



Bio-Energy: A Quick Tour From 10,000 To 1,000 Meters

**7th Annual B.C. Natural Resource Forum and Economic Summit
Prince George, B.C.
January 2010**

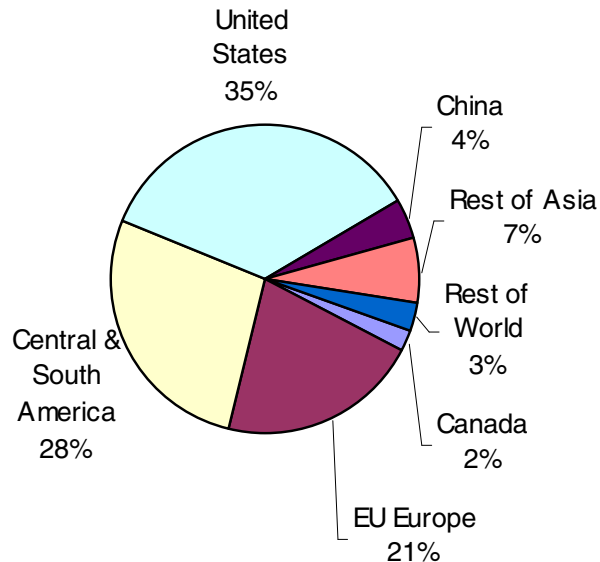
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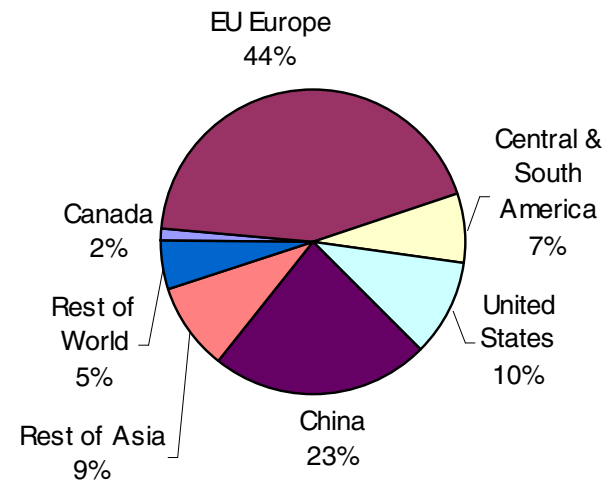
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Global Bio-Energy Investments (2005-2009)

Biofuels



Biomass

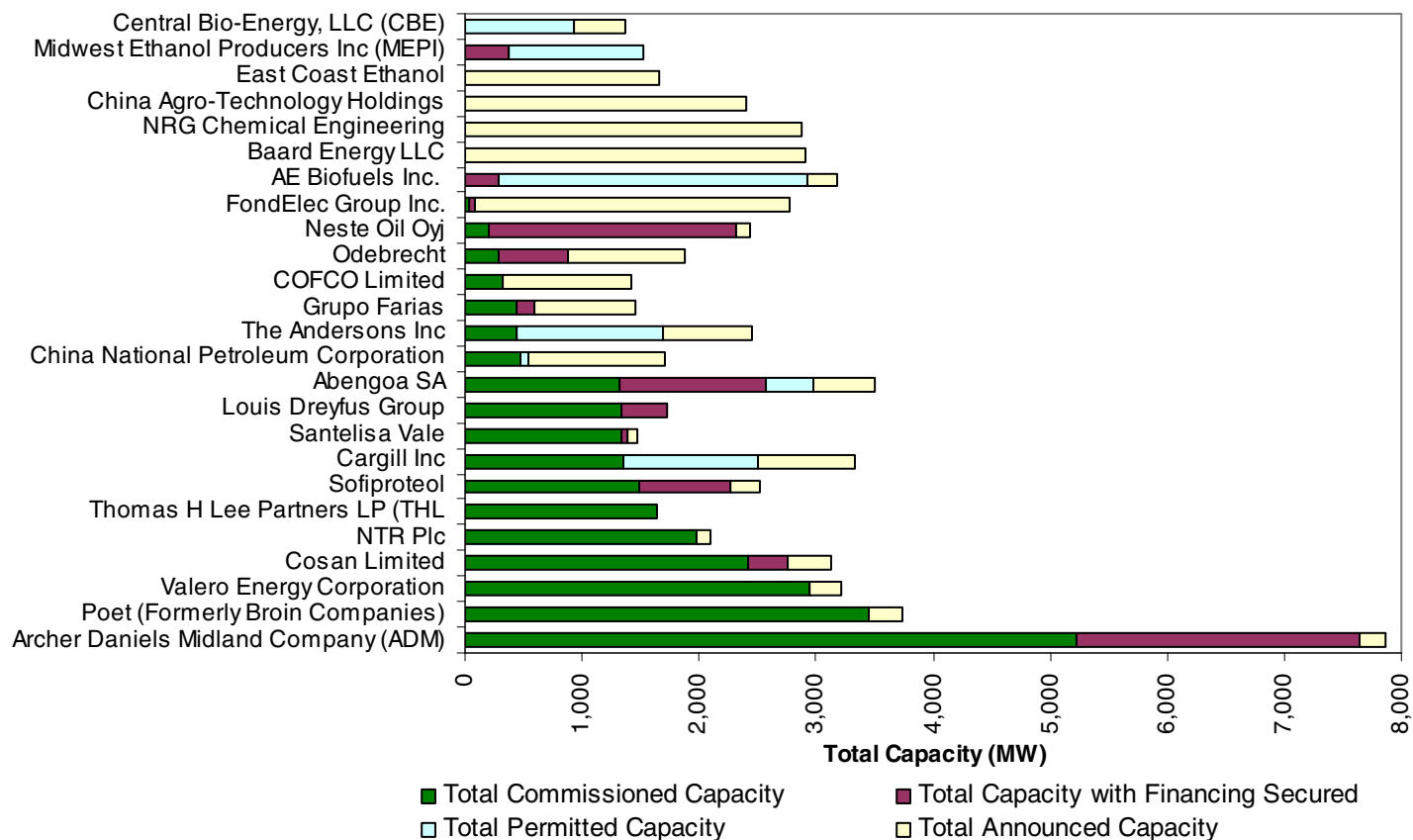


Source: New Energy Finance and CIBC World Markets Inc.

