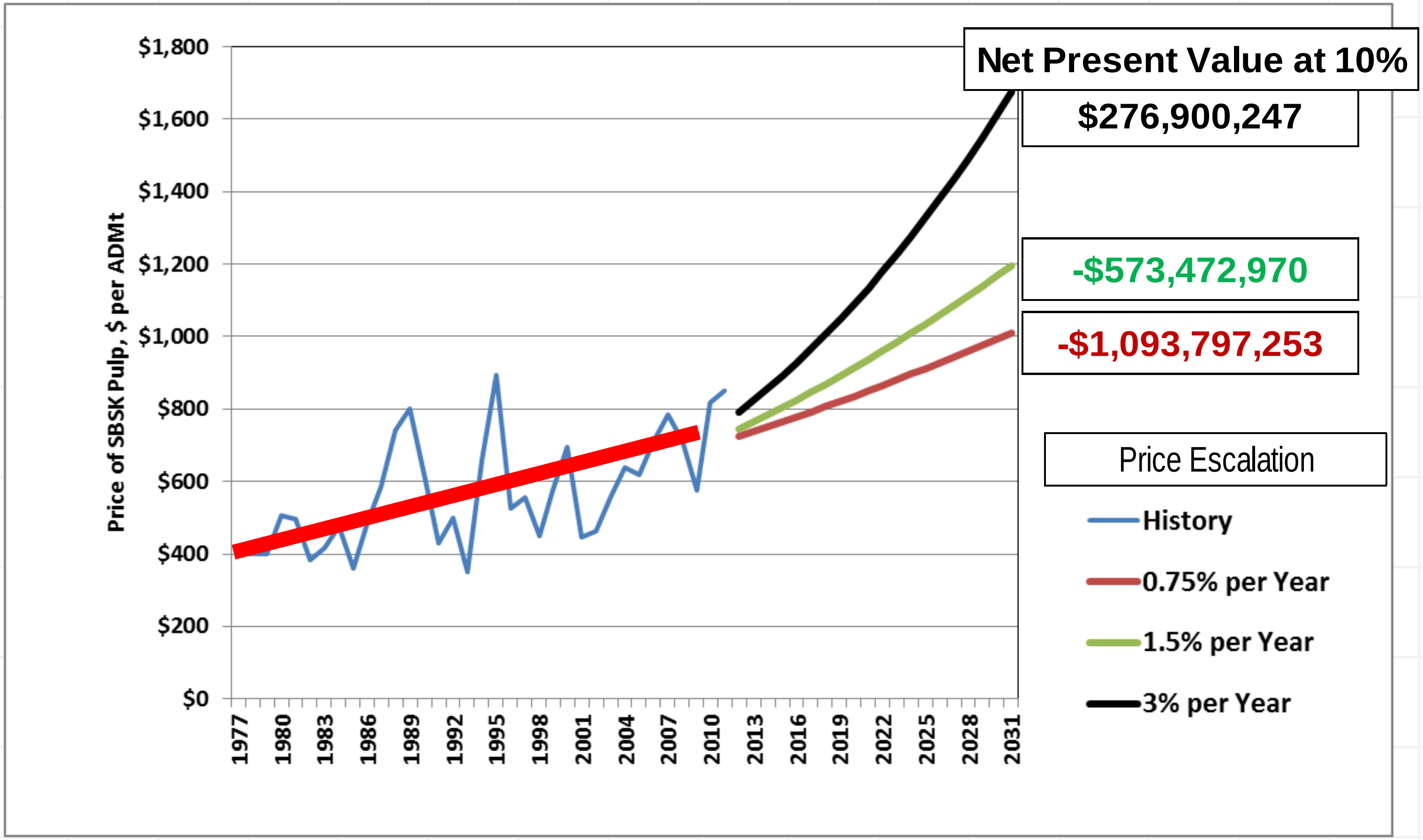
4 **Chemical Plant**
- Turpentine
- Tall Oil
- Pulping / Bleaching Chemical Prep

