Update on Lignol's Biorefinery Technology

October 15, 2009

www.lignol.ca

Introduction to Lignol

- A leader in emerging cellulosic ethanol technology
- Burnaby, BC and Berwyn, PA based, public company (LEC:TSX-V)
- Lignol's Biorefining technology offers:
  - Attractive economics for production of cellulosic ethanol and high purity lignin derivatives;
  - Major GHG emission reductions
  - Lowest carbon footprint of any biofuel
  - A demonstration-ready process
- 50 employees

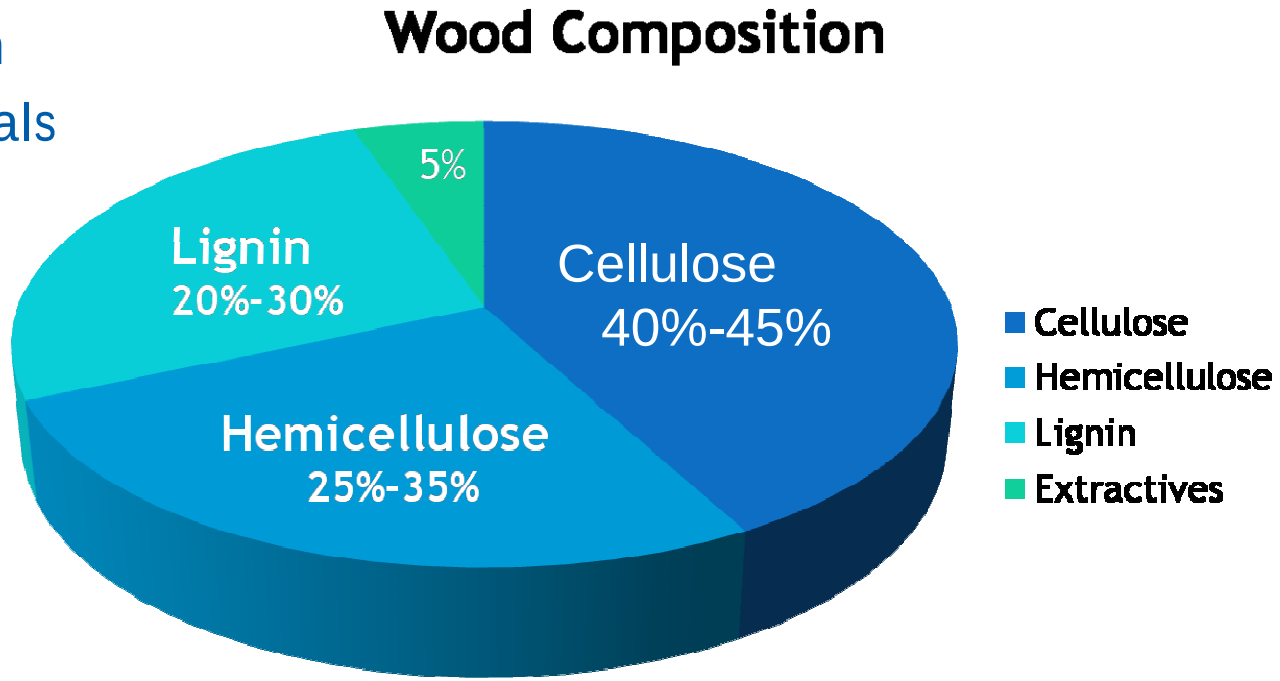
Lignol's mission and strategy

- Lignol was formed to commercialize its world class biorefining technology
- Step-wise roll-out of biorefining technology culminating in optimized commercial design

Stage	Capacity	Status
Lab	Grams/hour	✓Complete
Small Pilot Plant	Kilos/hour	✓Complete
Industrial Pilot	1 tonne/day *(100,000 l/y)*	✓Progressing
Demonstration	100-300 tonnes/day *(10-30 million l/y)*	✓Developing
Commercial	400-2000 tonnes/day *(40-200 million l/y)*	✓Planning

Technology

- Lignol's integrated biorefinery process technology maximizes added value from biomass feedstock
  - Cellulosic ethanol
  - HP-L lignin
  - Biochemicals