- **U.S. and Brazil have dominated the global investment in biofuels (liquid).**
- **While Europe and China have dominated the investment in biomass-based energy (solid and gas).**
- **Despite its large forestry resource and industry, Canada has lagged in bio-energy investment (~2% of global).**



Global Biofuels Producers

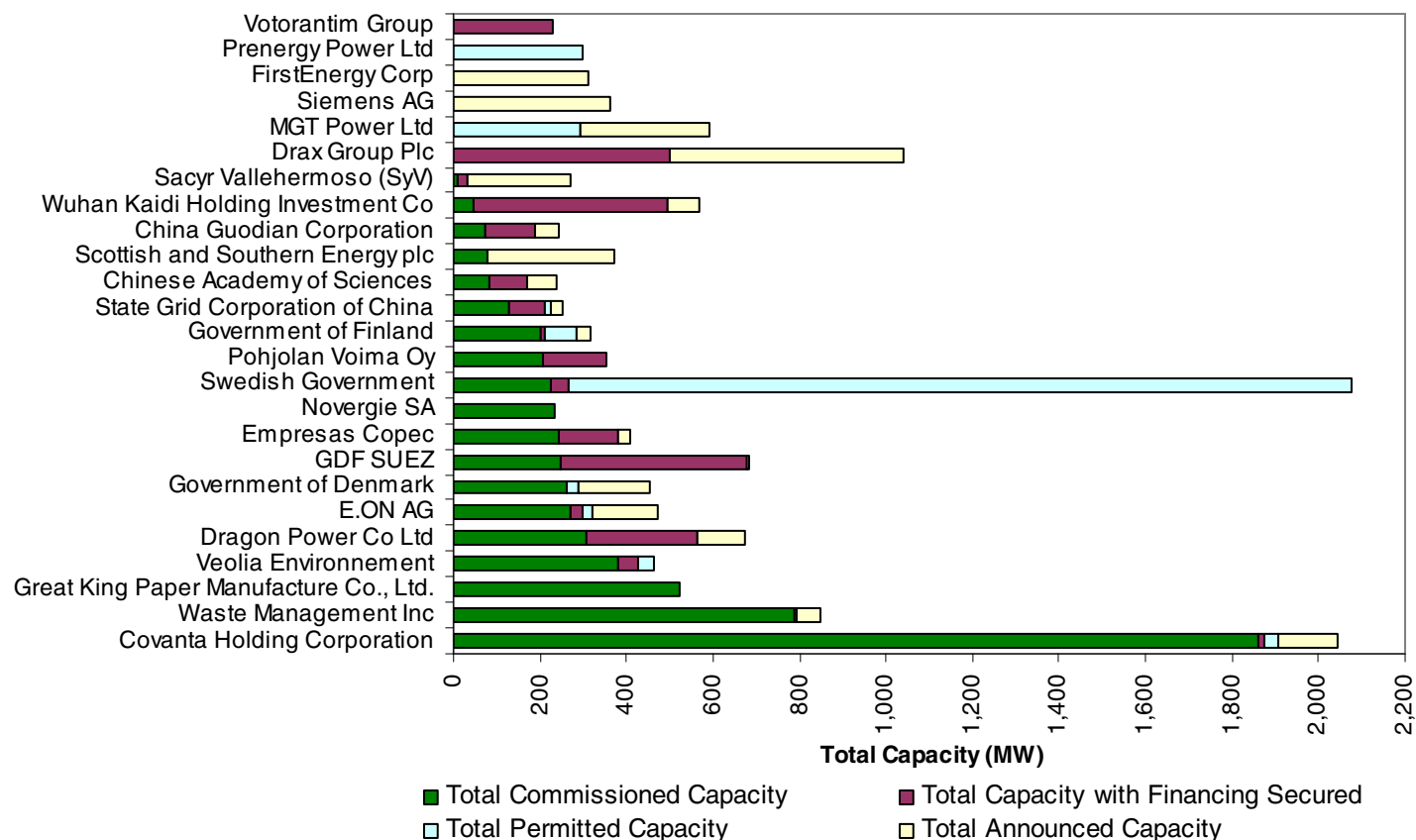


Source: New Energy Finance and CIBC World Markets Inc.

- **ADM is by far the largest biofuel producer in the world (with capacity approaching 8,000 MW equivalent), and the top 3 are all U.S.-based.**
- **Cosan from Brazil comes in fourth; the largest producer from Canada -- Greenfield Ethanol with total announced capacity moving above 700 MW -- is not even in the top 25 in terms of announced capacity.**



Global Biomass And Waste-to-Energy Producers



Source: New Energy Finance and CIBC World Markets Inc.

- Globally, Covanta is by far the largest established biomass-energy producer in the world (includes proposed \$500 million, 90 MW Gold River Project). The Swedish government will soon match it and Drax (U.K.) will become the third largest.**

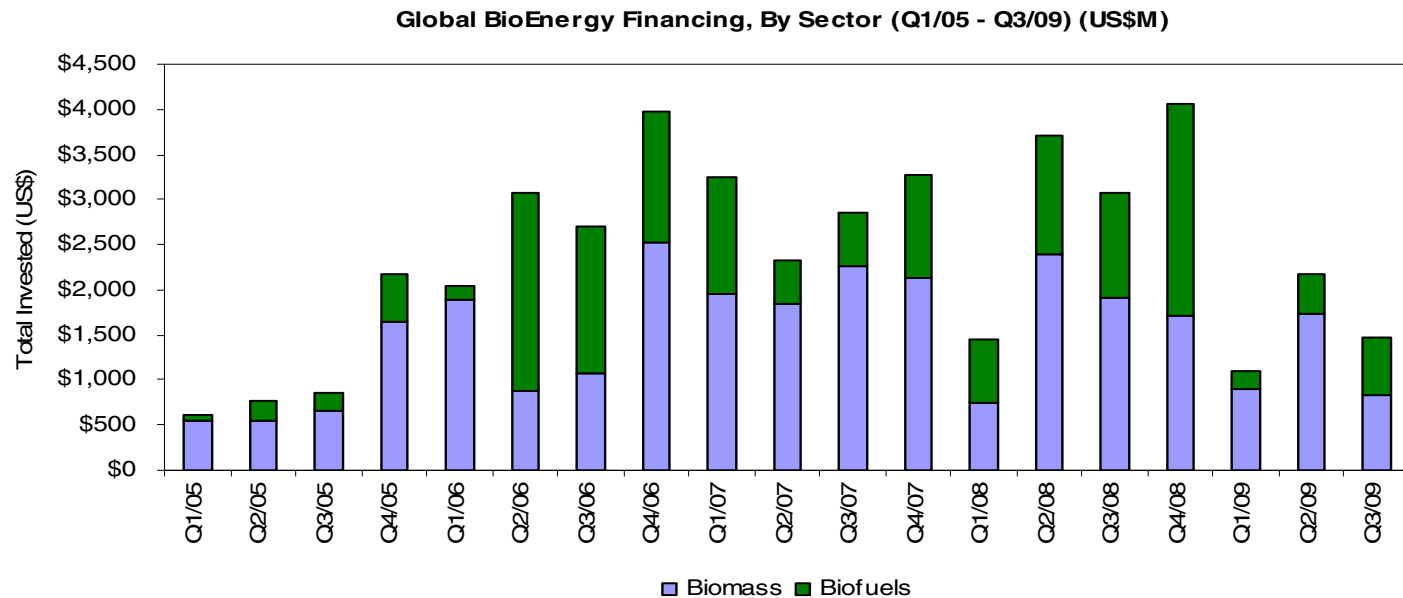


- Boralex is the largest in Canada, but is not even in the top 25 globally.**

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CIBC World Markets Inc.

Global Bio-Energy Financing



Source: New Energy Finance, CIBC World Markets Inc.

- **The economic crisis has had a major impact on the level of investment in the global bio-energy sector. After exceeding \$12 billion in 2008, it fell by ~75% from Q4/08 to Q1/09. Now starting to recover.**
- **Bio-energy can be split into two types: biofuels (i.e., liquids) and biomass (solids and gases). In 2008, the split was roughly 45/55.**
- **We expect the proportion of the investment made in the biomass segment to increase. The growth in the biofuels segment is increasingly in the form of second-generation (cellulosic) capacity, and mostly from agricultural and forestry residues.**



What Drives The Economics Of Bio-Energy?

