Global Trends for Investments in Forestry & Bio-Energy

by Don Roberts, Vice-Chairman, CIBC

October 17, 2011

MegaFlorestais Working Group
Oaxaca, Mexico

Agenda

1. Context
2. Impact of the Great Recession
3. Is Forest Products a *Sunset Industry*?
4. Global Fiber Markets
5. Investment Trends in Bio-Energy
6. Case Study: Renewable Fuel Oil from Biomass

Appendix:
Levelised Cost of Electricity – How Does Bio-energy Currently Compare?

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The Global Landscape

- Over the past decade the global forest sector was experiencing some of the most fundamental changes in markets and public policies since the end of the Colonial Era.
- For example:
  - Explosion of the Asian wood deficit…
  - Fundamental forest tenure reforms in Russia, China, India…
  - Revolution in electronic communication…
  - Expansion of the bioenergy sector…
  - Prospective pricing of carbon…

……and then came the Great Recession – the worst in over 70 years.

Impact of the Great Recession

Global Consumption of Softwood Lumber

	2005 (million m3)	2009 (million m3)	% Change
Global	320	242	↓ 24%
NA	129	67	↓ 48%
Europe	101	79	↓ 22%
China	9.8	20.4	↑ 108%

Big Dichotomy

Source: FAO Annual Market Review 2010 – 2011.

Global Consumption of Wood Pulp

	2005 (million tonnes)	2009 (million tonnes)	% Change
Global	**178**	**160**	↓ **10%**
NA	**70.3**	**55.8**	↓ **21%**
Europe	**55.0**	**47.4**	↓ **14%**
China	**12.5**	**19.8**	↑ **58%**

Big Dichotomy

Source: FAO Annual Market Review 2010 – 2011.

Global Consumption of Paper & Paperboard

	2005 (million tonnes)	2009 (million tonnes)	% Change
Global	**362**	**374.1**	↓ **3%**
NA	**98.6**	**77.2**	↓ **22%**
Europe	**97.6**	**92.1**	↓ **6%**
China	**64.4**	**90.2**	↑ **40%**

Big Dichotomy

Source: FAO Annual Market Review 2010 – 2011.

Global Demand for Roundwood

	2005 (million m3)	2009 (million m3)	% Change
Global Demand	**3,560**	**3,270**	**-8%**
Industrial **(coniferous & non-coniferous)**	**1,720**	**1,420**	**-17%**
North America	**618**	**403**	**-35%**
Europe	**517**	**440**	**-15%**
China	**125**	**121**	**-3%**

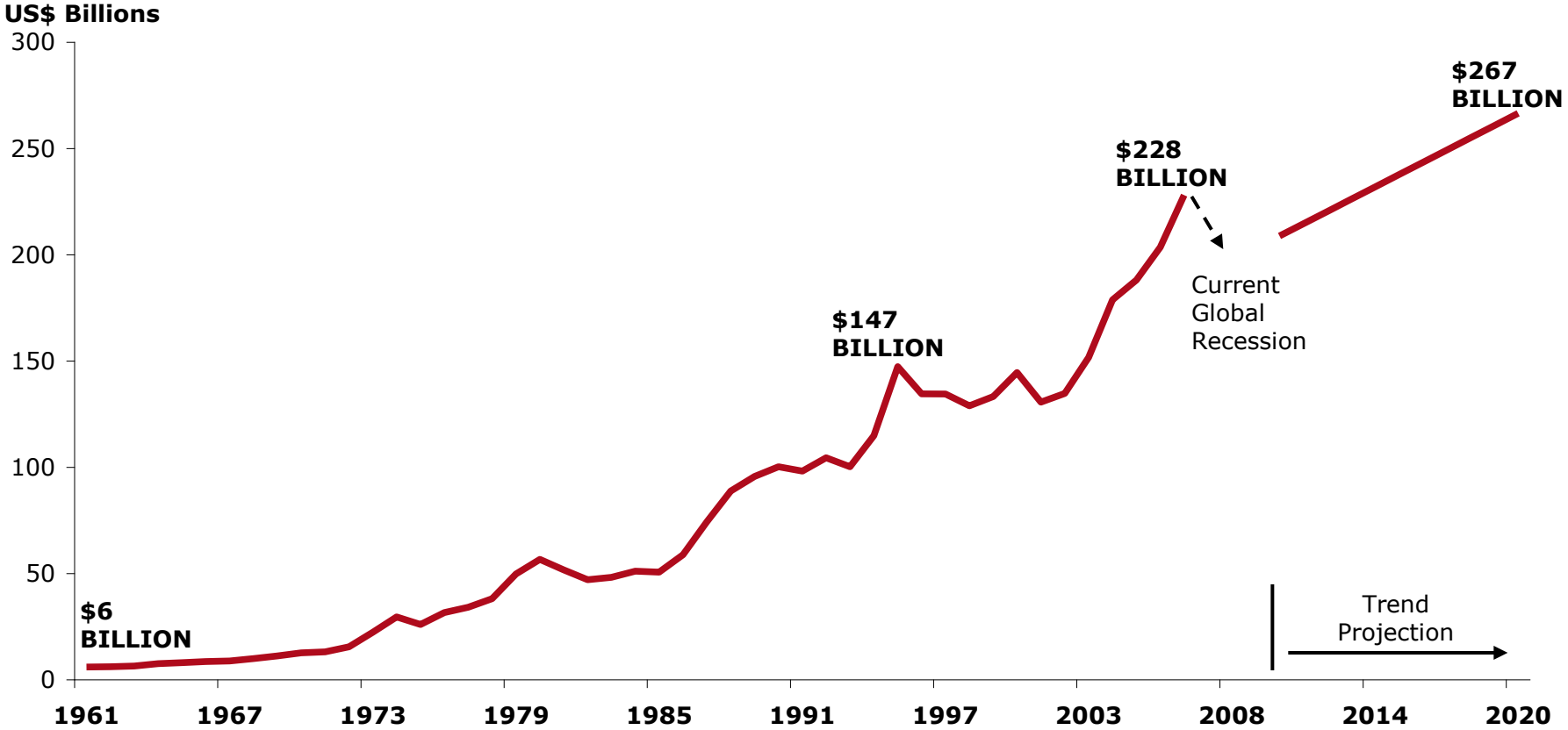
Source: FAO Annual Market Review 2010 – 2011.

Is Forest Products a Sunset Industry?

Longer-Term Outlook

- Inevitably, there will be an economic recovery.
- What is the longer term outlook for forest products?