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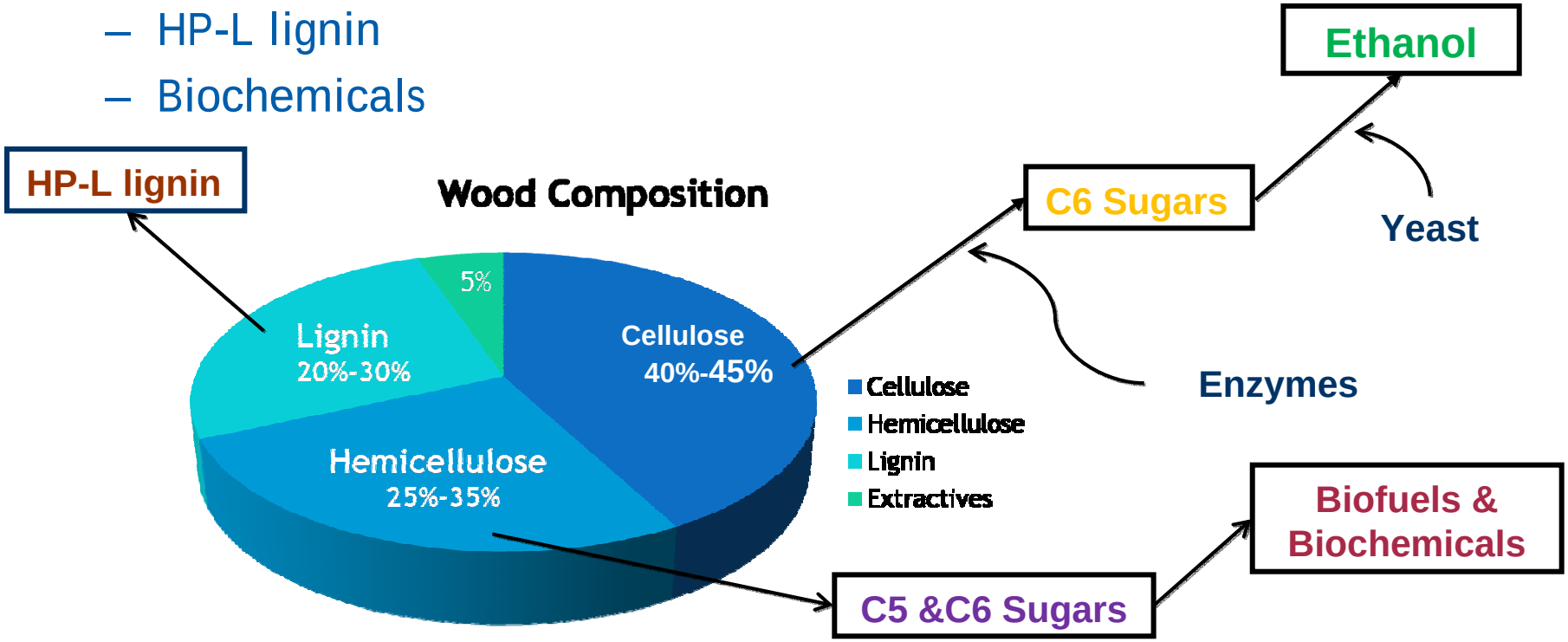
