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World Markets

The Global Bio-Energy Market: Developments and Implications

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Agenda

- **Convergence of the Markets for Food, Fuel & Fiber**
 - **Global Bioenergy Policies**
 - **Shifts in Land Use**
- **Implications – So What?**

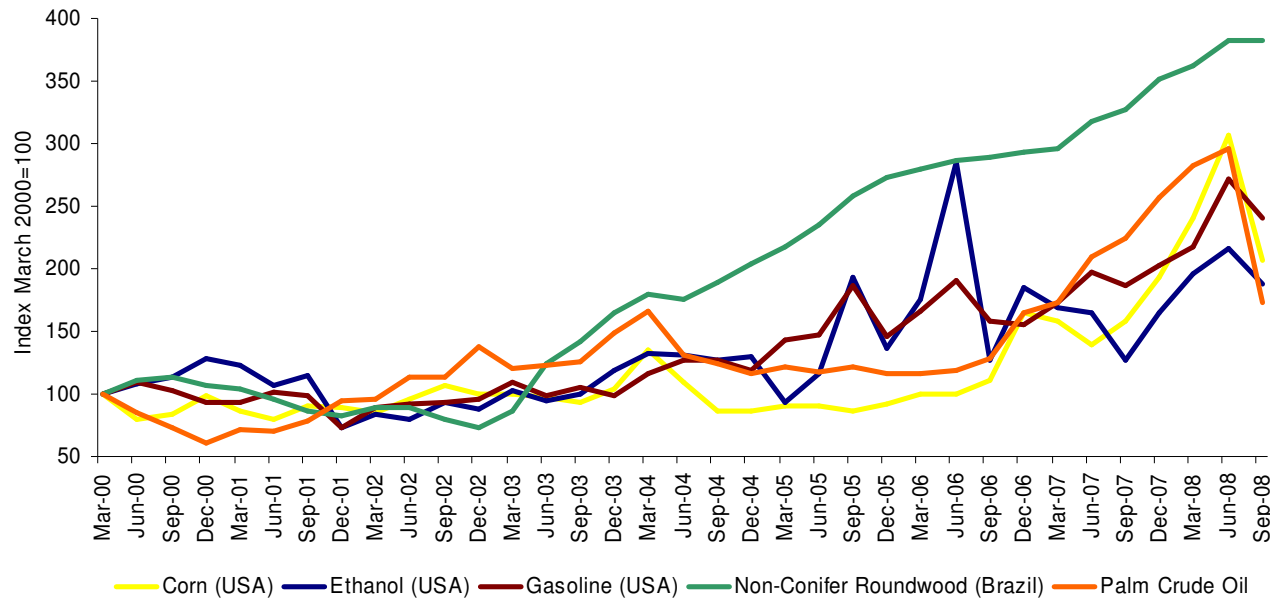
Convergence of the Markets for Fuel, Food and Fiber

A key driver of the bio-economy.

Convergence is occurring for a range of reasons, but all related to security (and driven by anxiety)

- Environmental Security: (i.e., Combat climate change);**
- Economic Security (i.e., Protection against the rising real price of oil)**
- National Security: (i.e., Diversification of energy supply)**
- Food Security: (i.e., Access to food at reasonable prices)**
- Political Security: (i.e., Secure political support at local level by rural development).**