Five key variables shape the economics of investing in bio-energy:

- 1. The price of fossil fuels (the main substitute)**
- 2. The price of carbon**
- 3. The conversion technology**
- 4. The cost and quality of feedstock (50%-80% of the variable cost)**
- 5. Public policy**

The secular outlook for bio-energy is strong.

However, all five of these variables are in a state of flux – and this discourages investors. Public policy is the variable most easily influenced by governments, and one of the greatest sources of uncertainty.



Menu Of Public Policies

Most bio-energy investments would not be undertaken without government support... Not surprising, given the fossil fuel industry receives an estimated US\$200 billion/year in subsidies.

The key public policy instruments available to us include:

- 1. Carbon pricing – either directly through a Carbon Tax or indirectly through a Cap-and-Trade System. Also potential Carbon Tariff for internationally traded goods.**
- 2. Renewable Portfolio (or Fuel) Standards**
- 3. Feed-in Tariffs and/or Producer Incentives**
- 4. Cost subsidies – both capital (fixed) and variable**
- 5. Research, Development & Deployment subsidies**

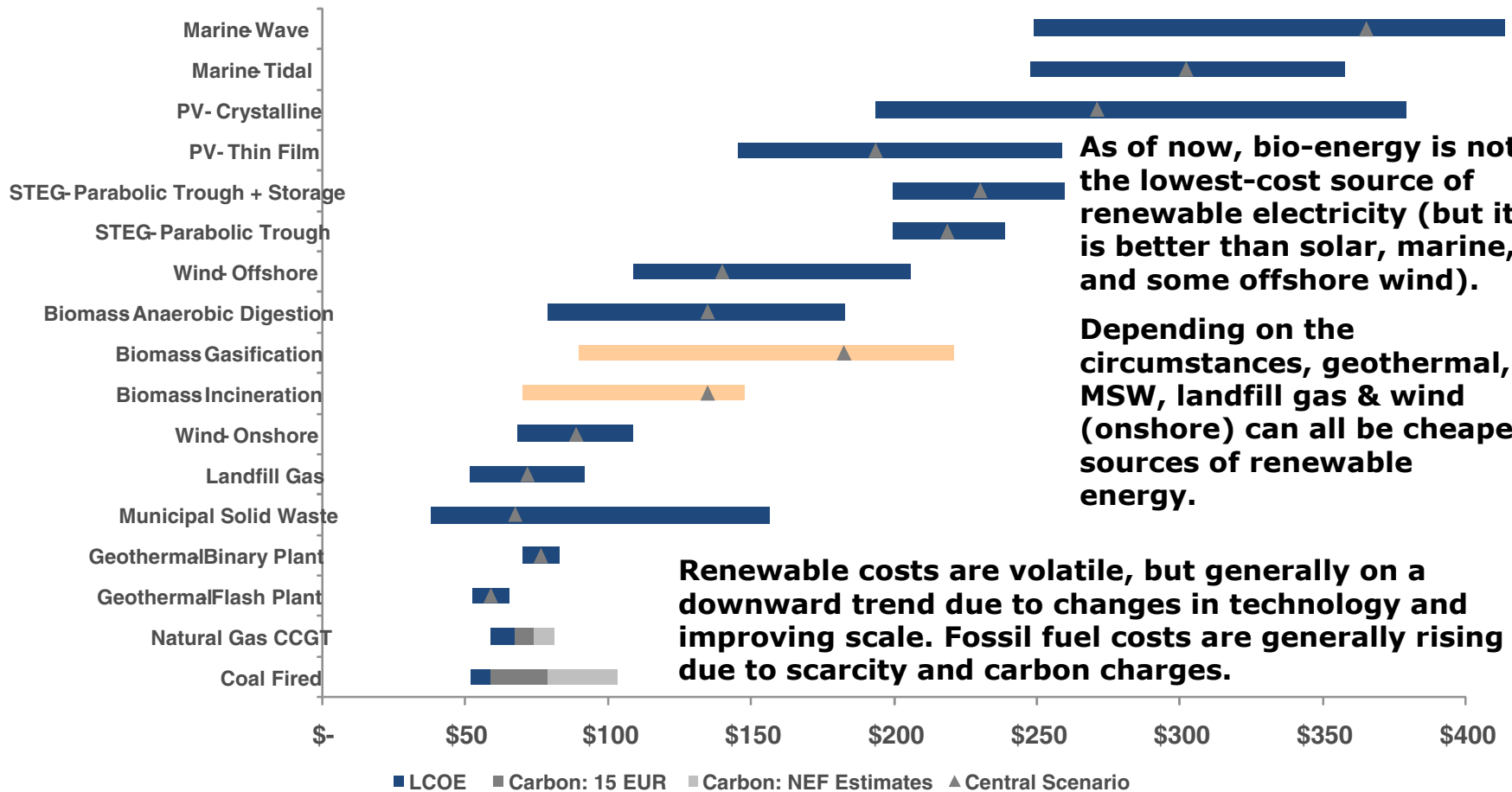
In choosing the right policy mix, recognize that investors will be influenced by the relative competitiveness of the alternative forms of renewable energy.

How does the cost of bio-energy compare with wind, solar, geothermal, etc.?



Levelised Cost Of Electrical Energy Q2/2009

(US\$/MWh, By Type Of Energy)



Source: New Energy Finance, CIBC World Markets Inc.

- **Wide range in costs within a given technology, which mainly reflects location (quality & cost of inputs) and scale.**



Public Policy Update

Quick update on bio-energy policies in three key regions:

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



United States

- **Renewable Fuel Standard in the Energy Bill requires 36 bln. gallons of renewable fuels by 2022 (vs. ~13 bln. in 2009)... including 21 bln. gallons of “advanced” (non-corn starch) biofuels.**
- **Given the announced projects to date, it will be almost impossible for the U.S. to meet its interim targets for advanced biofuels in 2010-2012.**
 - **100 million gallon target by end of 2010, but less than a dozen pilot and small-scale demonstration plans are operational, with annual output of ~4 million gallons.**
- **The unavailability of private debt and spiraling developer capital cost estimates due to the financial crisis have been major hurdles.**
- **Federal and state governments are responding with significant subsidies.**



United States

The American Recovery and Reinvestment Act

Key new measures applicable to bio-energy projects include:

- **The Dept. of Treasury's temporary new grant program, intended to spur renewable project growth by offering developers cash in lieu of tax credits.**
- **Committed to issuing funds representing 30% of a project's qualifying capital costs within 60 days of that project's commissioning.**
- **Some state governments (e.g., Oregon) are topping the grant up to 65% of the capital cost.**



United States

In May 2009 President Obama directed the USDA to expedite and increase the production of bio-energy within 30 days.

Five key measures were announced on June 8, but the most significant is the launch of the Biomass Crop Assistance Program (finalized in Feb.?)

- **Compensation for the collection, harvest, storage and transportation of biomass. To be paid to the supplier of the biomass.**
- **Biomass must be used for heat, power, bio-based products or biofuels.**
- **Matching payments will be made up to \$45/ODST.**
- **\$1 billion over the next two years, but could be up to \$8 billion over 15 years.**
- **Equivalent to:**
 - **\$35/MFBM-\$45/MFBM of lumber (~20% of current lumber price)**
 - **~\$50/ODST of pulp if black liquor ends up qualifying**

Potential distortive effects for existing biomass consumers are significant.