5 **Pulp Line**
- Pulp Drying
- Pulp Bales for Shipment

Characteristics of Modern Kraft Pulp Mill

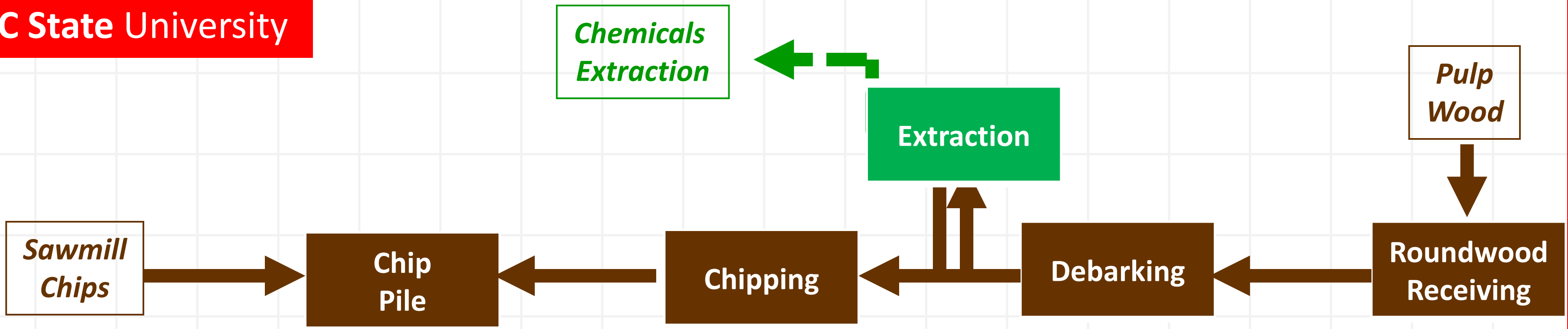
Greenfield Pulp Mill Investment	
1,000,000 ADMt per Year	
Southeastern USA	
Woodyard	$119,826,634
Pulp Mill	$312,398,638
Caustic Plant	$204,870,330
Evaporation	$139,684,316
Recovery Boiler	$377,829,924
Power Boiler	$102,787,517
Turbogenerators	$108,156,996
Machines	$433,187,011
Chlorine Dioxide Plant	$103,043,210
Infrastructure	$99,143,913
TIC (USD 2016)	$2,000,928,488