Value of World Exports of Forest Products
- Growing at 8.5% per Year

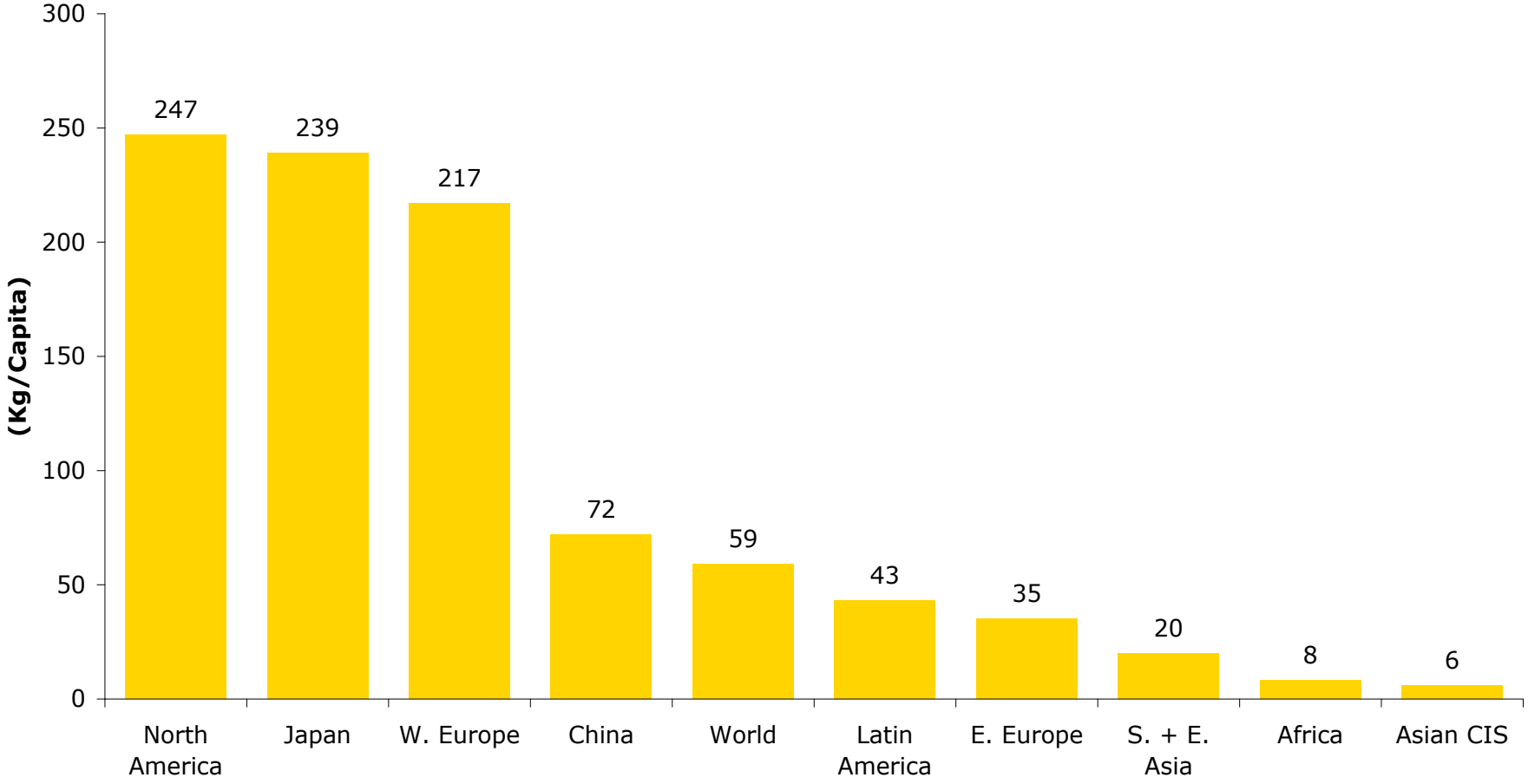


Data Source: FAOSTAT
Projections: Exponential Least Squares

Global exports are growing faster than demand because demand is growing fastest in countries that are not self-sufficient in forest products.

Basis for Global Growth

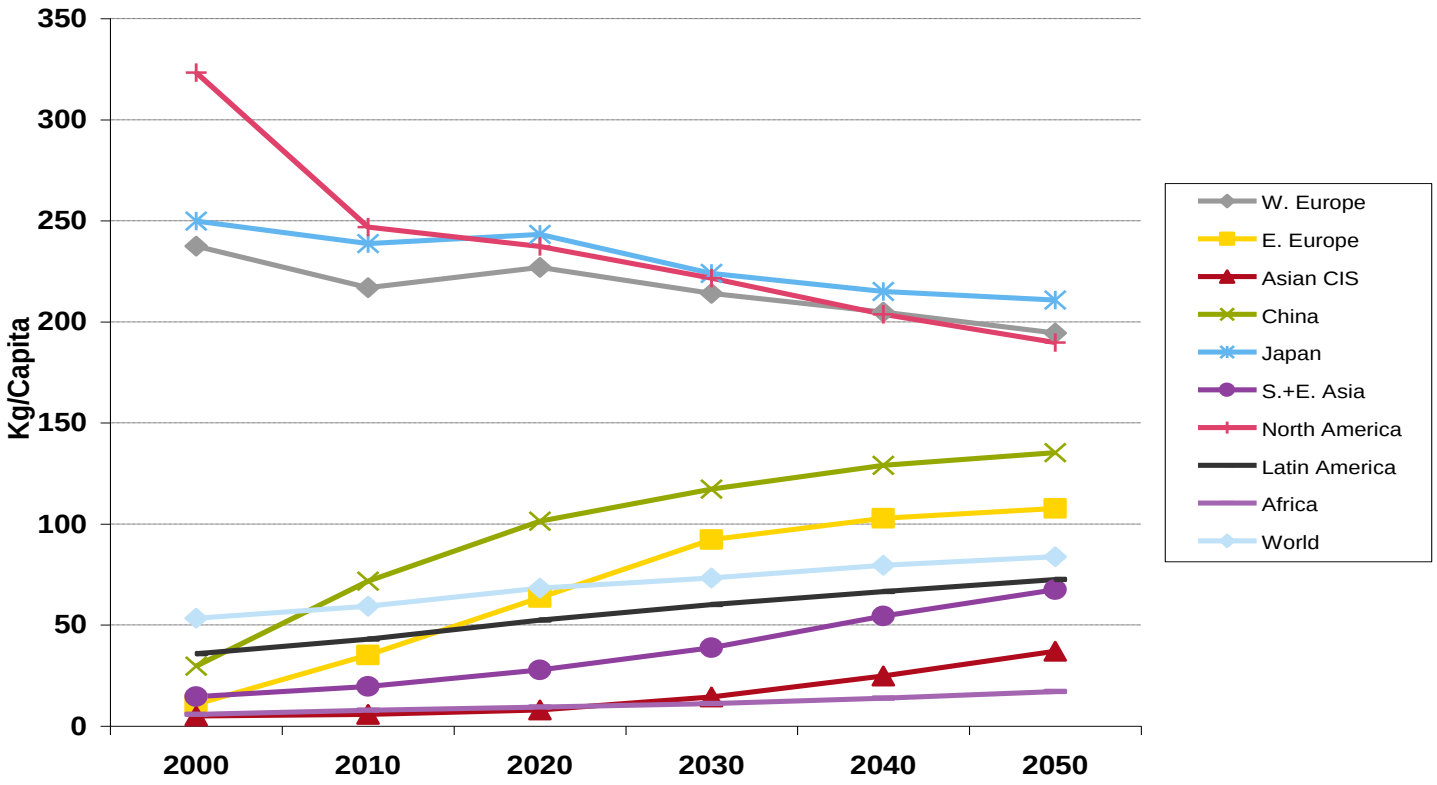
Per Capita Consumption of Paper & Board (2010)



Global economic growth is concentrated in those regions which currently have the lowest per capita consumption of forest products. Consumption in the developing world will drive future global demand due to faster increases in economic growth and population.

Source: FOEI

Per Capita Consumption of Paper & Board (2000-2050E)



Rising per capita consumption and population in the developing world will more than offset the declines in the developed countries.

Note: 2010-2050 are forecasts
Source: FOEI

China – Fiber Imports Estimate 2011

Logs	**41.7 million (m3)**	**41.7 million (m3)**
Lumber	**20.6 million (m3)**	**20.6 million (m3)**
Pulp	**11.3 million (tonnes)**	**45.2 million (m3)**
	TOTAL	107.5 million (m3)

- Approximately 35 million m3, or 33% of this amount, will be sourced from N.A.

Source: International WOOD MARKETS Group Inc., CIBC Estimates.

China's fiber deficit is expected to grow to **between 150 million m3 and 170 million m3 by 2015.**

Source: CNDRC & Chinese Society of Forestry.

The global forest industry is NOT a "Sunset Industry".

However,

- There is a geographic shift in global growth;
- Important segments of the industry are in long-term decline;
- Transformational change is required to ensure a sustainable forest industry
- Developing the bio-energy market will be key for the industry's future.