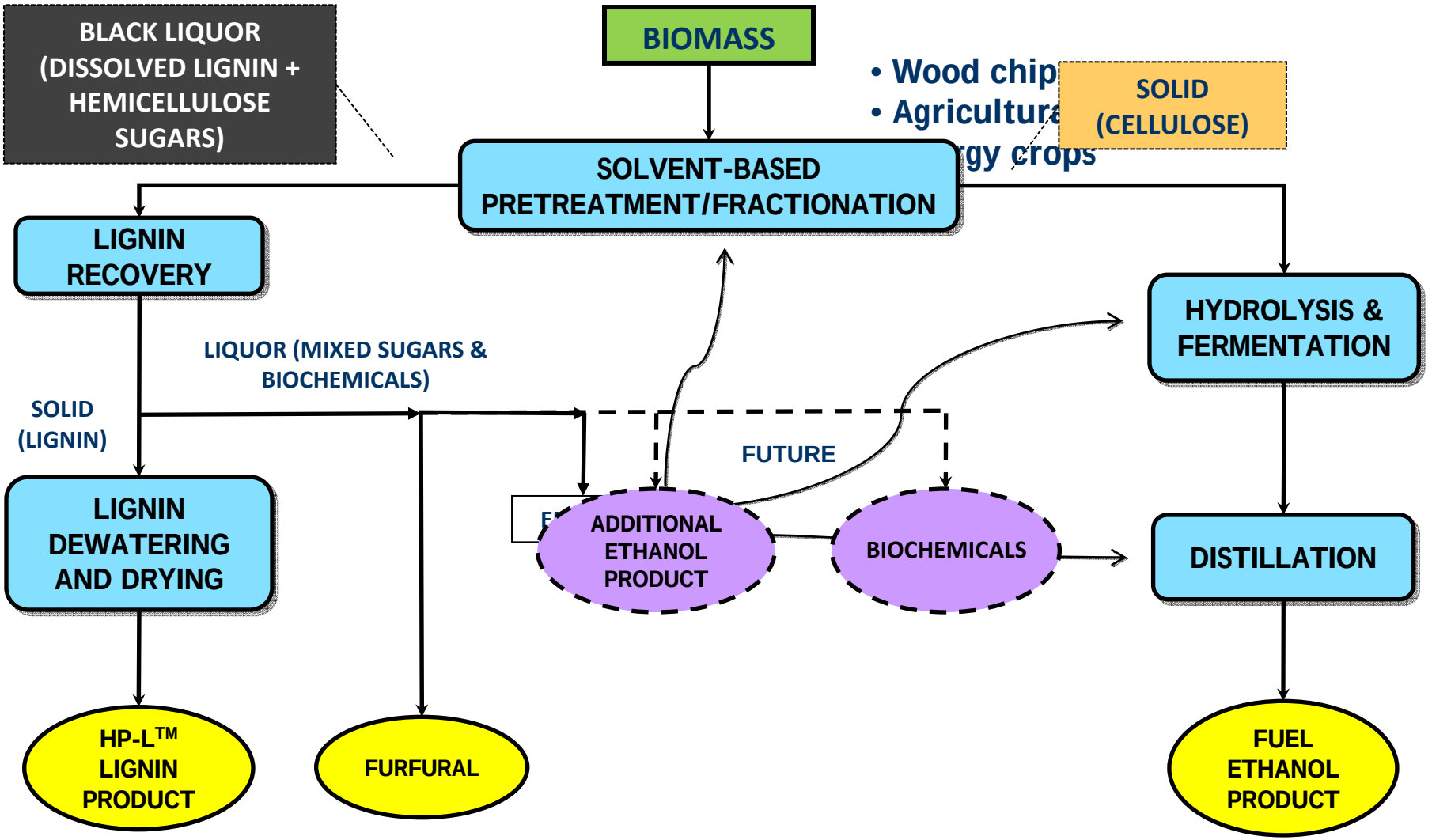
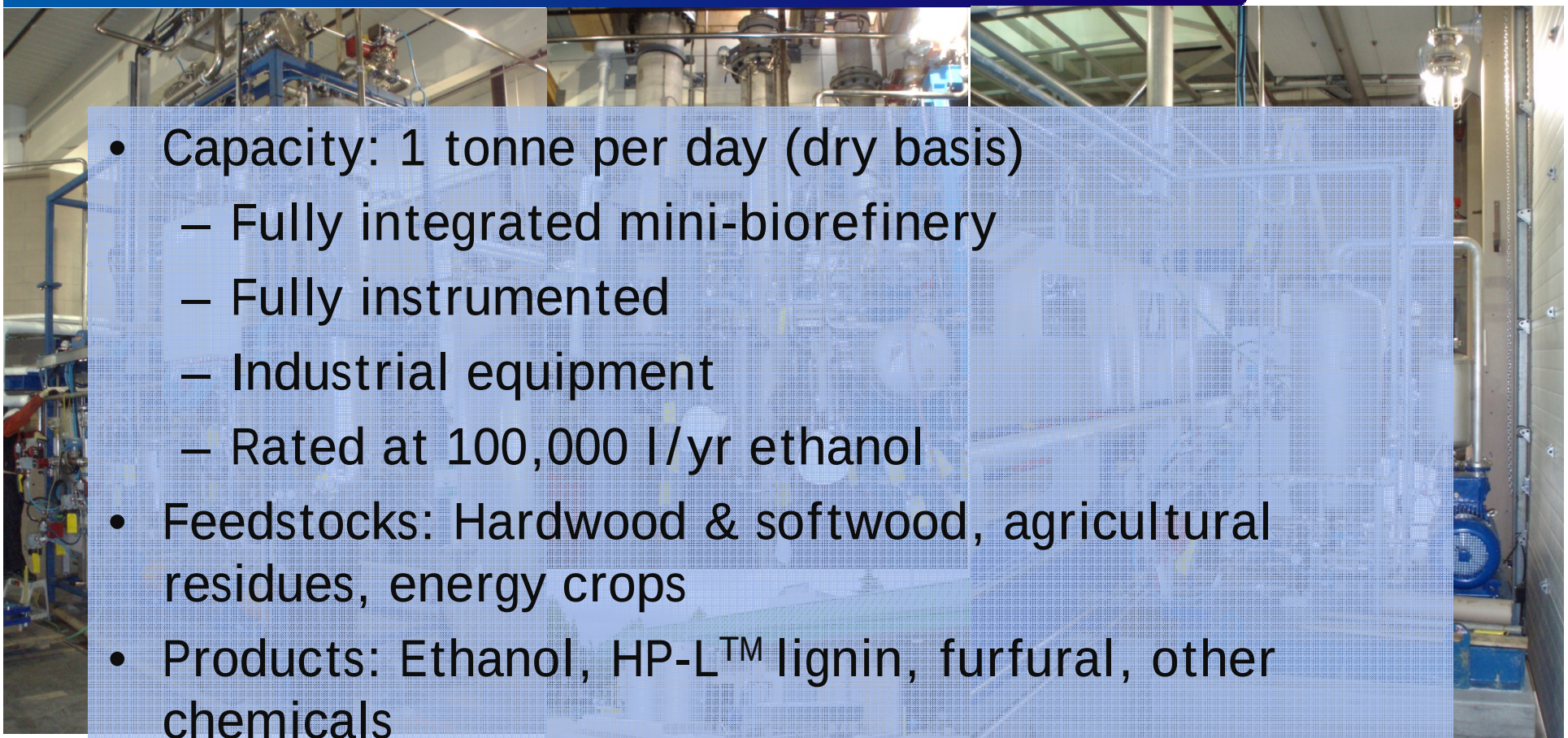