Net Present Value (10%) requires unrealistic price for Paper Pulp

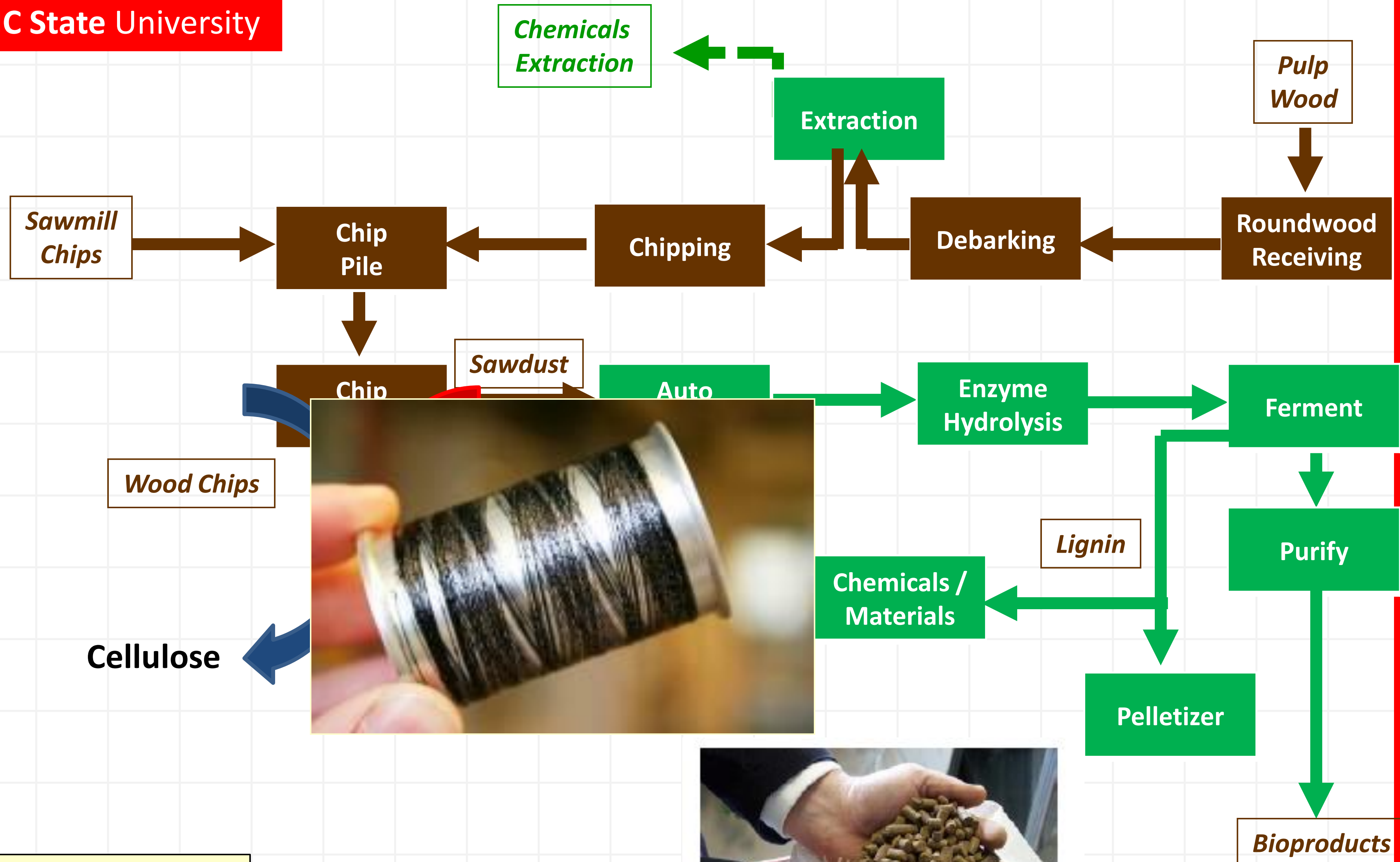


Analysis is based on southeast United States with the lowest softwood pulpwood price in the world