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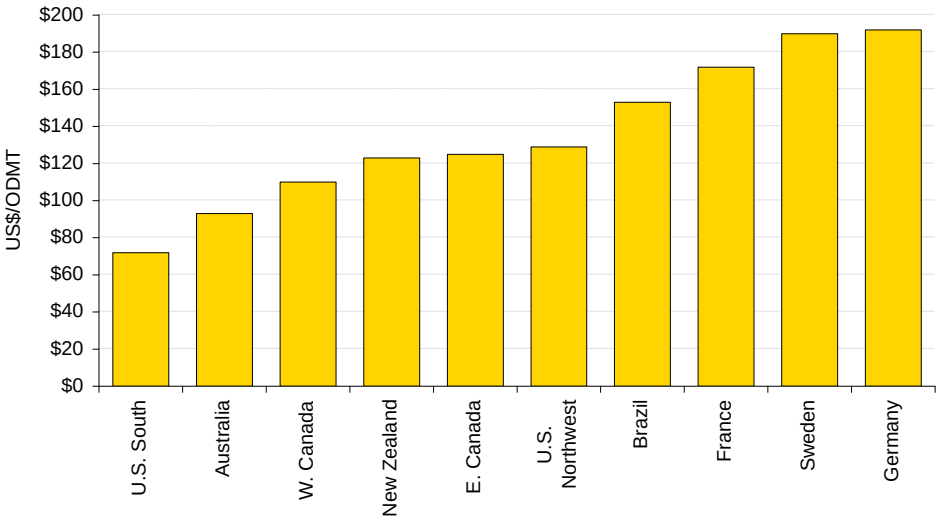
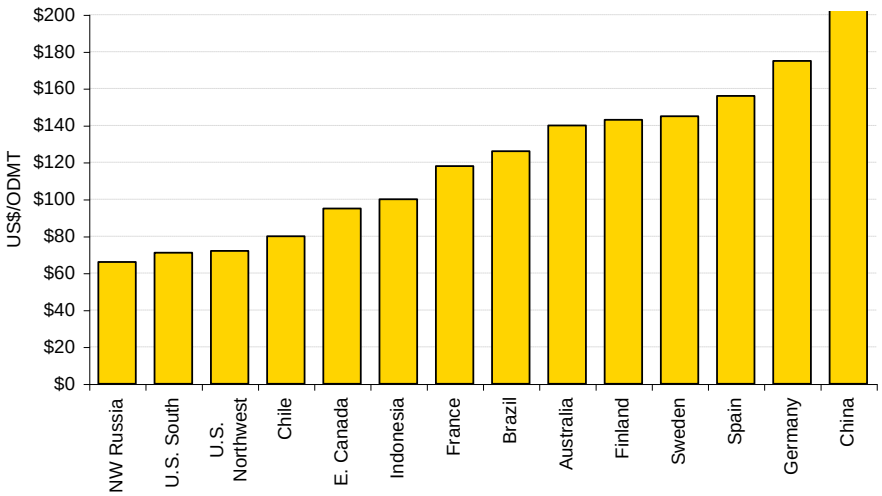
Global Fiber Markets

Pulpwood Fiber: Global Cost Comparison

Average Delivered Conifer Chip Fiber Prices Q2/2011



Average Delivered Non-Conifer Roundwood Fiber Prices Q2/2011

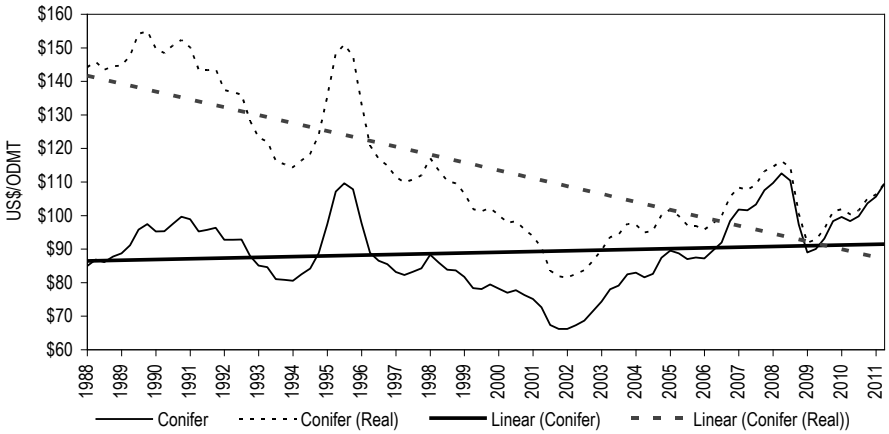


- There are large differences in the cost of pulpwood around the world. As a result, it matters where you invest
- If you are a consumer of pulpwood, the U.S. South is the most attractive region - it is the largest, and lowest cost source of commercial pulpwood in the world.
- The strongest price signal to grow more trees is in China - ~ triple the price in the lowest cost regions.

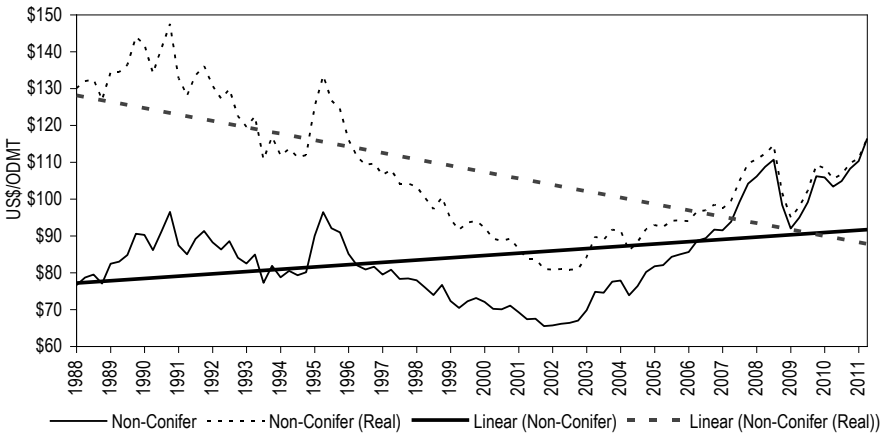
Source: Wood Resources International, CIBC World Markets Inc.

Trend in Global Pulpwood Prices

Global Average Prices for Conifer Pulpwood



Global Average Prices for Non-Conifer Pulpwood

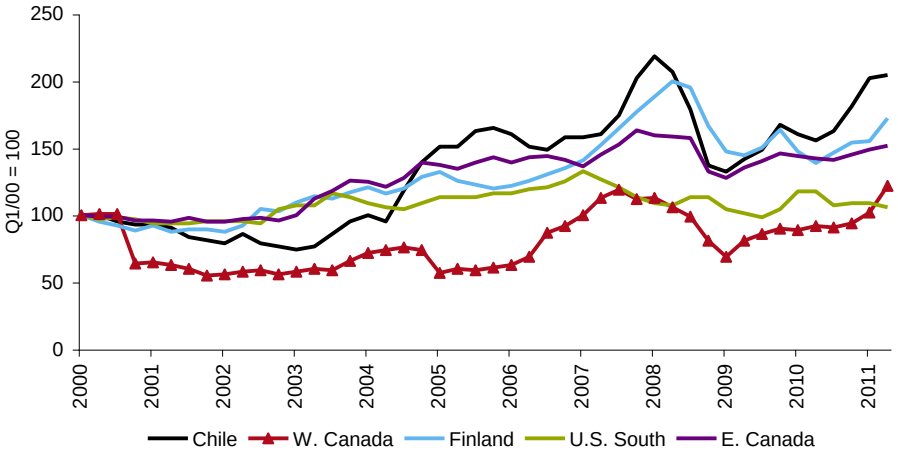


- Around 2000, the trend in global wood prices was reversed – it went from negative to positive.
- We think the upward trend will continue (subject to cyclical swings).

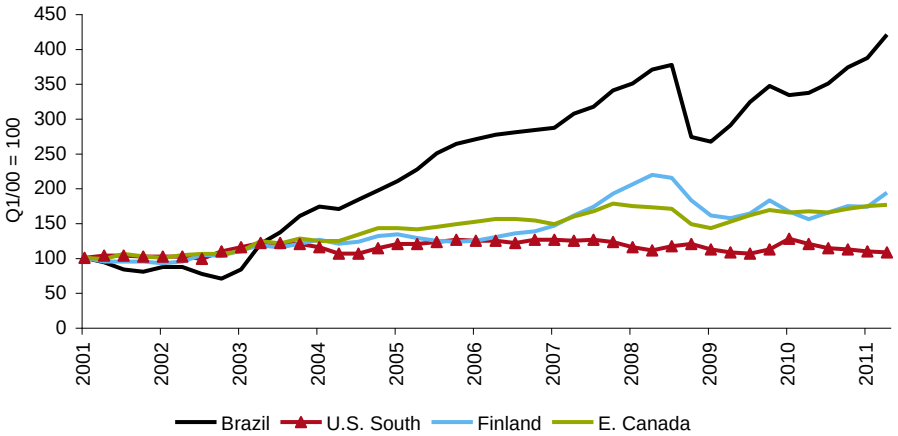
Source: Wood Resources International, CIBC World Markets Inc.