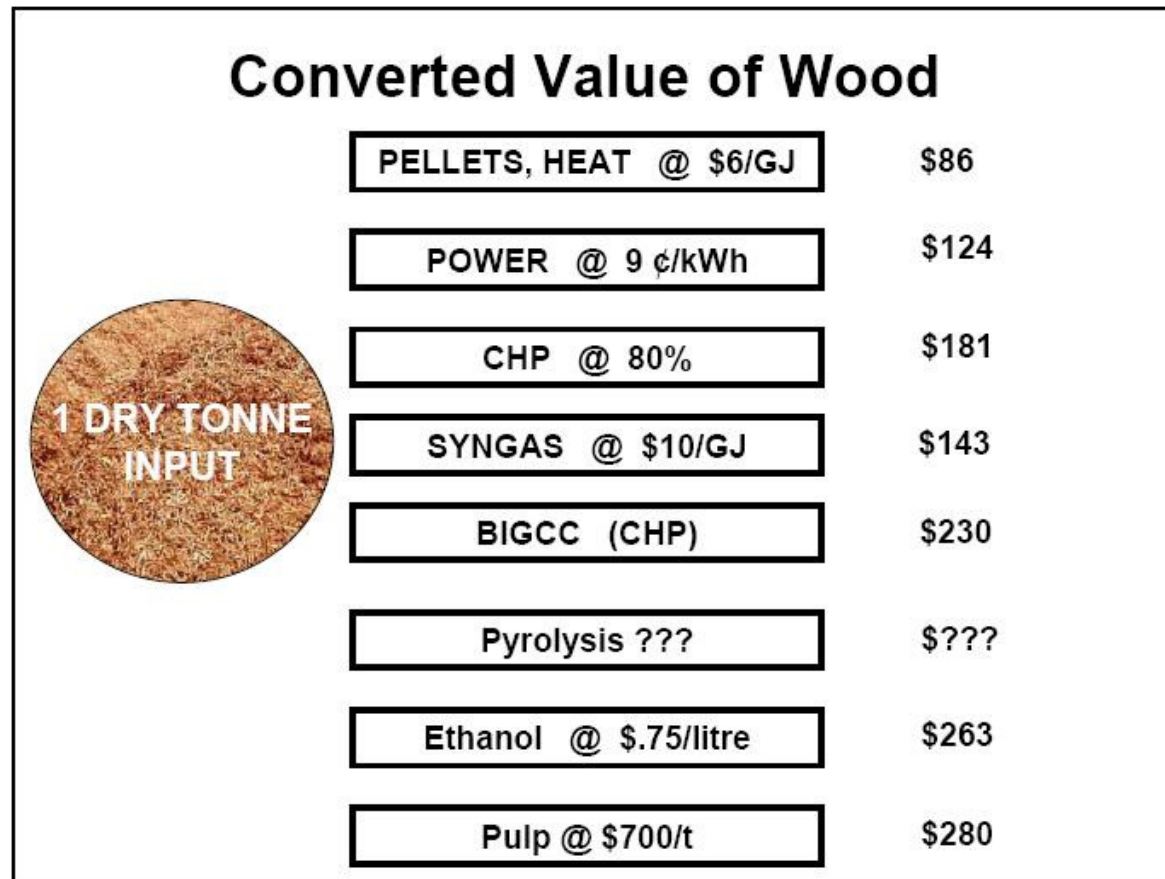
Biofuel & Feedstock Prices: Q1/2000 – Q3/2008



Note: Non-Conifer Roundwood Q3/08 Index is estimated.

Source: Bloomberg, WRI and CIBC World Markets Inc.

- **Convergence of the “3F” markets in the sense that the feedstocks will trade on the basis of their energy equivalency**
- **The price of oil is expected to become a support price for cereals, oilseeds and lower quality wood.**
- **Prices of all of the major feedstocks rose significantly, especially from 2006 to Q2/08 – outpaced both gasoline & ethanol, and caused squeeze on profits.**
- **Financial crisis has caused all of the biofuel and feedstock prices to fall – except wood (for now)**



Source: CANMET Energy Technology Centre, NRCAN

If biomass really is the scarce resource, what kind of processor will ultimately win the fiber auction?

Given these prices: Pellets the loser; Pulp the winner; but what about Pyrolysis? – depends on the output

What role is public policy playing in driving the convergence of the markets for fuel, food & fiber?

Consider a whirl wind global tour of bio-energy policies:

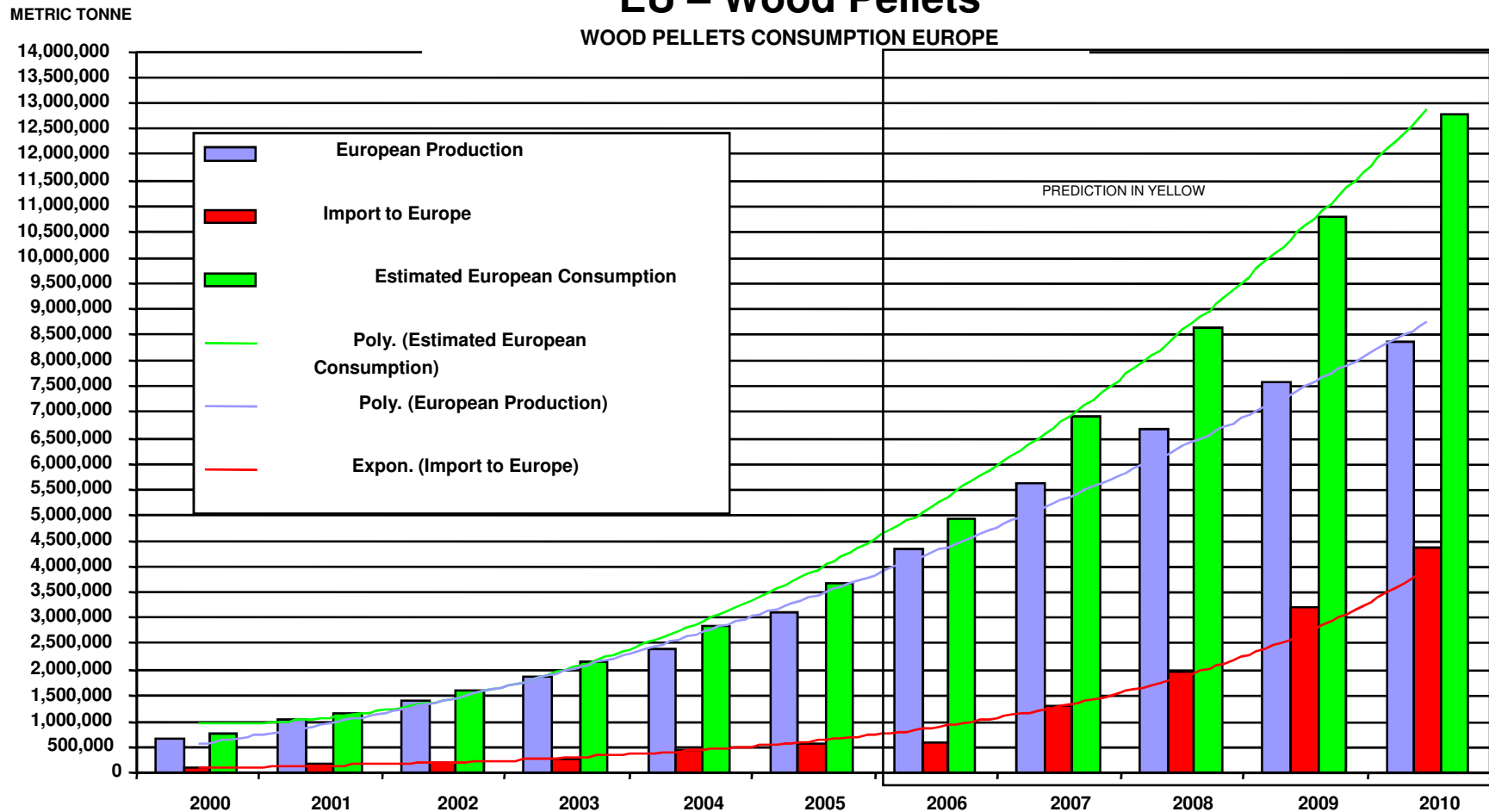
- **European Union**
- **United States**
- **China**

European Union

- **Estimated 185 biodiesel plants already built, and 58 more under construction. Biomass-based power estimated to expand at 35% CAGR over 2005-2010 period.**
- **The EU's binding target for renewable content in transport fuel by 2020 is 10% (with a reduction to 6% proposed in Sept. 2008)**
- **The EU-25 has agreed on a binding target to reach a 20% share of renewable energy source in total energy consumption by 2020 (currently ~7%):**
 - **~ 2/3 of the renewable energy is expected to come from biomass.**
 - **If enforced, Poyry/McKinsey study forecast a 200-260 million m³/year wood deficit in Europe in 2020.**
 - **More recent ECE/FAO study forecasts a wood deficit of 320-450 million m³/year to meet both the energy objective and support a growing wood-based industry.**

EU – Wood Pellets

WOOD PELLETS CONSUMPTION EUROPE



Source: Wood Pellet Association of Canada.

- **Europe is driving the global market for wood pellets. Consumption already up roughly 10x since 2000 to ~ 5 million tpy, and expected to rise to almost 13 million tpy by 2010.**
- **North American capacity expected to rise almost 3x from 2006 to 2010 – feeding Europe for now, but local use will increase.**

United States

- **Renewable Fuel Standard in the Energy Bill requires 36 bn gallons of renewable fuels by 2022, including 21 bn gallons of “advanced” (non-corn starch) biofuels.**
- **More than 65 major new wood energy projects identified, with the bulk being cogen, wood pellet, and then cellulosic ethanol.**
- **Wood energy projects could consume 50 million tons/year of wood by 2012 and 70-200 million tons/year by 2020.**
- **The forest industry in the southern U.S. currently enjoys some of the lowest wood costs in the world. However, wood energy demand is a new long-term source of competition for U.S. wood supply – expect higher prices.**