Source: Author



Kraft Pulp Mill integrated with Bioenergy and Biomaterials



Kraft Pulp Mill integrated with Bioenergy and Biomaterials

Chemicals Extraction

Extraction

Pulp Wood

Sawmill Chips

Chip Pile

Chipping

Debarking

Roundwood Receiving

Chip Screens

Wood Chips

Pre-Cook

Hemicellulose Extraction

Bioethanol, Foams/ Gels

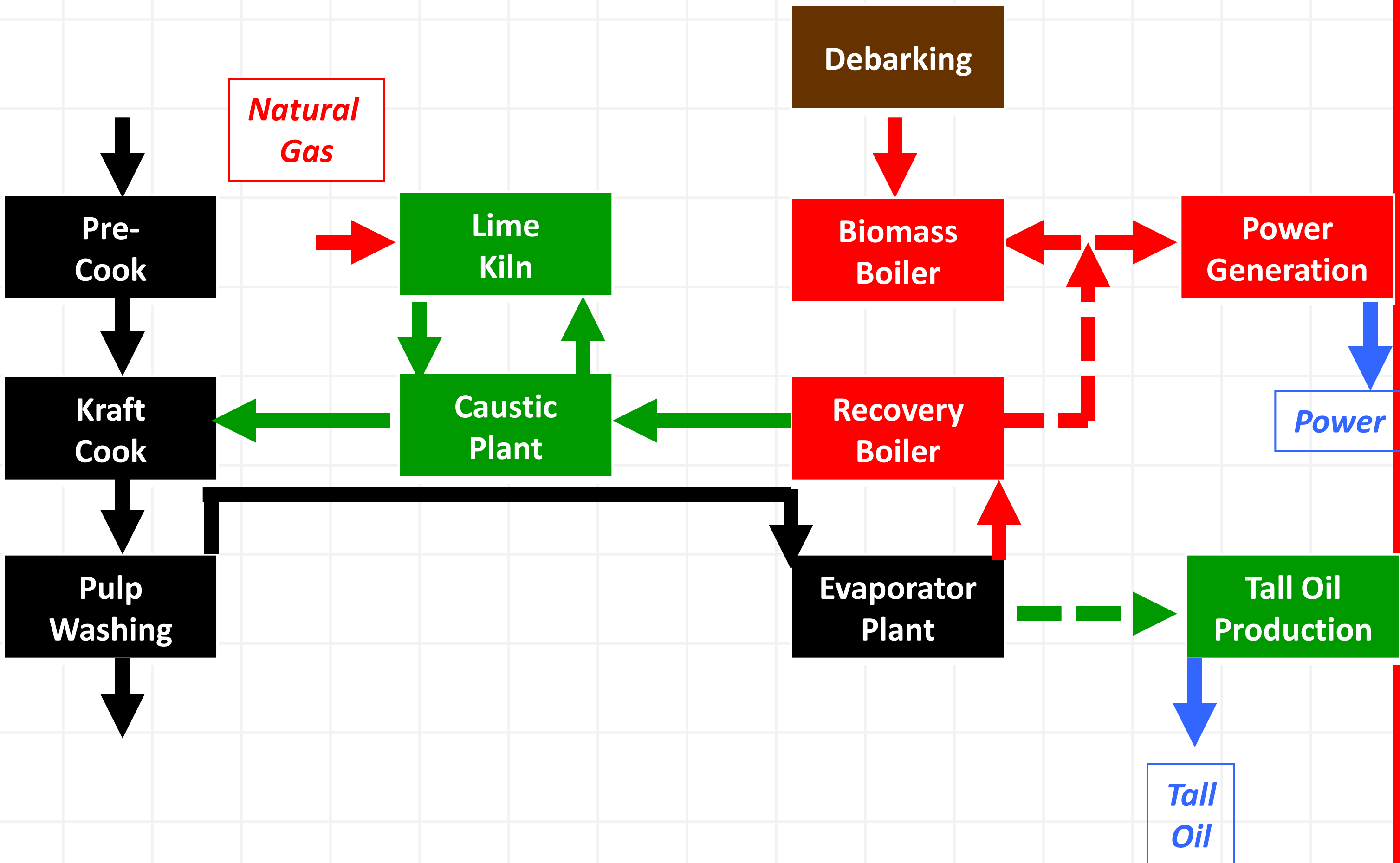
Kraft Cook

Collection

Turpentine

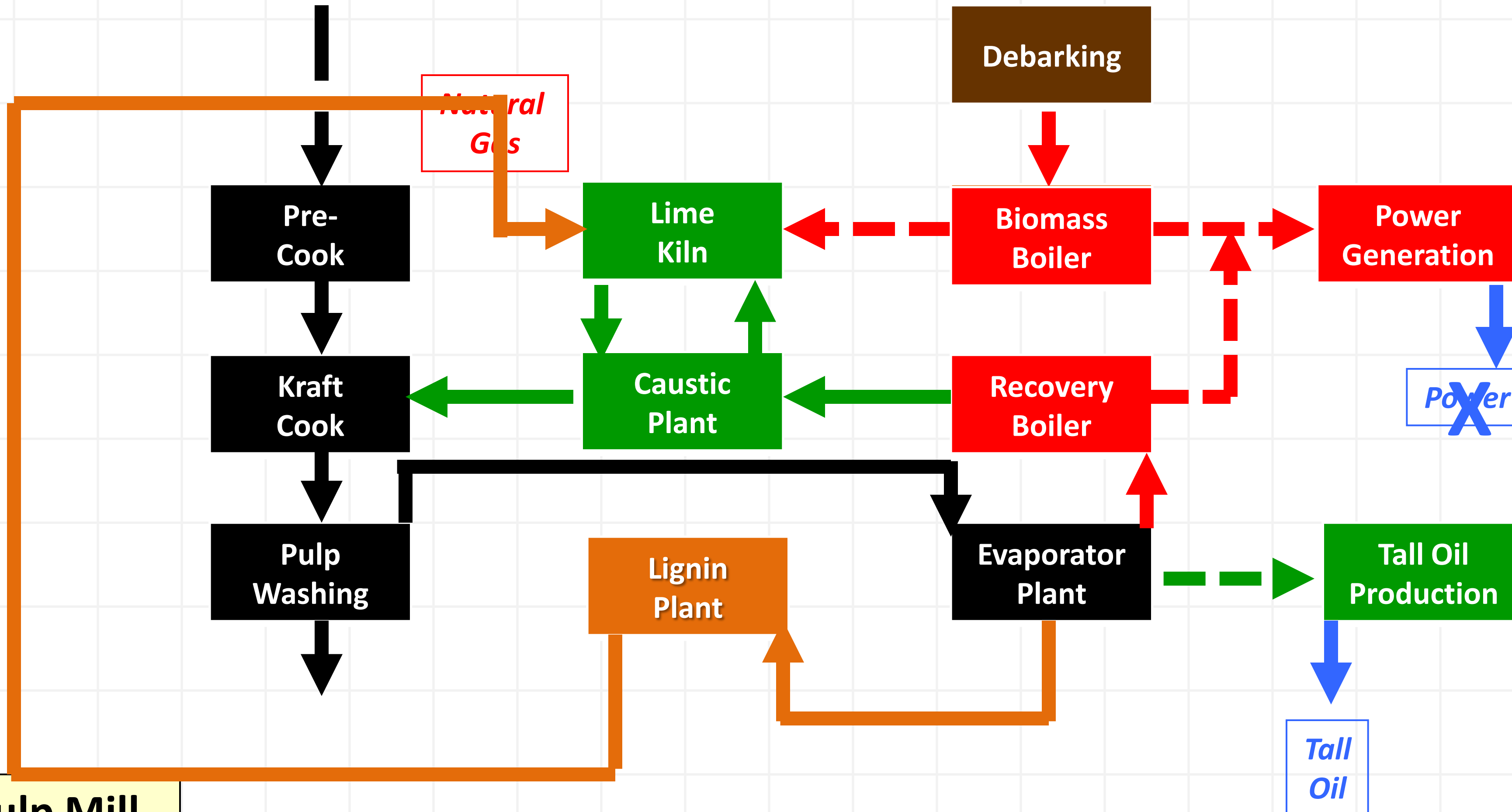
Kraft Pulp Mill integrated with Bioenergy and Biomaterials