Regional Trends in Pulpwood Costs

Nominal US$ Price Indexes of Conifer Pulpwood: Regional Comparison



Nominal US$ Price Indexes of Non-Conifer Pulpwood: Regional Comparison



- Low cost regions in S. America have been experiencing a significant increase in their relative cost of market wood since 2003/4. This is especially true for non-conifer pulpwood in Brazil due to rising land costs and an appreciating currency.

Source: Wood Resources International, CIBC World Markets Inc.

Investment Trends in Bio-Energy

What Drives The Economics of Bio-energy?

- Four key variables shape the economics of investing in bio-refiners:
  1. The delivered cost of biomass (50%-70% of the variable cost)
  2. The conversion technology
  3. The price of fossil fuels
  4. Public Policy (including the price on carbon)

- Given the trends in these key variables, the long-term outlook for bio-energy/chemicals is positive. In the mean time, there is considerable uncertainty in each of these variables

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Bio-Energy is classified into two forms.

Biofuels

- Liquids

Biomass

- Solids & gases
- Mainly in the form of wood & agricultural residues.

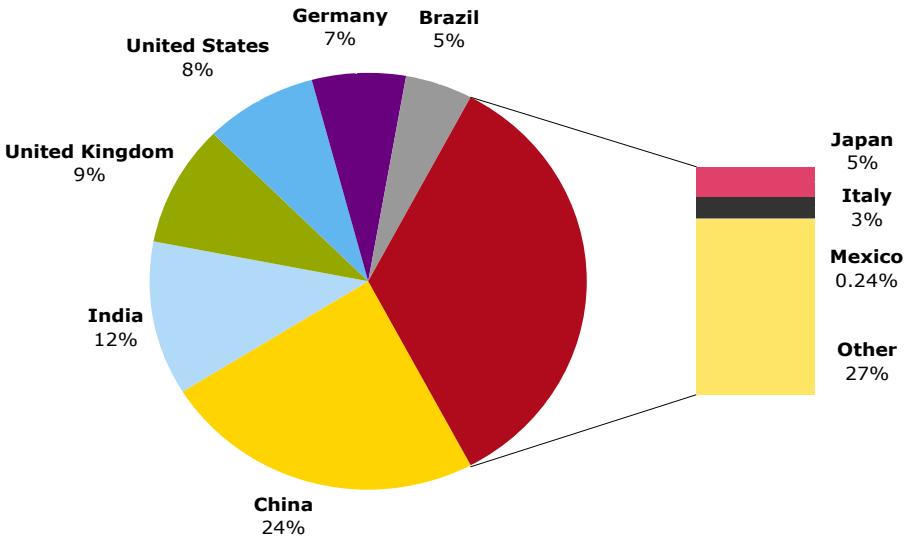
Historically, most investment has been for plants to produce biofuels.

Since 2009, biomass-based energy has been more important.

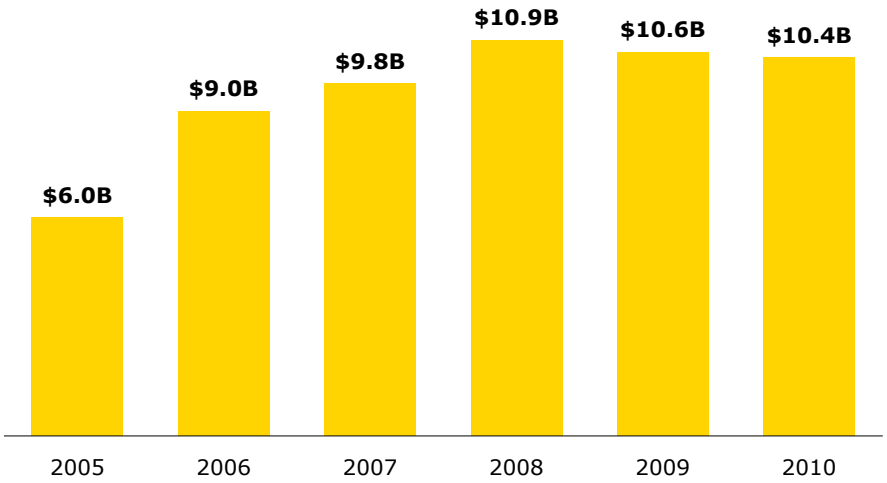
Global Biomass Investment Trends

- Global investments in energy plants using biomass have hovered around $10 B/year since 2007 – much more consistent than for biofuels.
- China is the leader, followed by India then the UK and USA.
- China's NDRC is targeting to increase biomass power from <6GW in 2010 to 24 GW by 2020 (estimated cost ~$70 billion
- EU expects to double biomass capacity by 2020 to ~26 GW (~$50 Billion)
- Brazil likely to spend at least $55 billion for power & cellulosic ethanol to use bagasse

Global Asset Financing in Biomass (2005-2010)[1]



Cumulative Growth in Biomass Asset Financing[1]

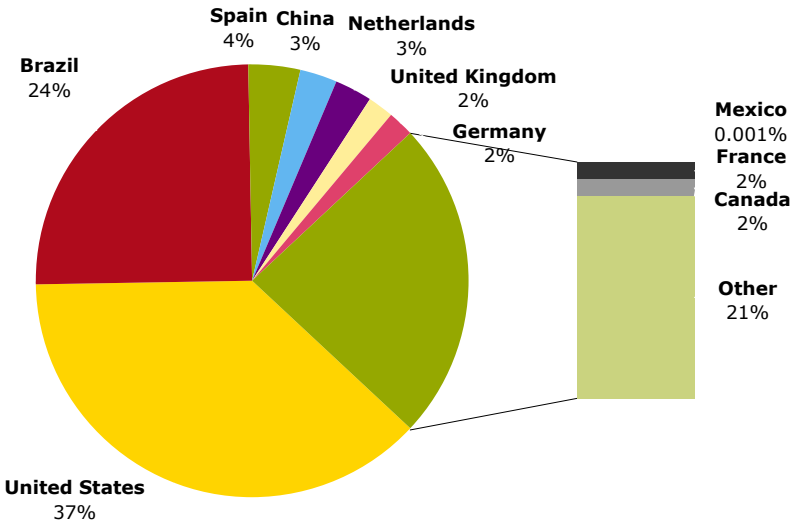


[1] Source: Bloomberg New Energy Finance.

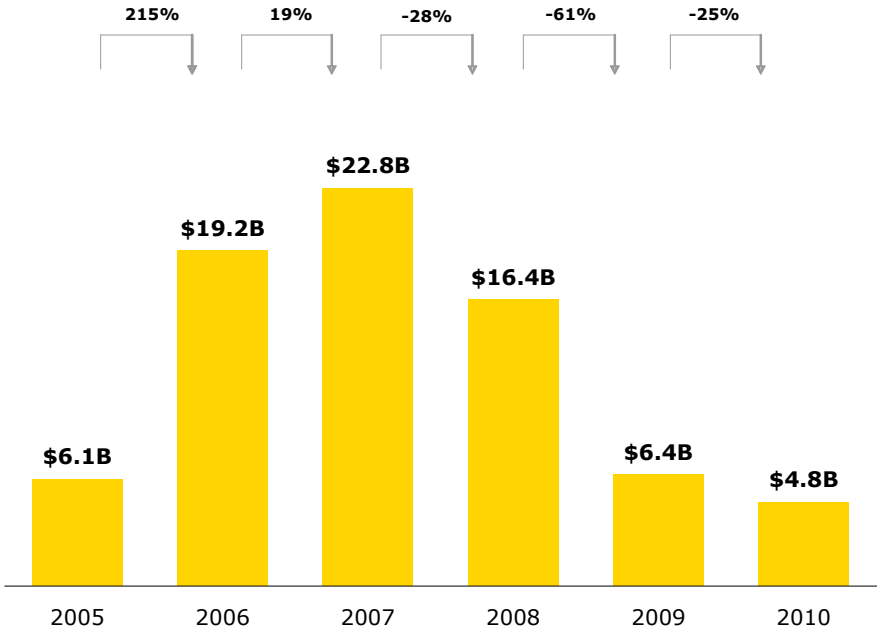
Global Biofuels Investment Trends

- The U.S. and Brazil dominate the global investments in biofuels.
- Feedstock is primarily corn or sugar cane.
- Since peaking at almost $23 B in 2007, global investments have fallen sharply to <$5 B. in 2010.