Lignol Biorefinery - Process Overview



Lignol's Integrated Biorefinery Pilot Plant



- Capacity: 1 tonne per day (dry basis)
  - Fully integrated mini-biorefinery
  - Fully instrumented
  - Industrial equipment
  - Rated at 100,000 l/yr ethanol
- Feedstocks: Hardwood & softwood, agricultural residues, energy crops
- Products: Ethanol, HP-L™ lignin, furfural, other chemicals
- Operation: 24/7 in campaigns

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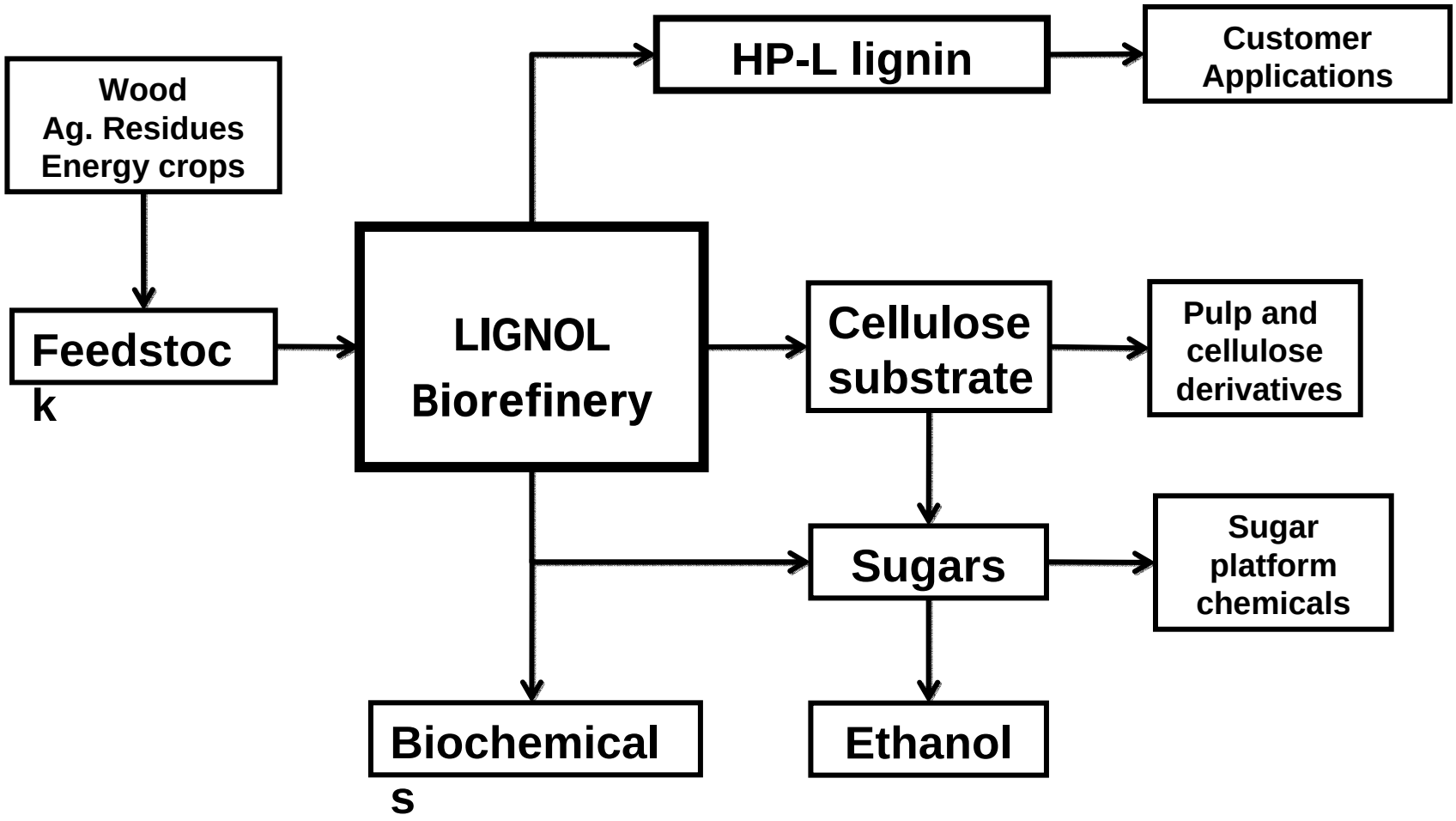
Business Models – Lignol and Partners



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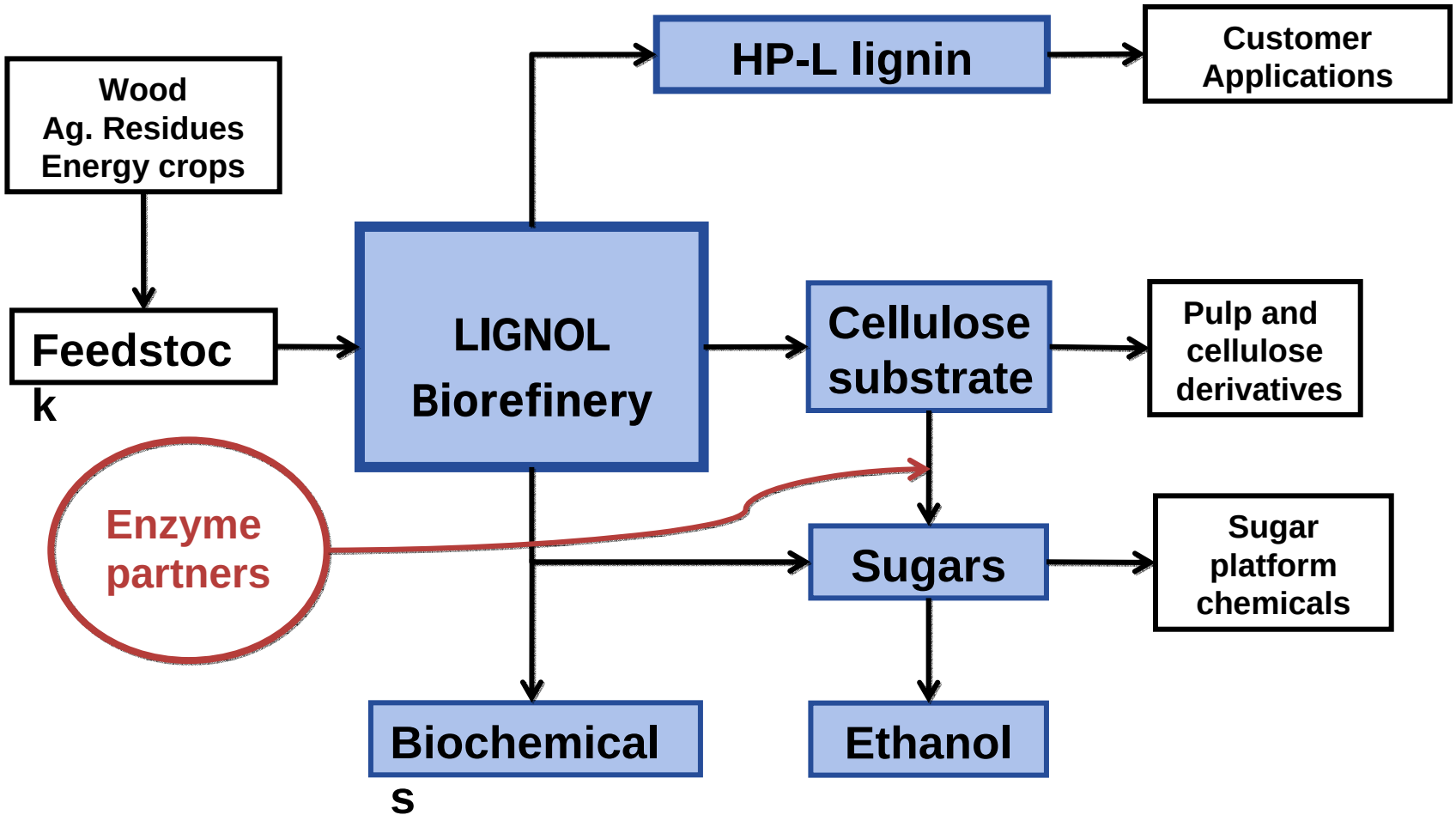