Chemical and Energy Recovery



Kraft Pulp Mill integrated with Bioenergy and Biomaterials

Lignin Recovery



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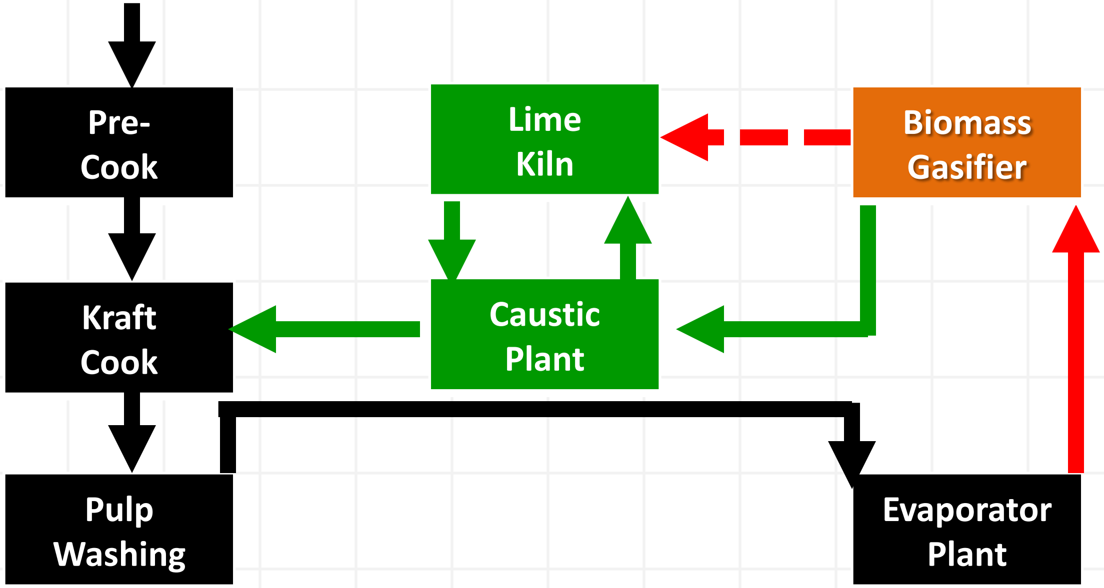
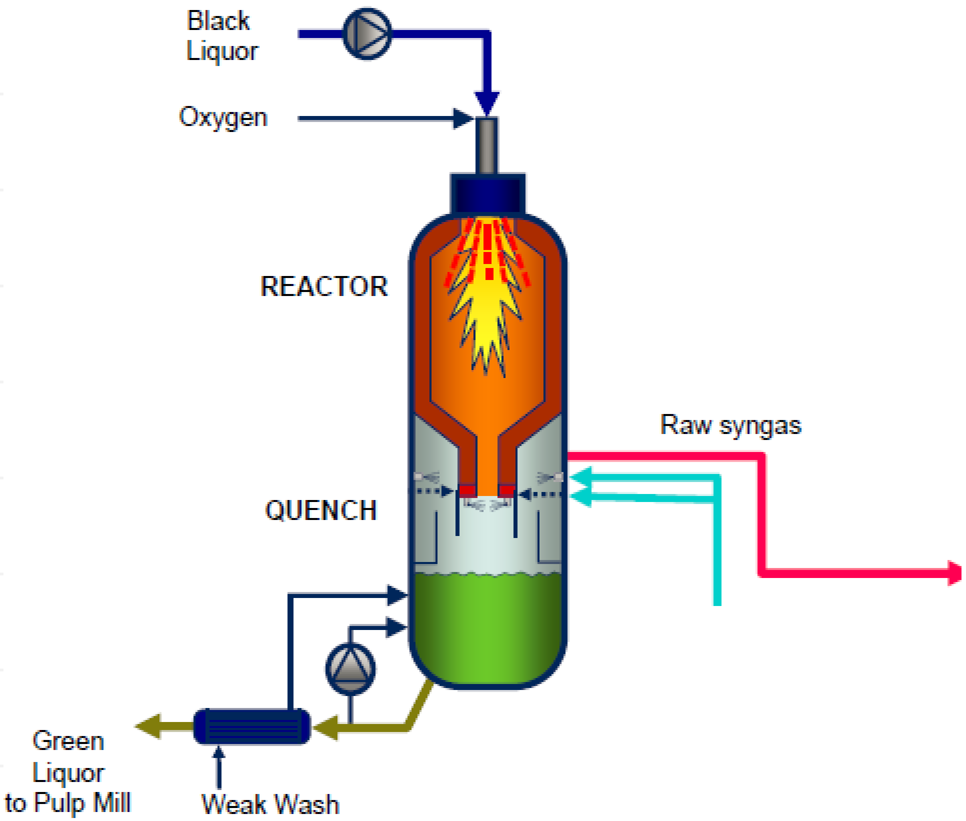
Biomass Gasification