Global Asset Financing in Biofuels (2005-2010)[1]



Cumulative Growth in Biofuel Asset Financing[1]

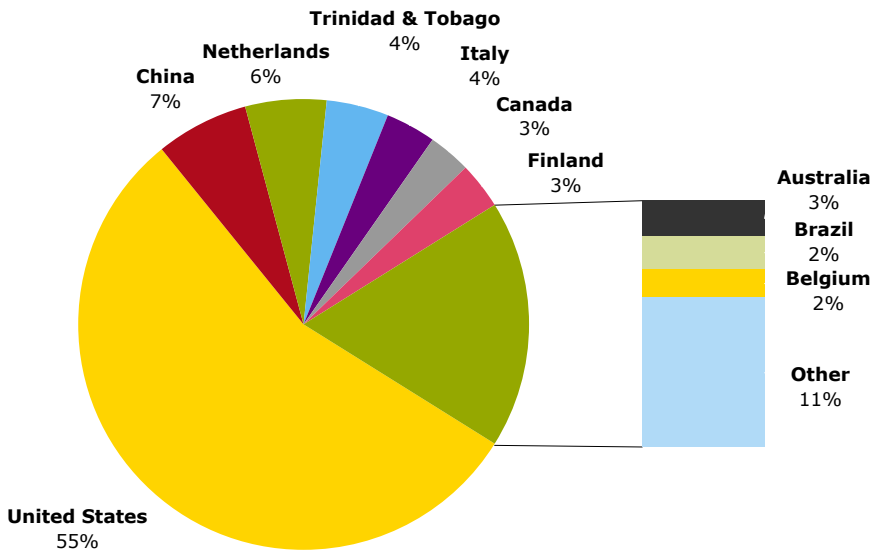


[1] Source: Bloomberg New Energy Finance.

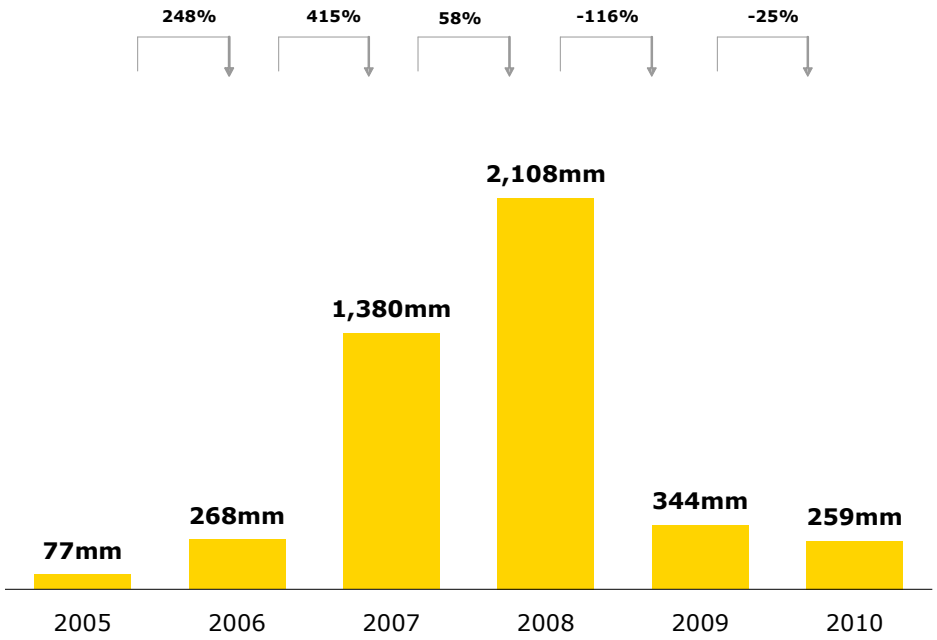
Global Non-Food Based Biofuel Investments

- Due to the global recession, investments in non-food based bio-fuels have fallen to about 1/10th from their peak in 2008.
- The U.S dominates the investments in this field, with more than one-half of the total.
- We expect the aggregate investment to significantly ncrease over the next 5-10 years, with most of the rise occurring in the United States and Brazil.

Asset Financing in Non-food Based Biofuels by Country (2005-2010)[1]



Cumulative Growth in Non-food Based Biofuels Asset Financing[1]



[1] Source: Bloomberg New Energy Finance.

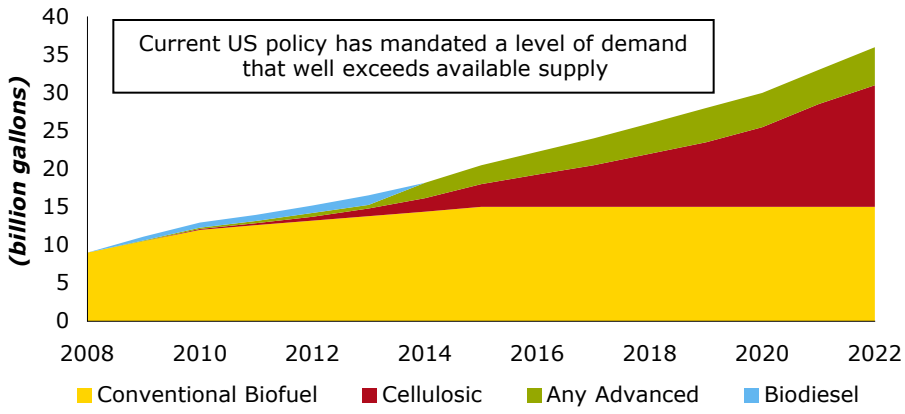
U.S. Government's Renewable Fuel Standard - 2

Objective is to stimulate the production of "next-generation bio-fuels"

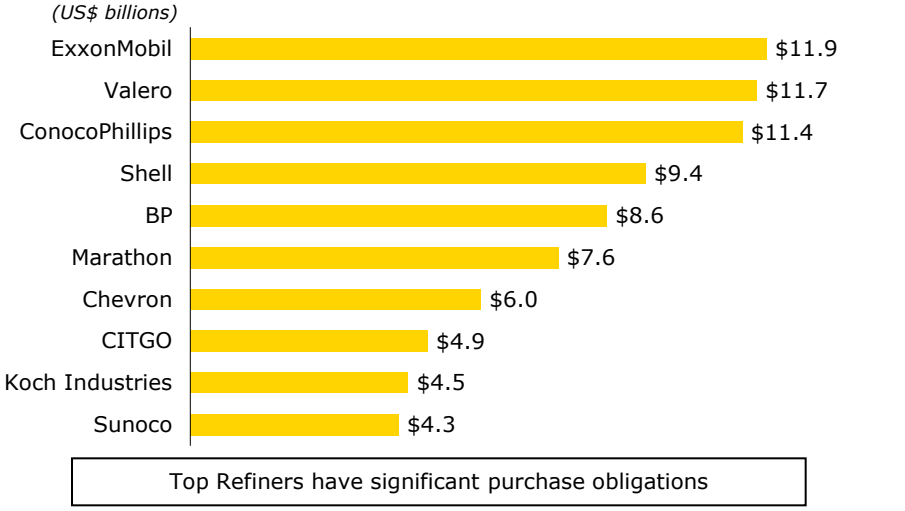
- One of the few federal initiatives to have bi-partisan support.
- Specific technological pathways must be approved by the EPA.
- The feedstock must come from a renewable and sustainably managed resource.
- Requires 21 billion gallons of advanced bio-fuels by 2022.
  - Up from 1 bgal in 2010
  - 2022 target must include at least 16 bgal of advanced cellulosic bio-fuel
  - Annual interim targets, with 5.5 bgal in 2015