Chemical Values in Woody Biomass

- Cellulose and hemicellulose are sources of sugars and other chemicals, including acetic acid, furfural and other sugar derivatives

- Native Lignin:
  - The natural binding material in all plant matter
  - A matrix aromatic polymer composed of phenolic structures
  - The only major source of aromatic structures in nature
  - The second most abundant bio-polymer after cellulose
  - A huge potential resource for the chemical and energy industries

Challenges for Conventional P&P Lignin

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- Difficult to extract lignin from the recalcitrant woody structure while maintaining desirable properties
- Conventional chemical pulping processes (Kraft and sulfite) do extract lignin but resulting lignin is degraded in the process:
  - Chemical adulteration (Na, **S**, Mg, etc)
  - Chemical modification
  - Requiring extensive and expensive post-treatment to return desired properties
- By definition, sulfite and Kraft lignins are byproducts of processes whose primary goal is producing pulps with particular fiber properties and qualities
- Other cellulosic pretreatment process can only produce adulterated low-value lignin – most will burn it

How is Lignol's HP-L™ Lignin different?

- HP-L™ lignin is a family of unique native lignin derivatives produced from Lignol's Biorefining process
  - High purity with minimal chemical adulteration
  - Natural phenolic bio-polymer
- HP-L lignin is a core product of Lignol's biorefining process
  - Lignin production is a key consideration when setting the biorefinery operating parameters
- Properties of HP-L lignin can be manipulated by adjusting:
  - Feedstock
  - Biorefinery process conditions
  - Post-treatment techniques
- Value enhanced from 10 cents/kg as fuel to >$1.00 /kg as a primary product