United States

Cap-and-trade legislation is now unlikely to be passed until 2011, and implemented until 2013.

U.S. Senate bill (Kerry-Boxer) released September 30.

- **Unlike the House bill (Waxman-Markey), of the 2 billion offsets allowed for compliance, only ¼ (instead of ½) may come from international projects.**
- **The amount of international offsets could increase by 750 million, if there are not enough domestic offsets available for compliance. (A key question is “at what price?” Significant international offsets associated with avoided deforestation and degradation appear available for less than \$10/ton.)**

In the meantime,

- **At the federal level, the EPA is moving towards regulation of CO₂.**
- **The BCAP program will significantly reduce the cost of delivered biomass, and is expected to effectively spur investment in bio-energy.**
- **Dozens of states are moving ahead with regulations that would penalize more carbon-intensive fuels.**



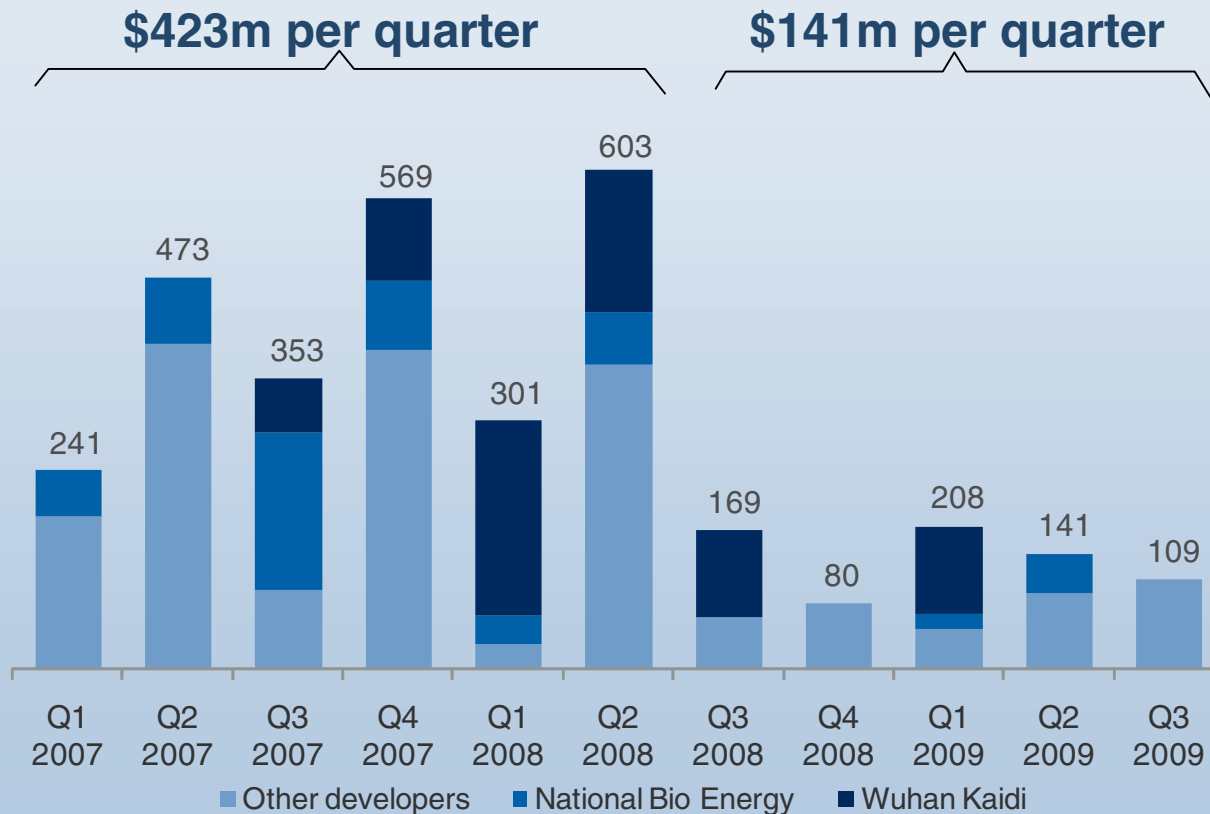
China

- **Ambitious target for renewables to account for 10% of all energy consumption by 2010 and 15% by 2020.**
- **Biomass power targeted to grow from 2.9 GW in 2008 to 4 GW in 2010 and 24 GW by 2020 – largely with agricultural waste.**
 - **Need to build roughly 850 biomass plants rated at 25 MW by 2020 (~6/month).**
 - **Huge logistical challenge to fuel a 25 MW biomass power plant. Must collect 150,000 tpy-200,000 tpy of bulky straw from thousands of small 0.15 ha farms.**
- **Most biomass power plants are suffering low profits, and not enough are being built at the required pace. Biomass power plant financings have fallen 66% since the start of the financial crisis.**
- **There could be a possible downward revision of the 24 GW target for 2020. A target of 10 GW appears more feasible.**



China

Asset financing for biomass facilities in China 2007-2009, \$m



Fragmented market: Main developers running out of steam and others are inexperienced, while state-owned utilities are not as involved in biomass as in wind and solar

Feedstock issues: Costs of feedstock and collection have risen substantially

Revised Targets?: Even a lower 10 GW target in 2020 would require ~\$265 m/quarter (vs. current level of ~\$140 m/quarter)



China

- **In 2007 the National Development and Reform Commission (NDRC) identified national wood pellet targets rising from 2 million tpy in 2010 to 50 million tpy in 2020.**
 - **In 2009 NDRC's Centre for Renewable Energy Development indicated that China's biomass feedstock resource is about 60%-70% less than the official numbers initially published.**
 - **Realistic pellet target likely closer to 35 million tpy by 2020 (so imports will likely be increased).**
- **State Forestry Administration had announced a target to develop 13.3 million ha of forests to produce feedstock for biofuel production and power.**
 - **What progress has been made?**
 - **Still a reasonable target?**

.....**We don't know.**



European Union

- **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, Pöyry/McKinsey study forecasts a 200 million m³-260 million m³/year wood deficit in Europe in 2020. (Canada harvests ~200 million m³/year.)**
 - **If the target is enforced, expect meaningful upward pressure on global wood/biomass prices.**