China

- **Ambitious target for renewables to account for 10% of all energy consumption by 2010 and 15% by 2020.**
- **Biomass power targeted to grow from 2GW in 2006 to 5.5 GW in 2010 and 30 GW by 2020 – largely with ag waste.**
- **Need to build more than 1,000 biomass plants rated at 25-30MW by 2020 (~6/month).**
- **Most facilities are direct combustion plants, but China Holdings is securing approvals to build five 100 MW pyrolysis/gasification plants.**
- **Huge logistical challenge collecting 150,000-200,000 tpy of bulky straw from thousands of small 0.15 ha farms to fuel a 25MW biomass power plant.**
- **SFA targeting to develop 13.3 million ha of forests to produce feedstock for biofuel production and power – must compete with industrial wood and environmental demand¹⁰**

Shifts in Land-Use

Secular rise in fuel, food and fiber prices will trigger changes in land use patterns. Historically, land kept under forests for 2 main reasons:

- 1. Owners want the production of some non-market good or service.**
- 2. The land can't make it in agriculture.**

Convergence is expected to have the largest impact in the southern hemisphere since it generally enjoys higher crop yields and has lower land and labor costs.

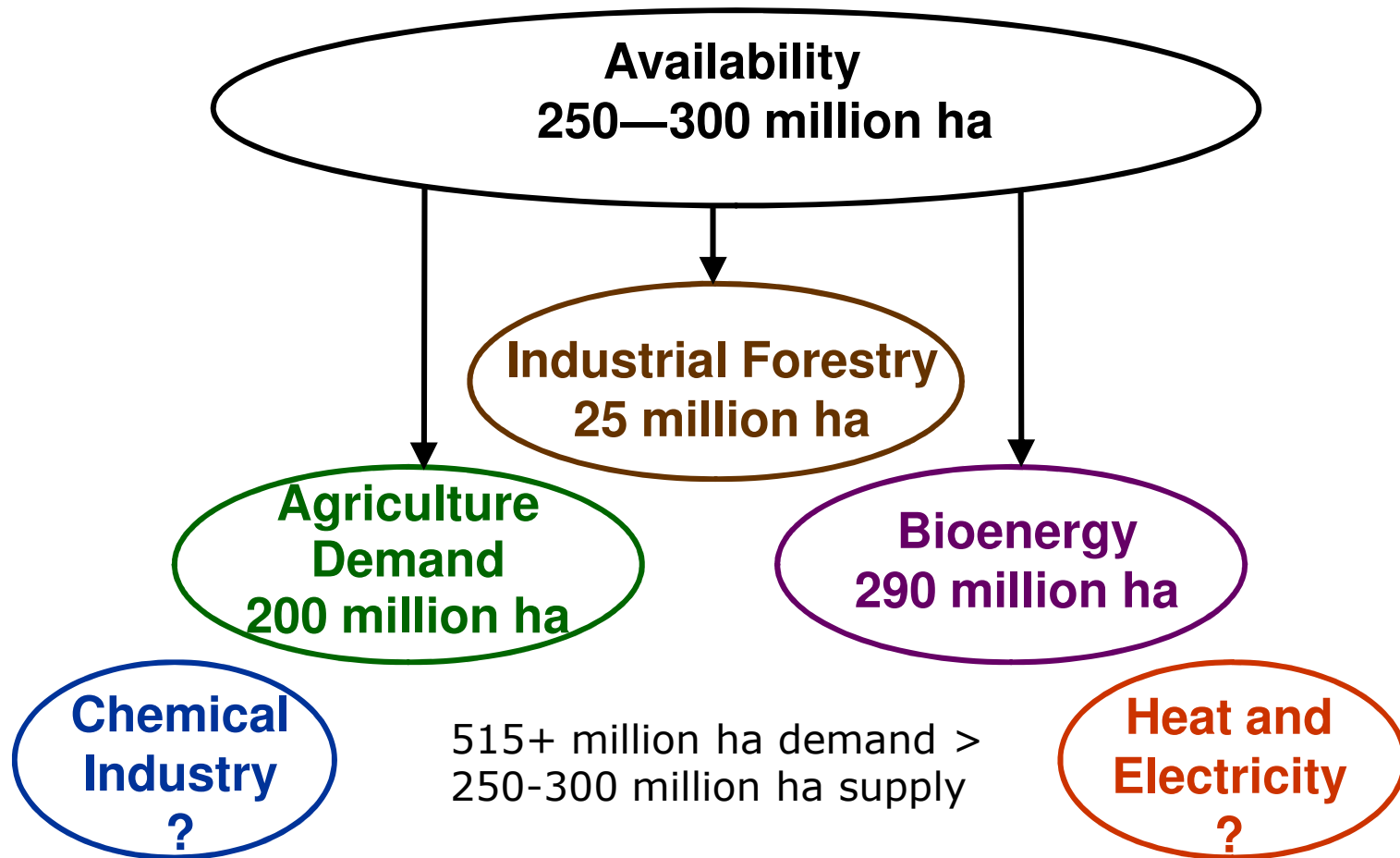
Shifts in Land-Use

- **We think some of the best forest land will be under pressure for conversion to either food or bio-energy crops – especially in the tropics where the opportunity cost is highest.**
- **Expect greater land-use conflicts in many regions due to rising demand relative to potential supply.**



Where is the Land Coming From—2030?