HP-L™ Lignin compared to other lignin-based products

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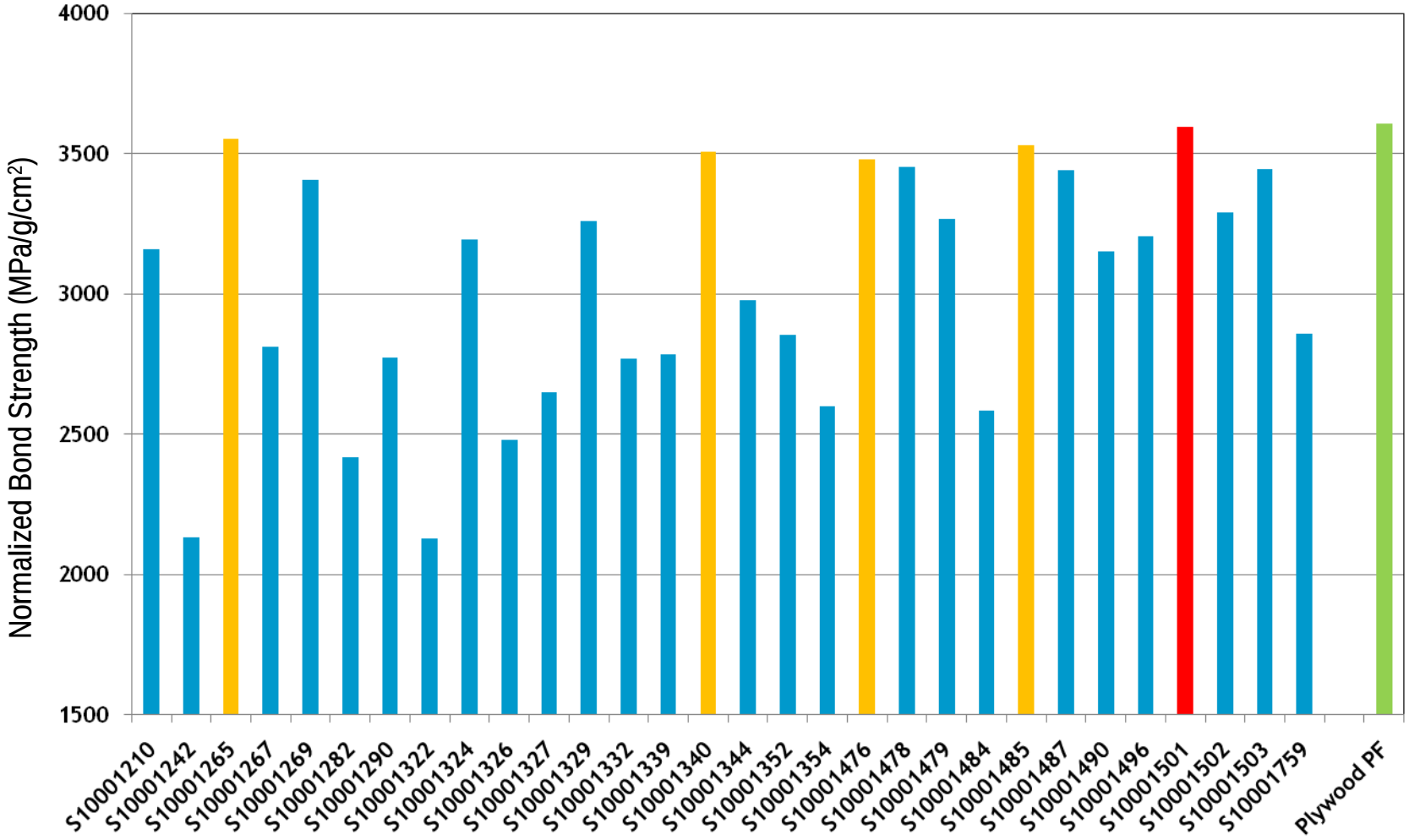
Properties (typical values)	HP-L™	Kraft lignin	Sulfite lignin
Ash	<0.5%	2 - 4%	5 - 10%
Carbohydrates	<1%	1 - 3%	5 - 7%
Sulfur	<0.5 ppm	1.5 - 2%	5 - 15%
Hildebrand Solubility - δ	~20	11 - 12	45 - 47
Polar Solvent (e.g. acetone)	100%	65-70%	<5%

HP-L can be customized

- Lignol works with partners to develop HP-L lignin derivatives tailored to specific applications
  - Major chemical companies
  - Industrial research and development centers
- Examples of areas of applications development:
  - Resins and resin ingredients
  - Adhesives and coatings
  - Carbon fiber
  - Animal feeds

Variation of properties for various grades of HP-L lignin



Lignol's Demonstration Project in USA

- US DOE grant awarded in 2007 - $30 million towards Colorado-based demonstration plant with partner - Suncor
- Presently restructuring project after departure of Suncor as host/partner
- Project development will seek additional leverage from DOE award:
  - New site – likely co-location
  - New location – improved feedstock supply, State funding
  - New partners – including product off-takers
  - Possible capacity increase – higher returns, more HP-L lignin available
  - More money – DOE grant expanded by stimulus funding, possible loan guarantees available