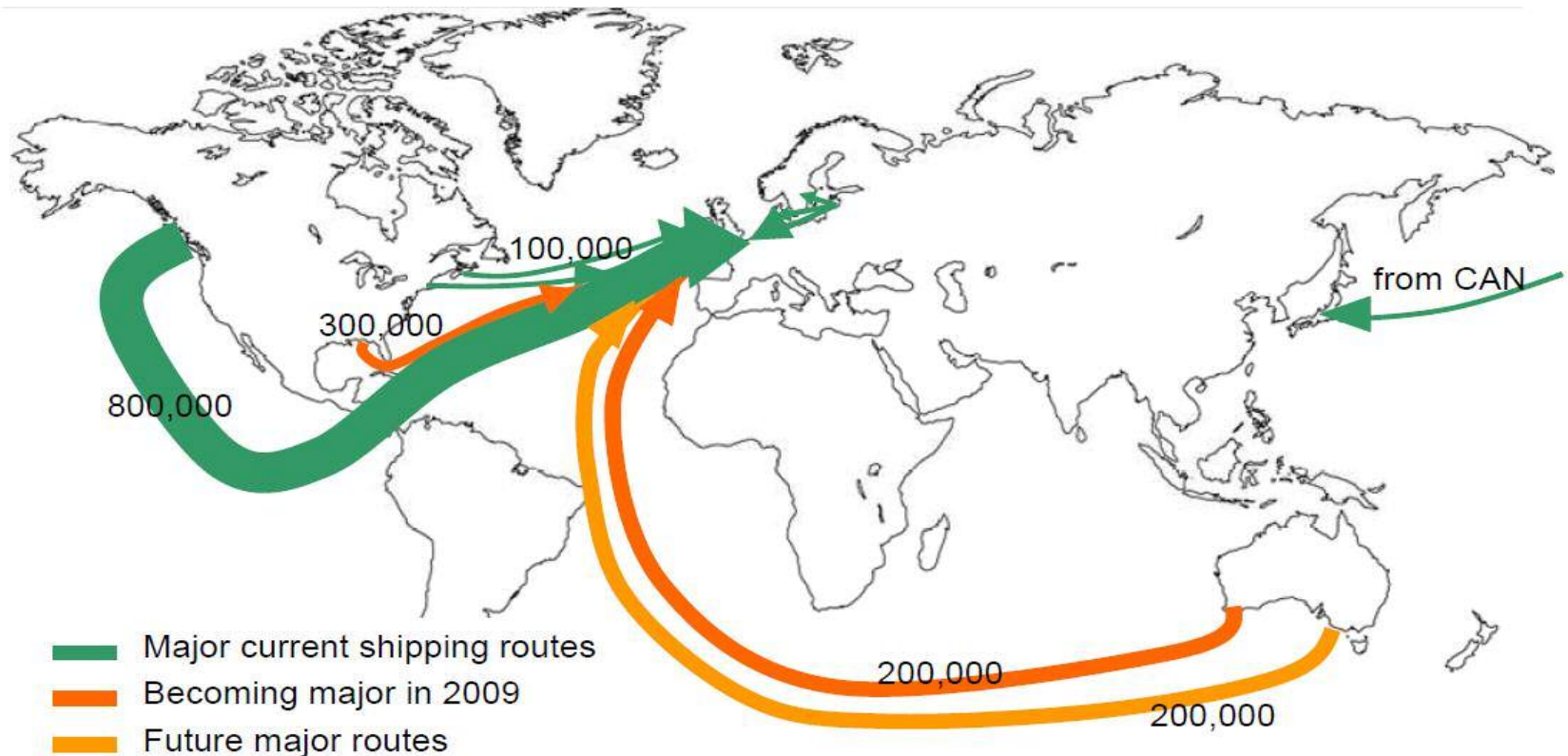


United Kingdom

- **GHG emission-reduction targets in the U.K. are amongst the most aggressive in Europe.**
- **Renewable energy's share to 15% by 2020 from ~1% in 2006.**
- **Twelve projects are already in various stages of development, with the capacity to generate 2.7 GW of biomass energy.**
 - **Equates to ~12 million ODMT of wood pellets, or 20 million tpy of green wood chips.**
 - **Equivalent wood requirements of four world-scale pulp mills.**



Global Wood Pellet Trade (Tonnes)



Source: New Energy Finance and CIBC World Markets Inc.

- **Wood pellets are the fastest-growing source of bio-energy in the world, and the market has been driven by European regulations. However, expect rising demand in N. America, Japan, China and S. Korea as well.**
- **Europe sources the bulk of its wood pellets from Canada, but Australia and the U.S. will soon become important sources as well. Three potential sources we think are underestimated are Brazil, Russia and West Africa.**



What About Canada?

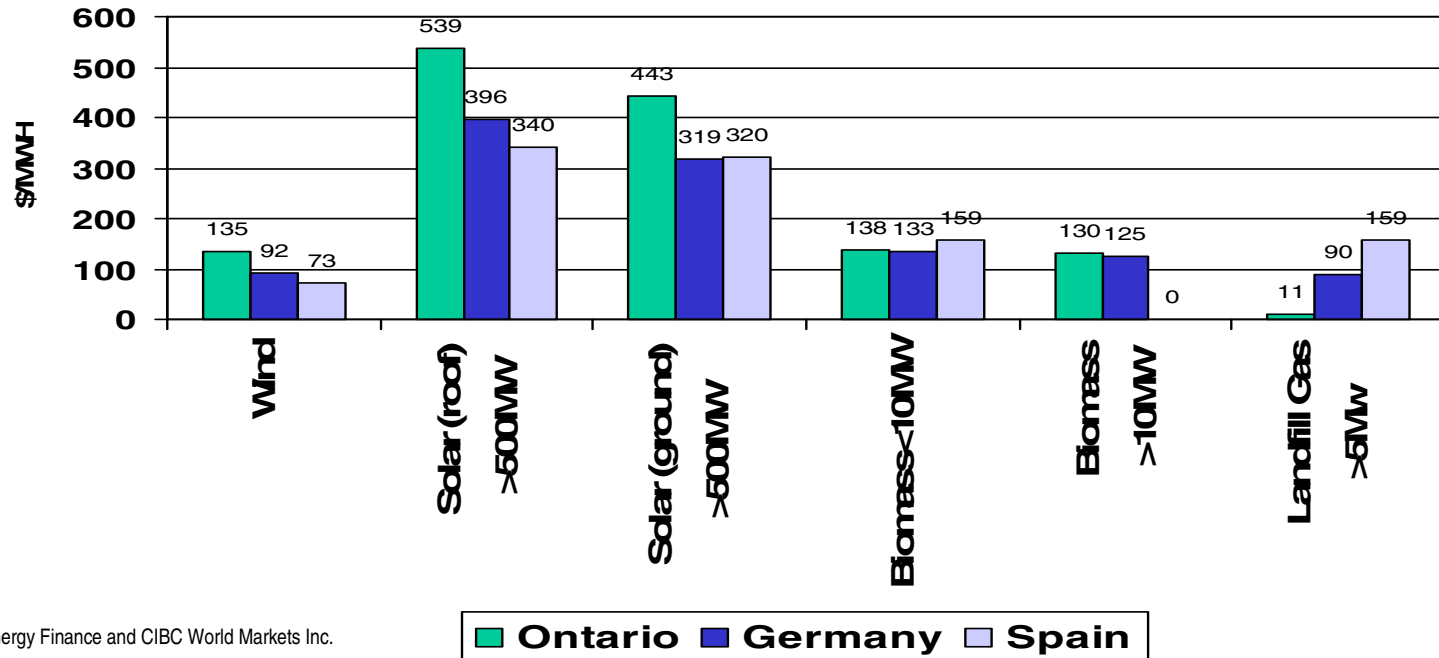
Most of the meaningful policy moves in Canada are being made at the provincial level.

Consider two case studies:

- **Ontario's Feed-in Tariffs**
- **British Columbia's Carbon Tax**



Case Study: Ontario's Feed-in Tariffs



Source: New Energy Finance and CIBC World Markets Inc.