How to Balance the Demand?



Source: S. Nilsson, IIASA

Wood vs Other Cellulosic Biomass

Wood is one of many types of cellulosic biomass that can be used to produce biofuels. However, wood does have the following relative advantages:

- **Longer storage life and lower storage costs.**
- **Higher bulk density (thus lower effective transport costs)**
- **Higher sugar content;**
- **Less intensive use of water & fertilizers**
- **Established collection system.**



Dedicated Cellulosic Energy Crops?

Miscanthus - a perennial grass - is likely the most interesting alternative.

- **Can already produce 2.5x more ethanol per acre than corn.**
 - **Green leaves arrive 6 weeks earlier, and stay 6 weeks longer**
- **Similar genome to corn, but is still unimproved. Potential for 3x increase in yield over time?**
- **Accumulates much more carbon in the soil since it is a perennial.**
- **Comparable growing season to switch grass, but much more efficient in converting sunlight to biomass.**
- **If harvested in Dec/Jan, after nutrients have returned to the soil, it requires little fertilizer.**
- **Is a sterile hybrid, thus must be propagated by planting underground stems (rhizomes). Patented farm equipment can plant 50 acres/day.**



SO WHAT?

- Analytical Implications of Convergence?
- Organizational Implications?
- Policy Implications?
- Investment Implications?

Analytical Implications?

- The key task is to move to cross-sectorial analysis and integrated land-use policies (break the “silo” mindset)
 - Food/fiber/fuel/water/chemicals/climate/natural preservation—a real systems analysis approach
 - But has this need arisen at a time when the analytical resources/capacity have actually diminished in both our industry and governments?
 - More resources need to be dedicated to “thinking”



Organizational Implications?

- Need to break out of our sectorial silos
 - At HQ, develop more “virtual” teams that cut across sectors.
 - For forestry organizations (provided the big picture themes are understood and communicated), move the decision making closer to the land-base.

Policy Implications?

It depends –

are you a “Focused Fixer” or a “Paradigm Shifter”?

Policy Implications

If you are a “Focused Fixer”, likely emphasize:

- Bio-engineering, especially to increase productivity and “robustness”
- Agro–forestry–energy interface
- Pasture improvements
- Yield gaps between private and public lands.

When allocating public timber, be aware of the differences in
Employment and GDP multipliers across end-uses

Given the complexity of the issues, worth actively supporting the
development of formal markets to address as many of the historical
externalities as possible (eg., water, carbon, bio-diversity, etc).



Policy Implications

If you are a “Paradigm Shifter”, likely emphasize:

- Need for dramatic reductions in consumption levels and changes in consumption patterns among the wealthiest 10% of humanity (and altered expectations among most of the remaining populace)
- Need to convince voters that the world has gone down the wrong path, and that we have to go back.

Does demanding such fundamental change divert attention from practical solutions? Is this possible, at least without a major crisis first?



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Investment Implications

A McKinsey Global Survey: How companies think about climate change



- Surveyed 2192 C-level executives around the world (27% CEOs), Dec 07.
- Fully 60% regard climate change as strategically important, and a majority consider it important to product development, investment planning and brand management.
- Importance greatest in Asia/Europe, and least in North America.