RFS- 2 creates a broad and sizable market in the U.S. for cellulosic fuels with numerous motivated potential customers

RFS2 Mandate *(in ethanol equivalence)*



Potential Renewable Fuels Spend *(RFS2 by 2022)*

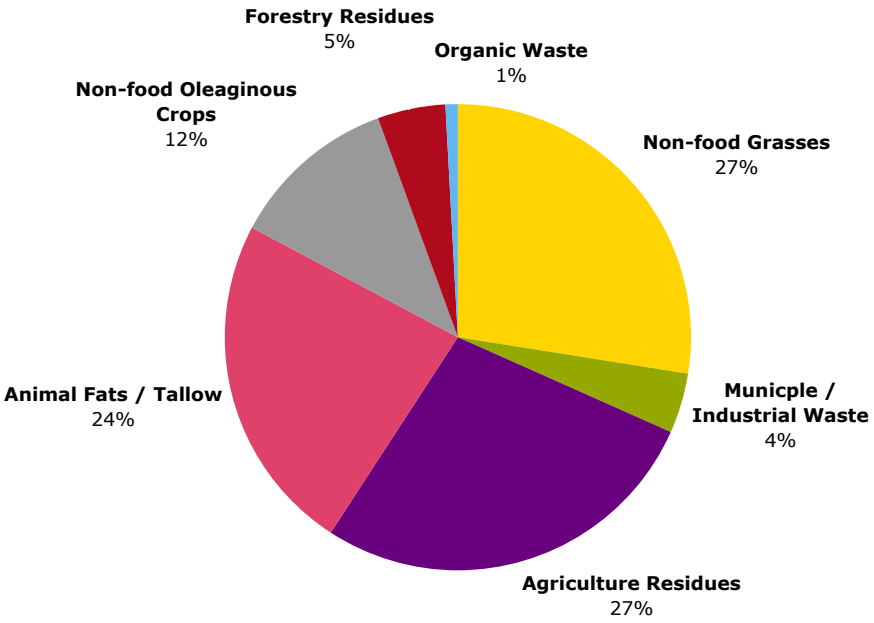


Source: U.S. EPA, Company Website.

Global Non-Food-Based Biofuels Investments

- Woody biomass accounts for only a small fraction (5%) of the feedstock currently used to produce bio-fuels from non-food materials.
- Agriculture residues, Non-food grasses and Animal Fats account for the majority.
- It is important for forestry officials to think outside their traditional "forestry silos".

Global Asset Financing in Non-Food-Based Biofuels (2005-2010)[1]



[1] Source: Bloomberg New Energy Finance.

Case Study:
Renewable Fuel Oil From Biomass
by Ensyn Inc.

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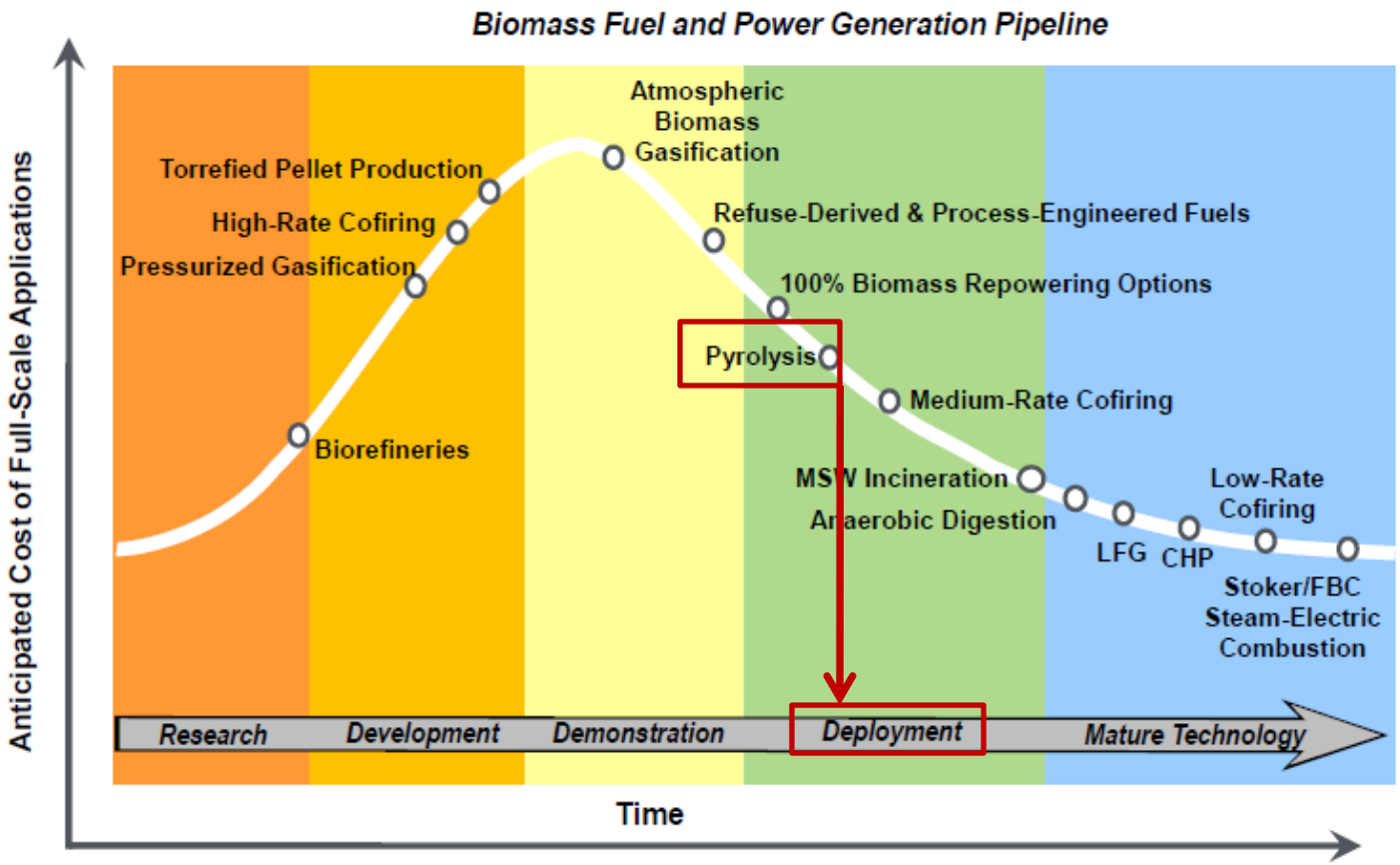
Pyrolysis - Deployment

Technology Readiness for Biomass to Power (EPRI 2010)



Source: EPRI Biopower Generation White Paper, February 2010.

Commercially Proven Breakthrough Technology

- Ensyn's Fast-Pyrolysis process is the only commercially operating biomass to liquid fuels technology – Renewable Fuel Oil (RFO)

Red Arrow Products Company

- Commercialized in 1989
- Four operating facilities
- Food ingredients and liquid fuels market

Ivanhoe Energy

- Commercialized in 2004
- 1,000 BDTPD
- Heavy oil facility
- Petroleum upgrading

Renfrew Facility

- Commercialized in 2007
- 100 BDTPD
- Renewable Fuels

Over 100 million liters (30 million gallons) of Renewable Fuel Oil (RFO) produced to date

Flexibility to Use a Wide Variety of Abundant and Low-Cost Feedstocks

- Woody biomass has historically shown much less volatility and price inflation compared to other commodities and feedstocks
- RFO can also be produced from other forms of biomass (e.g.bagasse, oil palm residues) which are a fraction of the cost of woody biomass.