Kraft Pulp Mill integrated with Bioenergy and Biomaterials

Chemrec Black Liquor gasification – biodiesel production



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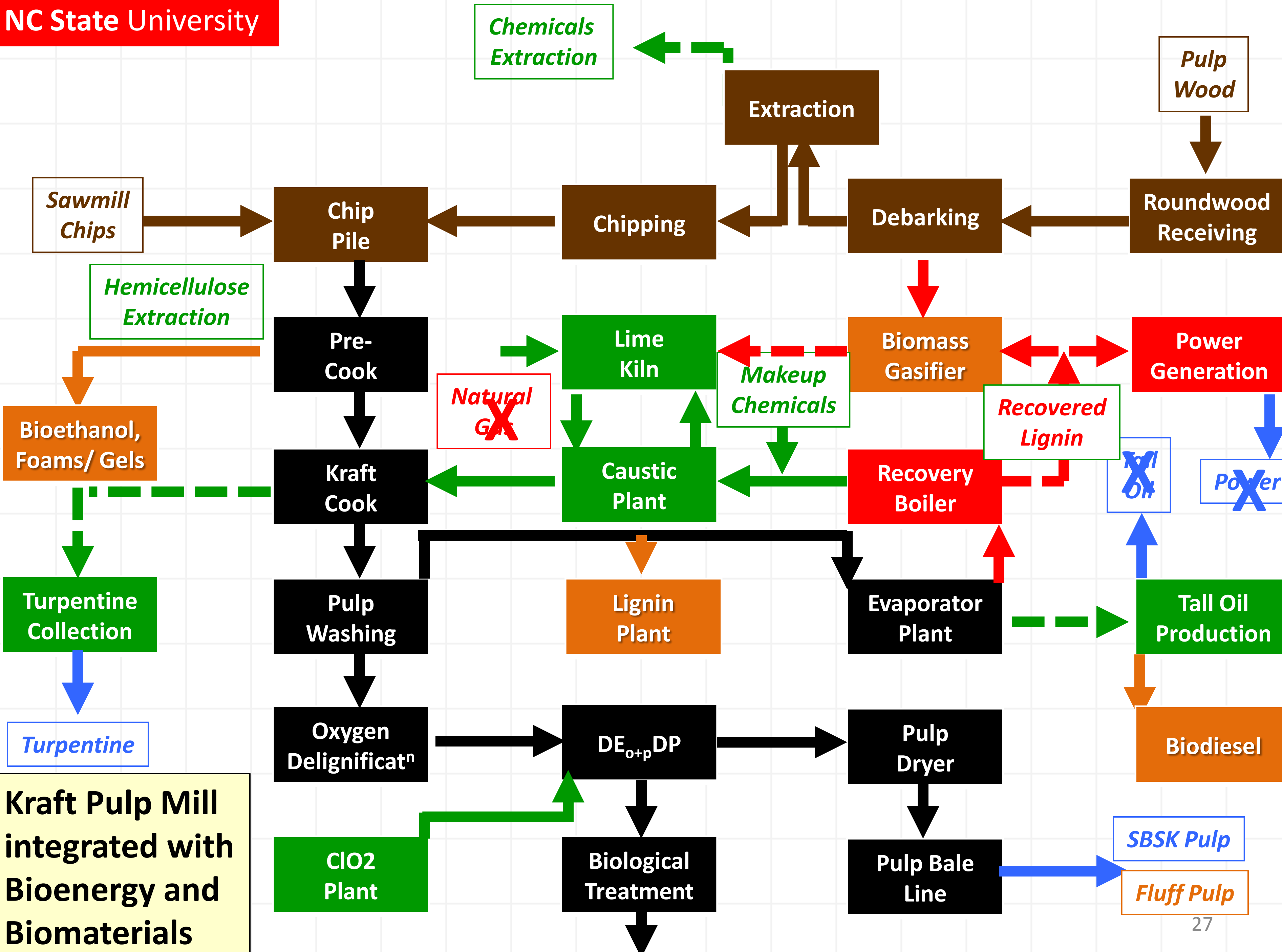
Kraft Pulp Mill integrated with Bioenergy and Biomaterials



- Asia has become overly – dependent on cheap Recovered Paper that will become scarce and expensive in the future
- New softwood capacity will be needed to provide fiber to Asia
- Softwood capacity difficult to justify financially – bioenergy and biomaterials integration may make it work
- USA – Southeast a strong contender for a new mill


Questions?