Source: Dec 2007 *McKinsey Quarterly* survey on climate change

Investment Implications

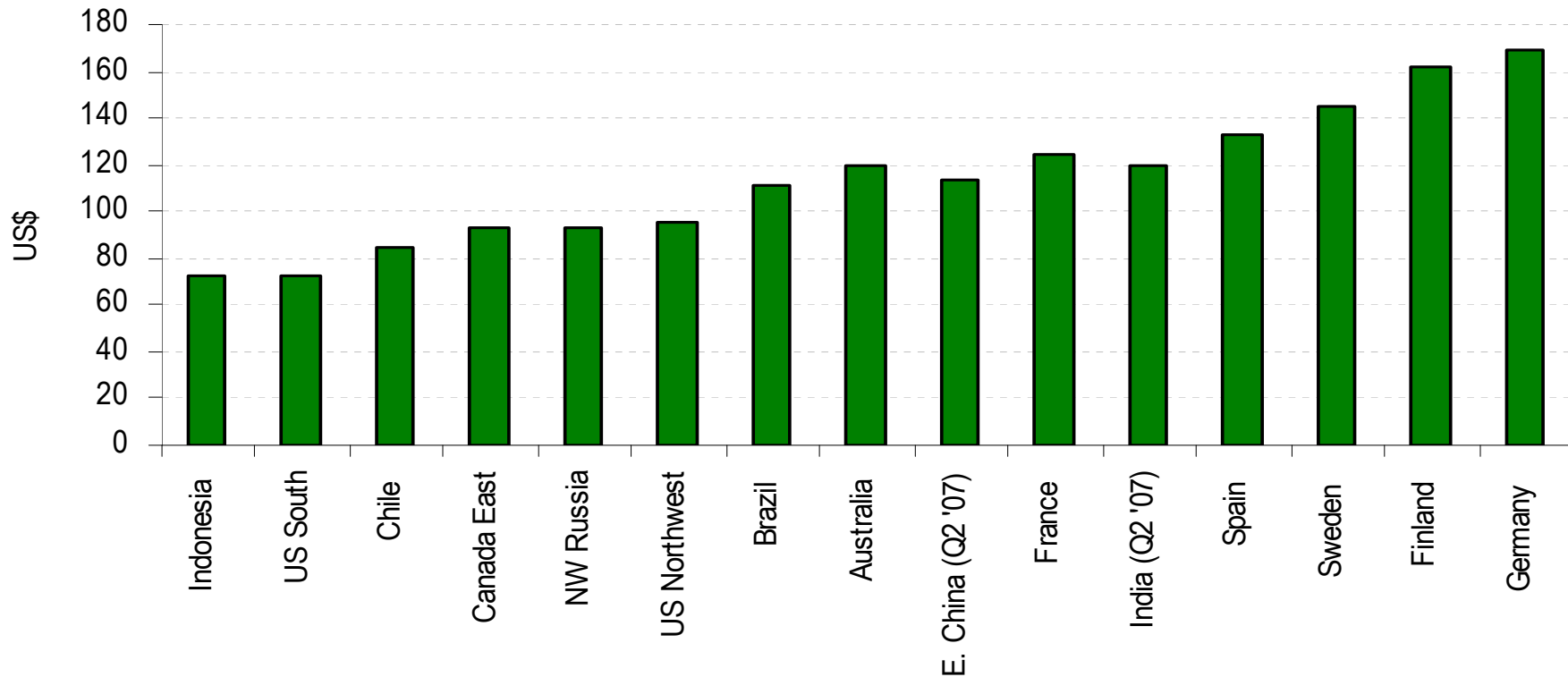
Good quality land will be the scarce resource.

...and access to clean water may be key in influencing the quality.

Users & owners expected to lobby for flexibility in switching land uses

Delivered Hardwood Biomass Prices Q2/2008 (\$US/BDMT)

Average Delivered Hardwood Pulplogs Prices Q2/2008



We think the convergence of the “Three F’s” (in combination with four other “shocks”) are going to cause the global cost curve for fiber to shift up and flatten.

Comparative advantage shifting back to the Northern Hemisphere?

Final Thoughts

- **The catalyst for the bio-economy taking off is higher prices for fossil fuels (whether market or policy driven). Expect current financial turmoil to slow down investments, but the long-term fundamentals remain in place.**
- **There is a need to break out of our “forestry silo” in balancing the competing demands for access to forest land.**
 - **Many new potential uses (and users) of biomass**
 - **Need to establish partnerships along the emerging value chain (eg., between biomass owners and processors)**
- **Land is going to become an increasingly scarce resource, and we can expect greater land-use conflicts.**