- **The new FiTs program in Ontario offers rates that are competitive with those in Europe, and far higher than those currently offered in the U.S. (However, the U.S. offers much more attractive capital subsidies.)**
- **In Ontario, the FiTs for biomass are far less generous than those for solar, in line with those for wind (onshore), and significantly greater than those for landfill gas.**
- **For biomass, Ontario is in line with Germany. Spain is more generous for plants <10 MW, but offers nothing for plants >10 MW. Germany now has a sliding-scale FiT for biomass, with the numbers reflecting those associated with a 5 MW and 15 MW plant.**
- **Given the levelised cost of energy, expect a greater supply response in wind and solar than for biomass or landfill gas.**



Case Study: Impact Of B.C.'s Carbon Tax

Kruger recently fully commissioned a biomass gasification system from Nexterra to replace natural gas consumption at its tissue mill in New Westminster.

- **What is the impact of B.C.'s carbon tax on the financial attractiveness of this project?**
- **The NPV of avoided carbon taxes and offset revenue is estimated to be \$4 million. Depending on the actual numbers, we estimate this corresponds to 35% to 45% of the total capital expenditures of the project. The estimated benefits assume:**
 - **A carbon price of \$30/ton by 2012;**
 - **Reduced CO2 emissions of 20,000 tpy, which enable Kruger to avoid paying \$600,000/year of carbon taxes; and,**
 - **Carbon offsets can be sold for \$10/tonne to the Pacific Carbon Trust.**
- **Bottom line? B.C.'s carbon tax can have a significant impact on the financial attractiveness of bio-energy projects in the province.**



FPAC's Future Bio-Pathways Project

.....**Descending from 10,000 to
1,000 meters.....**

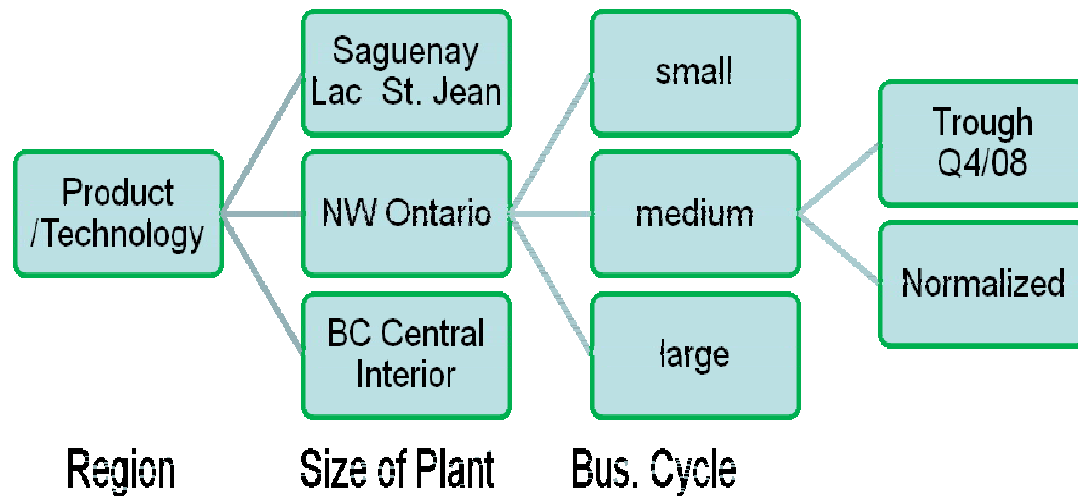
Glimpse of FPAC's Future Bio-Pathways Project

- **Objective is to help identify the right transformational strategies for the Canadian forest sector.**



Overview Of FPAC's Bio-Pathways Project

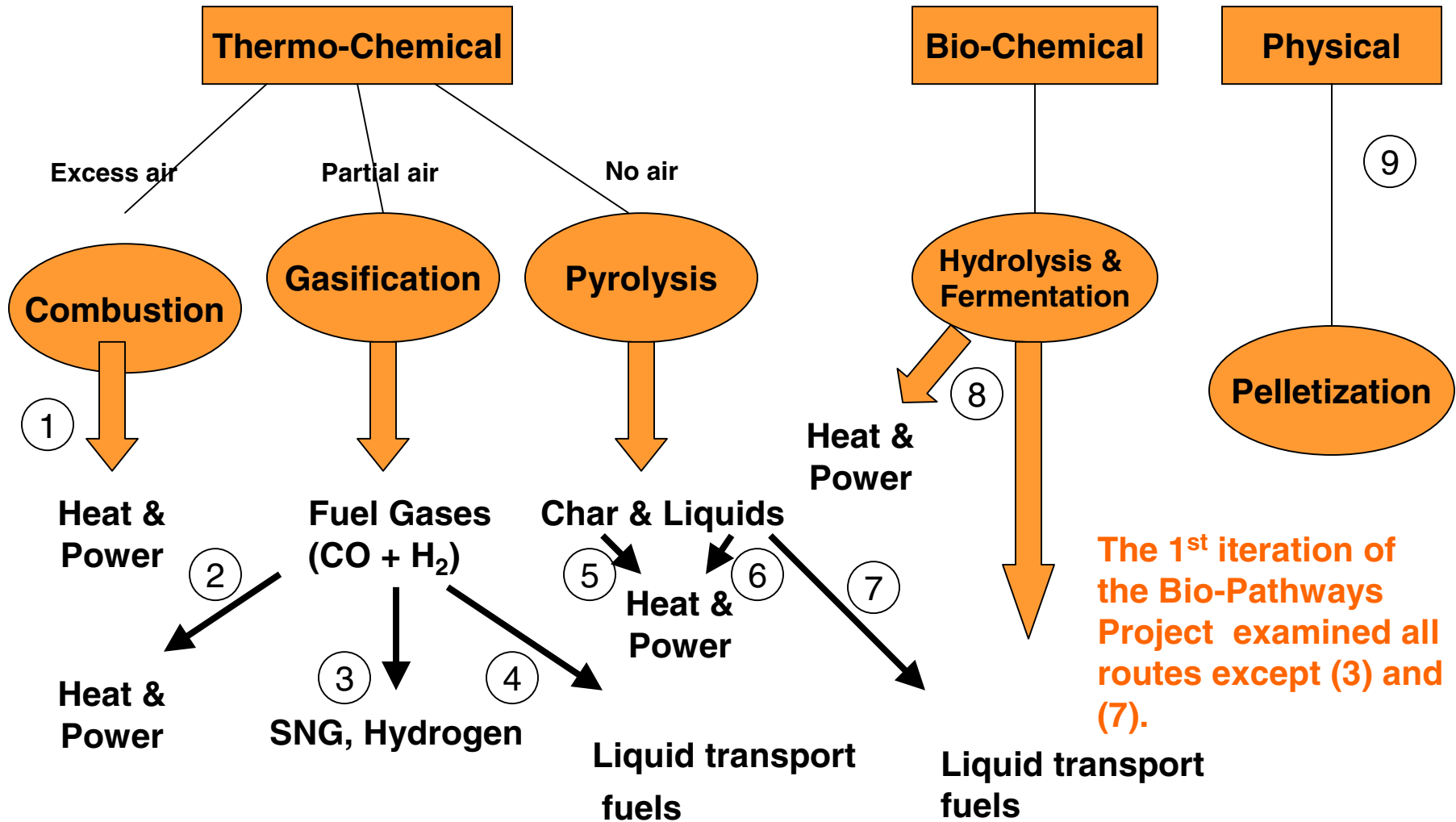
- Sensitivity analysis plays a central role in this approach



Source: FPAC.