Low Cost Abundant Feedstocks

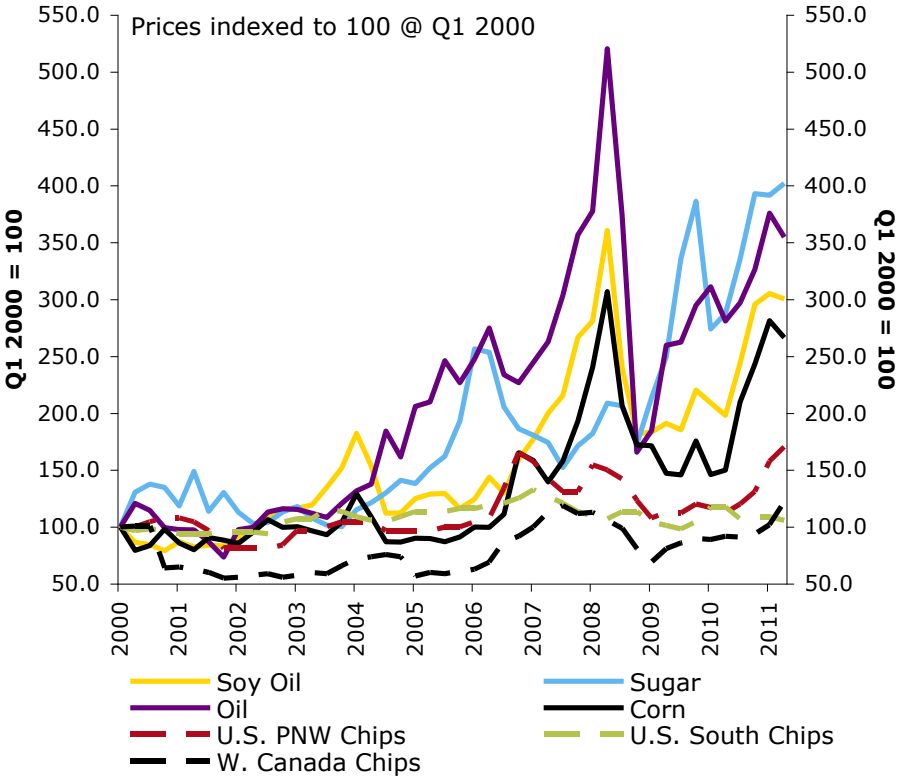
Hardwoods & Softwoods

Whitewood & Bark

Sawmill and Other Operational Residue

Agriculture Residue: Oil Palm and Sugar Cane Residues

Woody Biomass: Low Cost and Stable Pricing



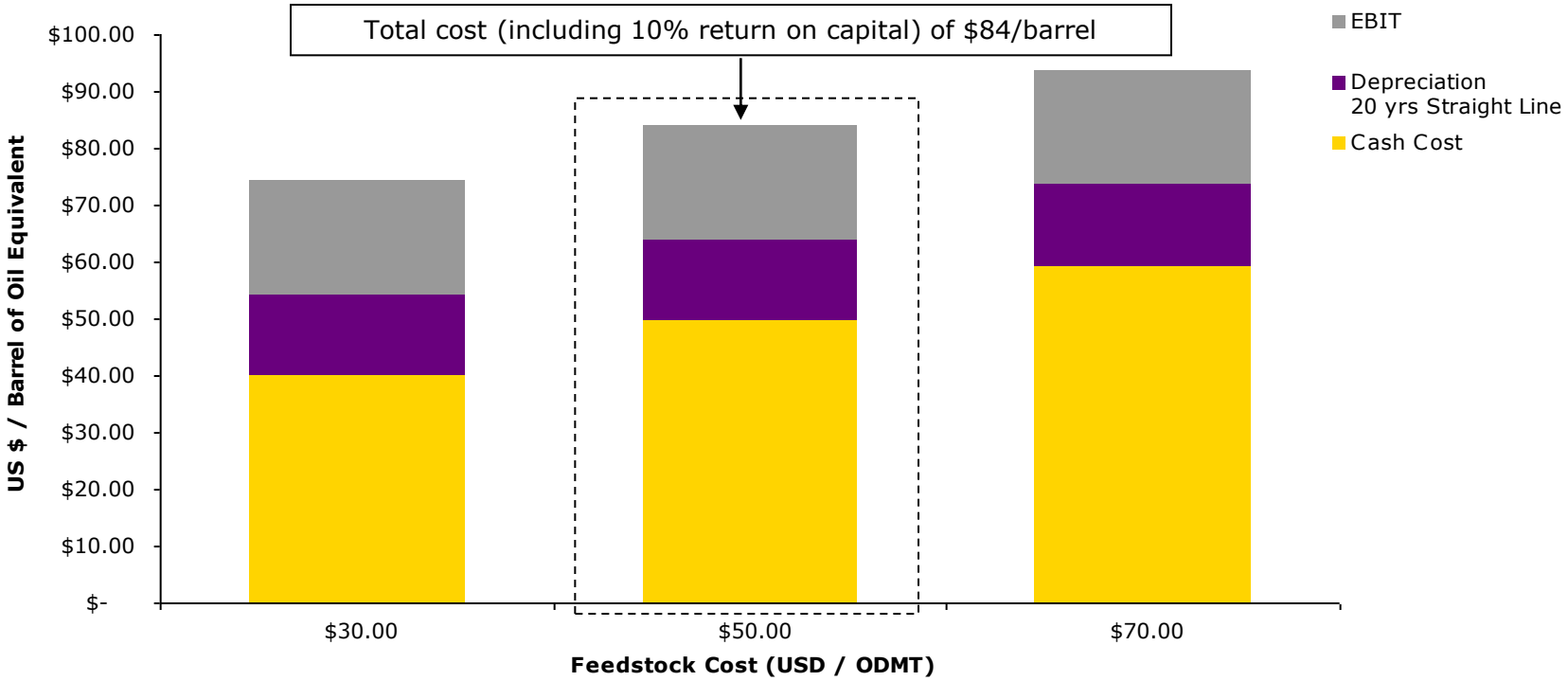
Source: Wood Resources Quarterly (wood chip prices); Bloomberg (other commodities). Data as of end of Q2 2011.

Cost Competitive with Traditional Hydrocarbon Technologies

- Joint venture between Ensyn and Honeywell has resulted in a significant reduction in costs.
- Given biomass price of $50/ODMT, the cost of RFO is now $84/barrel of oil equivalent[1]

Unleveraged Plant Pre Tax IRR: Feedstock Pricing ($/ODMT) vs. Fuel Pricing ($/barrel) Excluding RINs[1]

Cost Structure, US$ / BOE Equivalent, 10% Unleveraged Pretax IRR



[1] Source: Management.

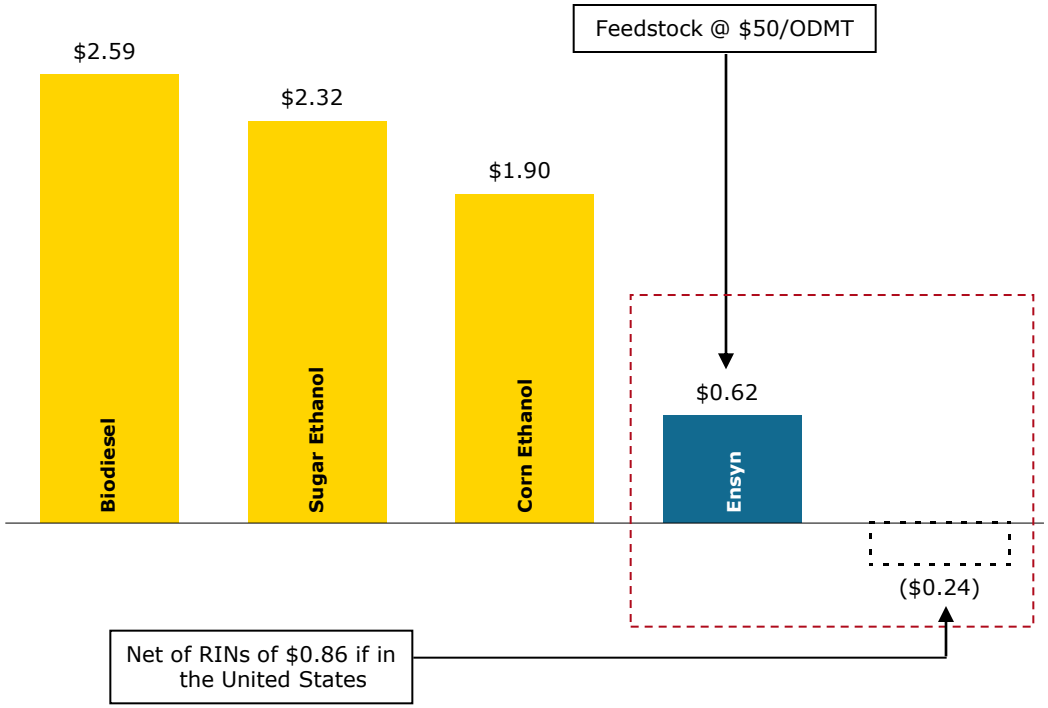
Significant Cost Advantage Over Other Biopathways

- Low cost biopathway able to compete with traditional hydrocarbons and other forms of bio-fuel.