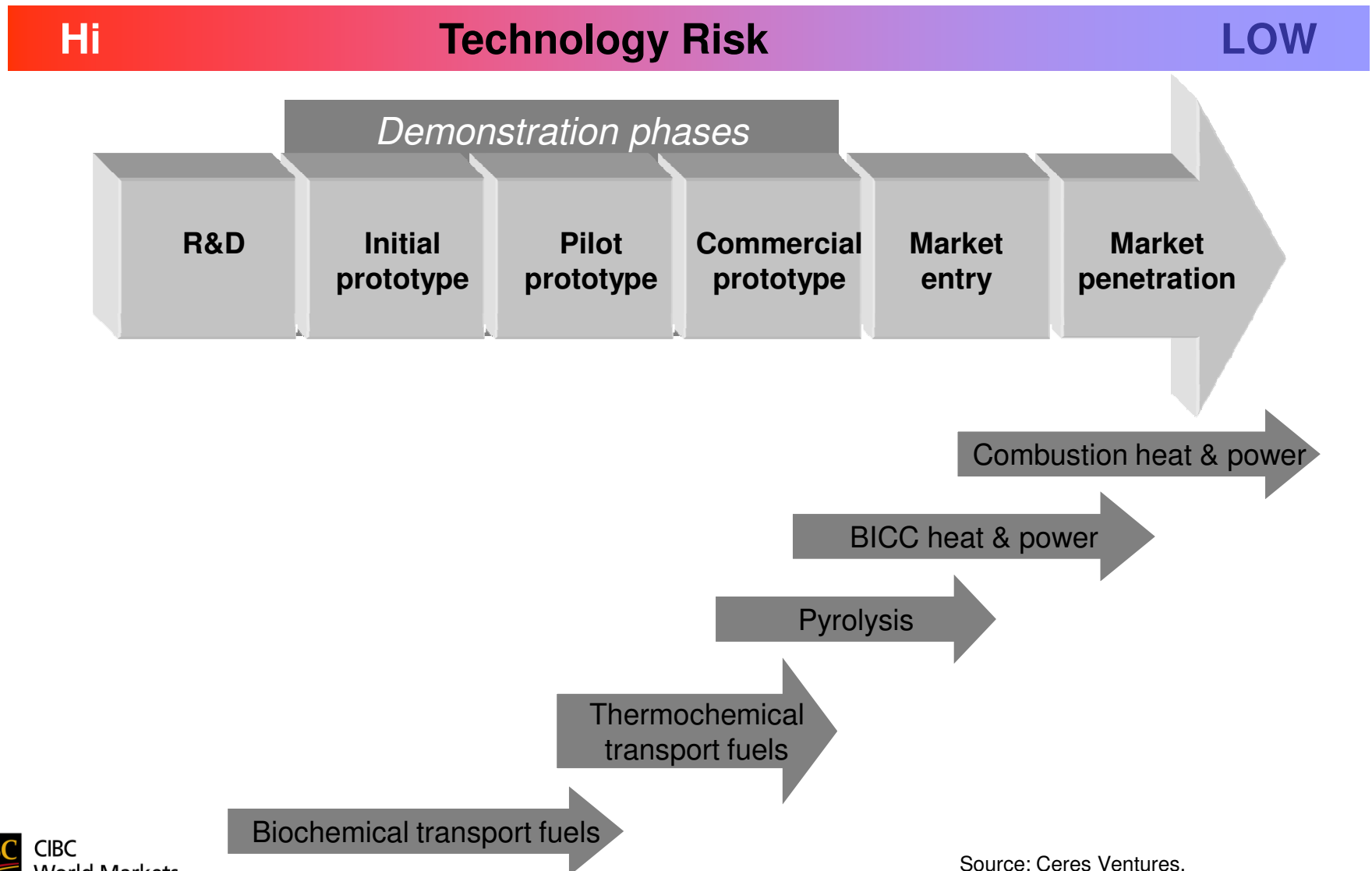


Central to all bio-energy strategies is a competitive price for delivered biomass

Appendix A:

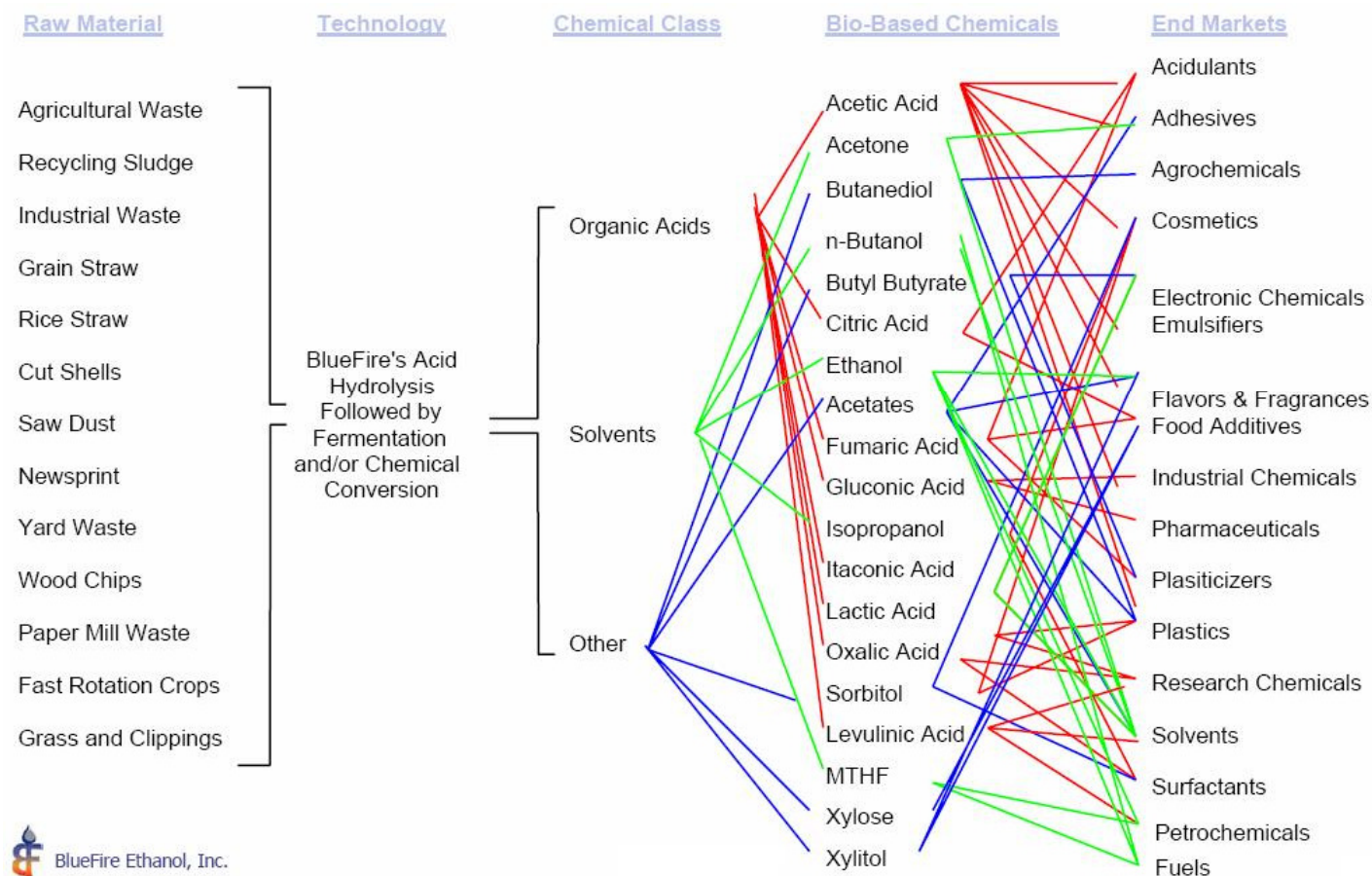
Status of Bio-Energy/Chemical Technologies

Current Status of Bio-Energy Technologies



Bio-Chemicals

Technologies Already Exist Which Can Provide Competitive Entry into Bio-based Chemicals and Target Market Segments



Source: BlueFire Ethanol Inc., CIBC WM

Appendix B: Bio of Don Roberts

- Mr. Roberts is a Managing Director with CIBC World Markets Inc., an investment bank with 23 offices around the world and over 2,600 employees. He leads CIBC's Paper & Forest Products Research Team, and is also responsible for the bio-fuels sector. His primary responsibility is to lead a team of analysts in advising financial institutions (e.g., pension/mutual funds) on their investments in the global paper & forest products industry. He is consistently ranked by institutional investor surveys as one of the top equity research analysts covering the forest products industry.
- Mr. Roberts specializes in international commodity markets, and has collaborated with a number of international forestry organizations to gain a global perspective on the paper & forest products sector. He has over 30 years of experience related to various aspects of the forest products sector. Prior to joining the investment business, he was Chief of Industry and Trade Analysis with the Canadian Forest Service.
- In addition to his work with CIBC World Markets Inc., Mr. Roberts is also
 - An Adjunct Professor in the Department of Forest Resource Management at the University of British Columbia (Vancouver);
 - On the Board of Executives of the Sloan Center for Paper Business and Industry Studies at the Georgia Institute of Technology (Atlanta, Georgia); and
 - Serves in an advisory capacity for a range of government, industry, and NGO groups.
- Mr. Roberts has a Bachelor's degree in Agricultural Economics from the University of British Columbia, a Master's degree in Forestry Economics from the University of California at Berkeley, and both an MBA and doctoral studies in International Finance and Economics from the University of Chicago.



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