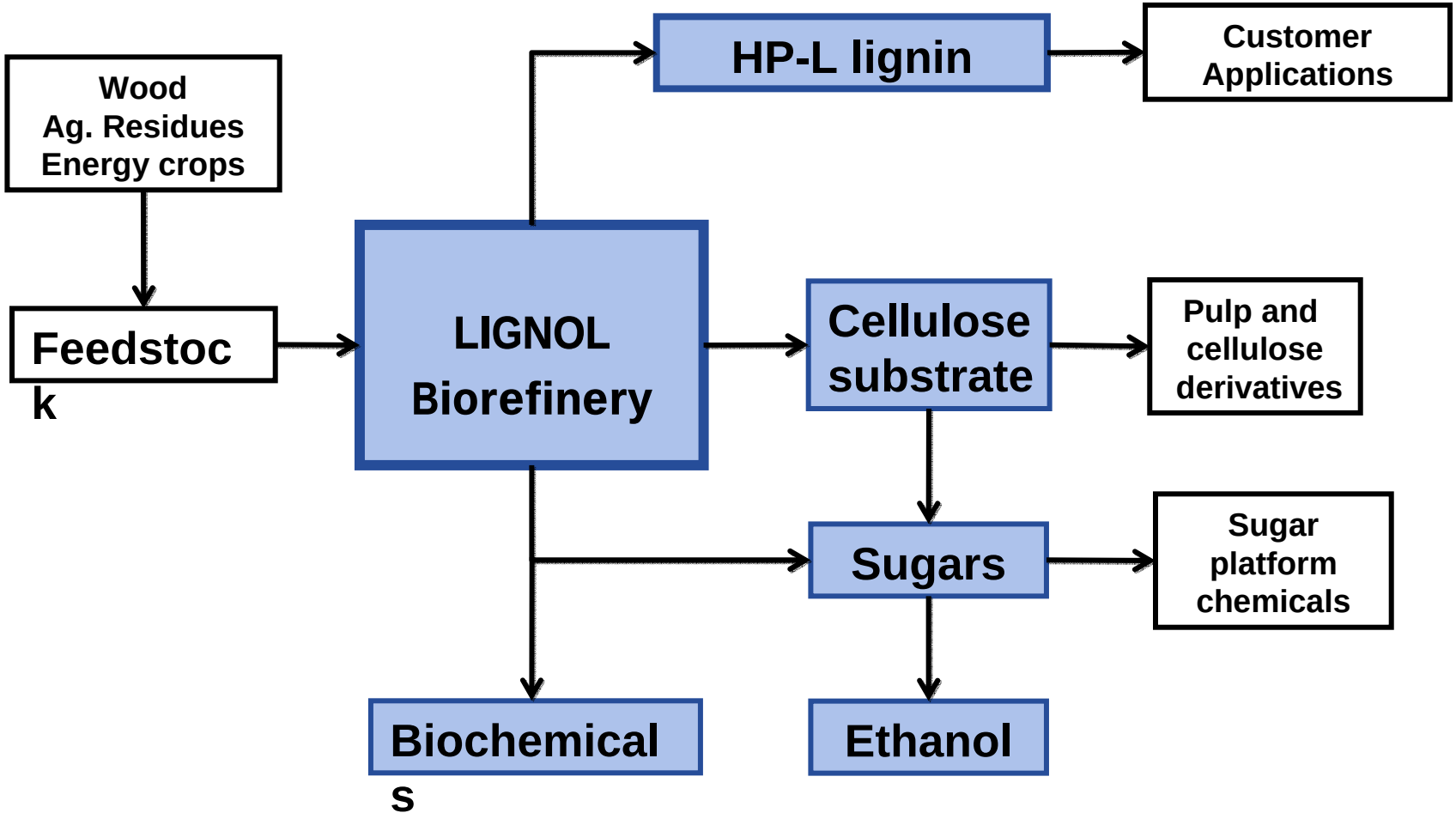
Biorefining and the Pulp and paper Industry

- Biorefining represents a clear opportunity for the Pulp and Paper Industry
  - New business
  - Increased revenue from existing core assets
  - Synergistic operations
  - Use of excess feedstock and fiber waste

Lignol's Technology and the Pulp and Paper Industry

- Co-location
  - Pulp mill could be ideal site to locate Lignol's demo plant
    - Feedstock
    - Land
    - Utilities
    - Water and waste
    - Operating synergies
  - Mill could benefit from co-location of Lignol's demo plant
    - Additional revenue – lignin, utilities, biofuels, chemicals
    - Additional fiber
    - Substantial capital assistance

Business Models – Lignol and P & P



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Thanks!

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