Significant Production Cost Advantage

Estimated Production Costs (not including subsidies)

$/Gallon RFO (normalized by energy content)



Source: Management estimates; Feedstocks converted to Ensyn RFO equivalence on an energy basis.

Blue – Chip Network of Strategic Partners, Joint Venture Partners and Shareholders

JV Partners

UOP A Honeywell Company

CAT

premium RENEWABLE ENERGY

Strategic Partnerships

Ivanhoe Energy

TOLKO

RCR

COLL'ENERGIA

FPI FELDA PALM INDUSTRIES

RED ARROW Smoke • Grill • Browning • Cooking Flavors

ENSYN

Shareholders

IMPAX

Chevron

CREDIT SUISSE

FPI FELDA PALM INDUSTRIES

Off-take Agreements

Chevron

CIBC

Leveraging Joint Ventures

- Joint Venture between Ensyn, Honeywell and Premium Renewable Energy to produce power and transport fuels from oil palm biomass in Malaysia ($5/ODMT)

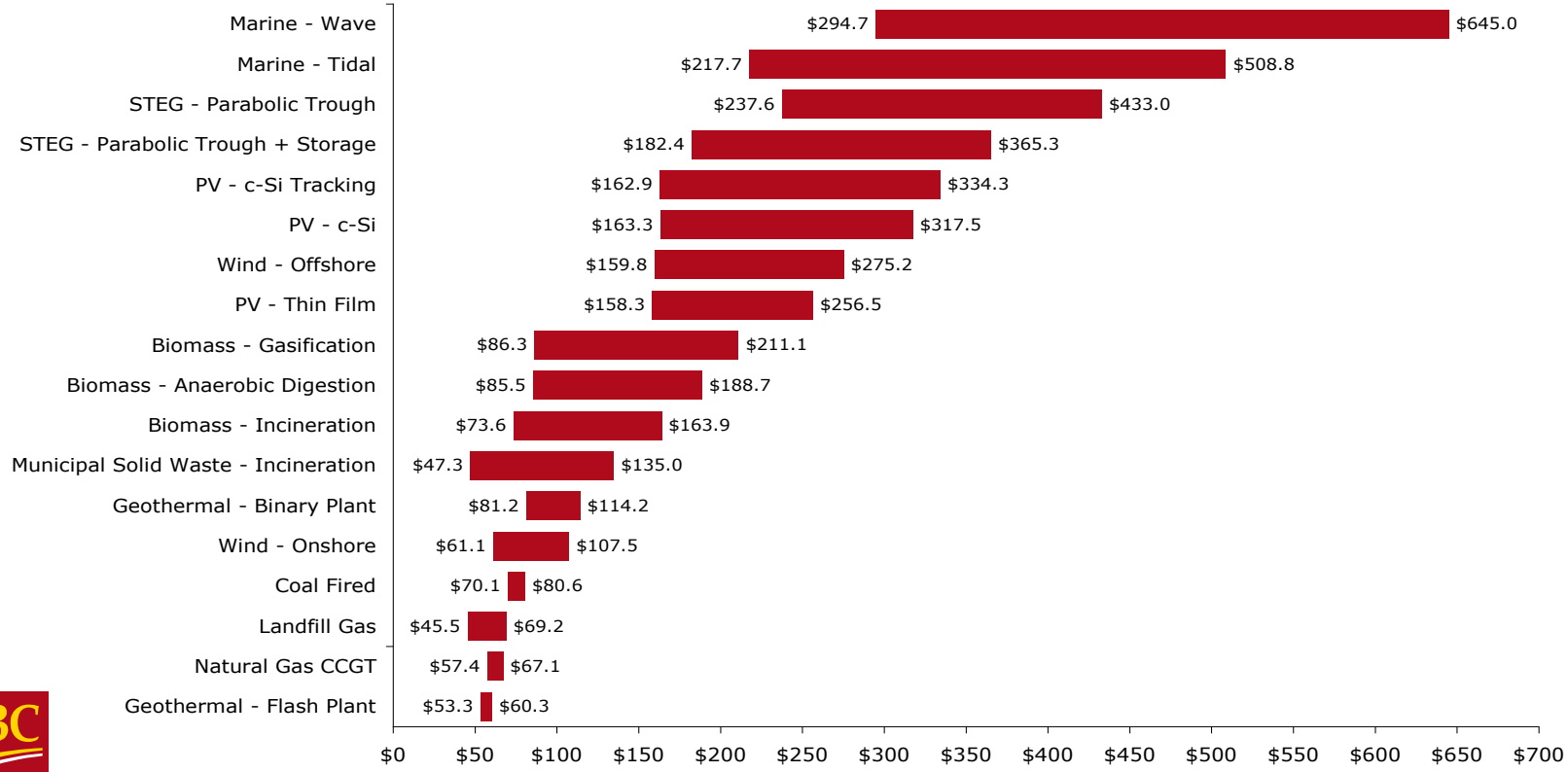
- Roughly 60 million tonnes of biomass is produced yearly by the Malaysian palm oil industry:
  - 32 million tonnes is in the form of empty fruit bunches and fiber:
    - This could produce 11 million tonnes of pyrolysis oil/year;
    - Equivalent of 41 million barrels of crude oil;
    - Annual revenue of ~$3 billion at today's prices

Appendeces

Appendix A: Levelised Cost of Electricity ($US/MWh)

In Q2 2011, the cheapest source of power generation in most jurisdictions remains the conventional thermal sources. However, the gap is narrowing with low-cost renewables

- For each form of renewable energy, there is a range of cost estimates which reflect differences in technology, scale and location
- Based on traditional technologies, bio-energy is in the middle of the cost curve for generating electricity
- How will bio-energy's relative position change in the future?



Source: Bloomberg New Energy Finance. , CIBC World Markets Inc.

Appendix B:
Bio of Don Roberts

- Mr. Roberts is a Vice-Chairman of Wholesale Banking, and Managing Director in Investment Banking with CIBC World Markets Inc.. He leads the bank's Renewable Energy & Clean Technology Team. Don also provides senior coverage for companies in the Global Forest Products Industry
- In 2011, Mr. Roberts was chosen by Corporate Knights Magazine as the individual in the Financial Services sector who contributed the most to sustainable development in Canada
- During a sabbatical year in 2009 Mr. Roberts designed and guided the Future Bio-Pathways Project on behalf of the Forest Products Association of Canada
- Prior to assuming his current position, investor surveys consistently ranked Don among the top equity research analysts covering the North American forest products industry over a 18 year period. Previous to entering the financial services industry he was Chief Economist for the Canadian Forestry Service. In addition to his work with CIBC World Markets Inc., Don is also
  - An Adjunct Professor in the Department of Forest Resource Management at the University of British Columbia (Vancouver);
  - On the Board of Directors, Rights and Resources Institute (Washington, D.C.); 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. He is also a certified Board Director with the Institute of Corporate Directors.

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