- **In the first iteration of the project, 27 products/ technologies are examined (16 traditional and 11 emerging).**
- **For each product, a series of financial, social and environmental metrics are calculated.**

Conversion Pathways For Processing Woody Biomass To Energy



Do We Need To Change?

- **Yes, we need to change. Most of the traditional products are not expected to earn their cost of capital in a normalized environment.**
- **The financial returns expected from traditional pulp & paper products are simply not good enough. This has clear negative implications for the viability of the whole industry.**
- **Despite the inevitable volatility, over a cycle the lumber segment is expected to generate an attractive ROCE in all three regions. This is important since:**
 - **Higher-value solidwood products form the cornerstone of a competitive forest complex.**
 - **They justify the cost of extensive forestry operations due to their ability to pay a higher price/m³ of fiber.**



Are The Emerging Options Any Better?

- **Some of the emerging products are better, but we have to be selective.**
- **Many of the emerging bio-energy products are still not attractive. Aside from some technical challenges, they are often too capital intensive, and do not generate enough value added.**
 - e.g., ethanol via bio-chemical processes using wood.
- **The bio-refinery concept offers some of the most promising emerging options. A much closer look is warranted, including a critical assessment of markets and pricing for the following:**
 - Pyrolysis oil
 - Bio-products (i.e., pulp, bio-energy, bio-chemicals) produced via the Fractionation approach on a pulp platform
- **Depending on the price offered, some of the densified solid wood fuels (e.g., torrefied pellets) suggest attractive returns in some jurisdictions. However, there is meaningful public policy and exchange rate risk.**



Are The Emerging Options Any Better?

- **There are a range of biomass gasification technologies being developed, and they vary widely in their cost structure and range of products.**
 - **The only CHP via Gasification technology currently examined in this study is the one promoted by BBI International....it is not attractive.**
 - **Expect to shortly add a CHP via Gasification technology similar to that being implemented by Nexterra/GE.**
 - **Also expect to add a gasification approach to produce power, ethanol, methanol and methyl acetate, similar to that being developed by Enerkem.**
 - **... Preliminary results from the last two technologies appear significantly better.**
- **All of the bio-energy options in B.C. are expected to improve as the impact of the province's rising Carbon Tax is incorporated. This is not yet reflected in the estimated results.**



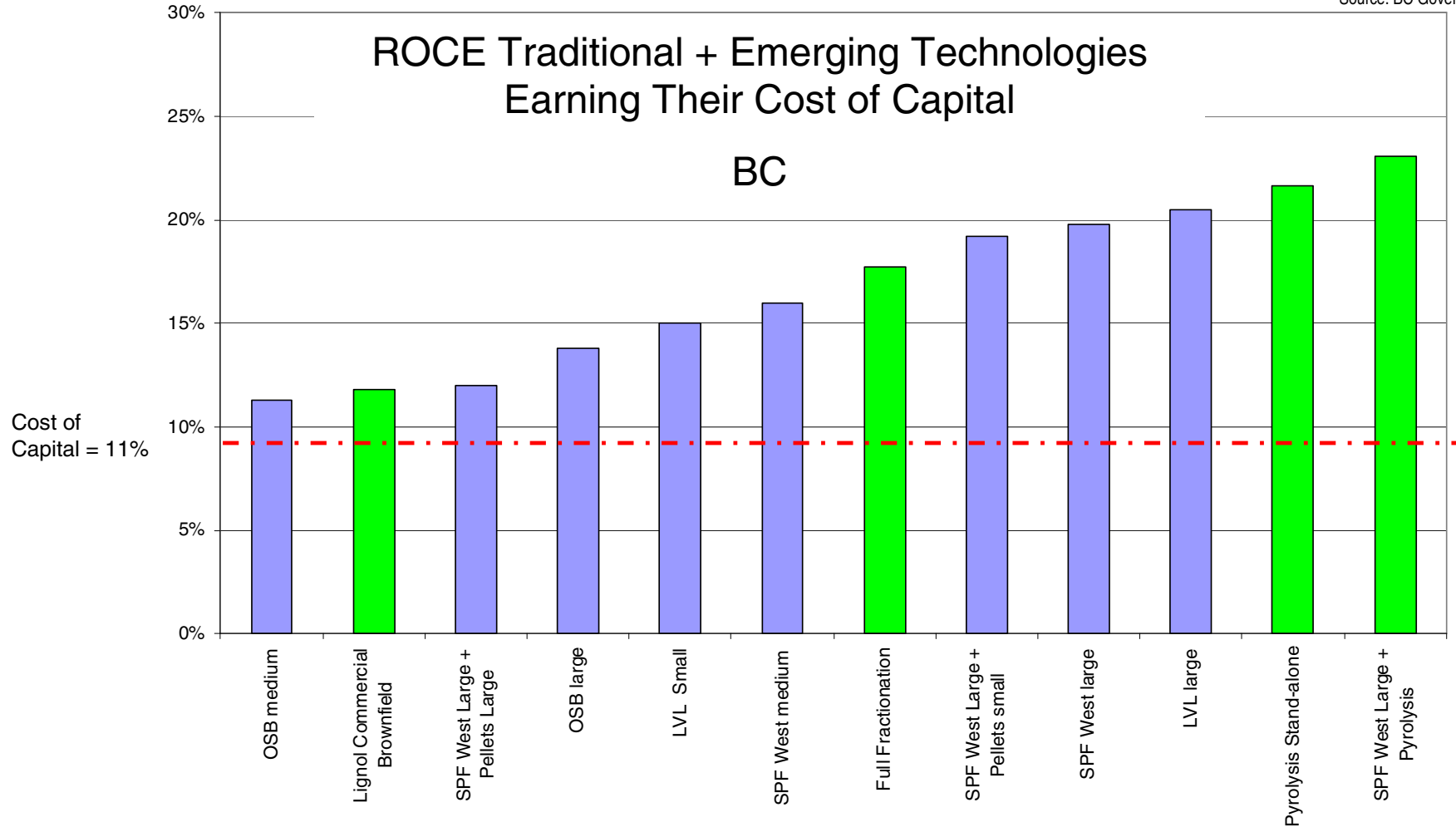
What Is The Best From Both Worlds?

- **Moving to the production of commodity bio-energy products is a necessary step in the transformation of the forest industry.**
 - **Commodity bio-energy should be part of the bio-refinery platform (i.e., integrated facility producing a range of products).**
- **However, there should also be increased emphasis on those higher-valued bio-chemical markets in which there are potential barriers to competition.**
 - **Identification and analysis of these opportunities is the rationale underlying the 4th and 5th Lines of Inquiry identified at the start of the Project.**



What Is The Best From Both Worlds?

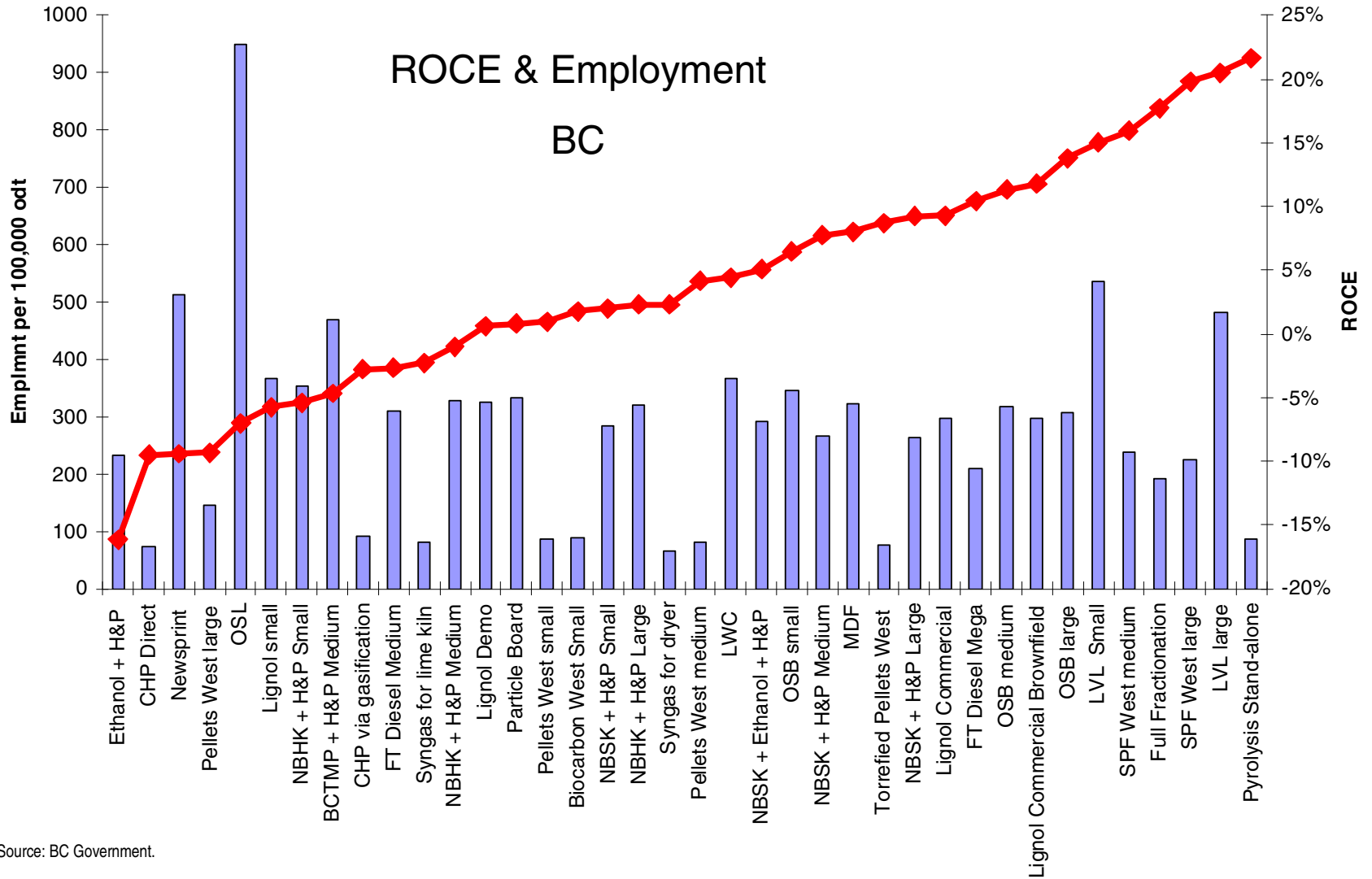
Source: BC Government.



- The majority of the products/technologies examined are not expected to earn their cost of capital in a normalized environment. However, the above are expected to generate an acceptable ROCE.**



How Does The Relative Attractiveness Of Products Change When We Shift From Financial To Social Metrics?



Source: BC Government.



Employment Conclusions

- **With the exception of LVL, there appears to be a general trade-off between ROCE and the Employment Generated per 100,000 ODT of fiber.**
 - **The top 8 products in terms of ROCE generate an average ROCE of 17% and average Employment Multiplier of ~300.**
 - **The top 8 products in terms of Employment Multiplier generate an average ROCE of only 1%, but an average Employment Multiplier of ~500.**
- **The traditional forest products tend to generate far higher employment multipliers than do the bio-energy products. Per unit of fiber consumed, it is estimated that the pulp & paper segment generates:**
 - **3x more total employment than does the bulk production of energy; and,**
 - **Almost 5x more when just the direct employment is considered.**



Bio-Energy Conclusions

- **The financial crisis has significantly slowed the development of the bio-energy sector, but the secular outlook is still encouraging.**
- **Canada has been slow in developing its bio-energy potential. However, we may be able to catch up given that:**
 - **It is unlikely the U.S. and China will meet their bio-energy targets over at least the next three years.**
 - **The EU will also likely have to reassess its aggressive targets due to the impact on feedstock prices and overall economic consequences.**
- **Given government budget deficits, in the future expect greater emphasis on Renewable Energy Standards than direct subsidies... there is still a cost, but it is indirect. In the meantime, WATCH OUT for the impact of the U.S.' Biomass Crop Assistance Program.**
- **In setting and meeting bio-energy policies & targets, it is important to:**
 - **Recognize that bio-energy must play a central role in the transformation of the forest sector. This role will be necessary (but not sufficient).**
 - **Consider both forestry and agricultural feedstocks – break out of your administrative “silos” – and focus on economic instead of physical supply.**
 - **Take a “systems approach” to avoid unintended consequences – an emphasis on integration with existing forest product complexes looks most promising.**
 - **Examine the competitiveness of bio-energy relative to other sources of renewable energy. What is the lowest-cost way to reduce CO2?**





Central to all bio-product strategies is a competitive price for delivered biomass..... True regardless of where you operate.



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Appendix A: Solid Energy Products

	Energy Content GJ/odt pellet	Energy Usage GJ/odt pellet
Pellet	19	0.8
Torrefied Pellet	24	4.5
Biocarbon	30	29
Coal (anthracite)	31	

Source: New Energy Finance.

Energy Density

- **Desirable to increase energy density in order to decrease the effective cost of transportation.**
- **Biocarbon requires a significant amount of energy in the manufacturing process, but the delivered product has a much higher energy content.**
- **Under what conditions does it make sense to use the various types of solid energy products? (e.g., when does it make sense to use the energy in the resource to densify the energy in the product?)**



Appendix B: Bio Of Don Roberts

- Mr. Roberts is a Managing Director with CIBC World Markets Inc. He is frequently described as a “thought leader” in the global forest products and bio-energy industries. From 1992-2008 he led a team of analysts in advising financial institutions (e.g., pension/mutual funds) on their investments in the global paper & forest products industry.
- During a sabbatical year in 2009, Mr. Roberts focused on two projects:
 - On behalf of the Forest Products Association of Canada he led the Future BioPathways Project, which examined transformational strategies for the Canadian forest industry.
 - On behalf of CIBC World Markets Inc. he developed a business plan for the creation of a Clean Energy franchise.
- 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);
 - On the Board of Directors of the Rights & 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.



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Boralex Power Income Fund (BPT.UN-TSX, C\$4.41, Not Rated)

Cosan (CSAN3-SAO, [BRL]23.15, Not Rated)

General Electric (GE-NYSE, US\$16.55, Not Rated)

Neste Oil (NES1V-HE, €11.43, Not Rated)

Siemens AG (SIE-DE, €54.31, Not Rated)

Valero Energy (VLO-NYSE, US\$19.09, Not Rated)

Veolia Environment (VIE-PA, €22.21, Not Rated)

Votorantim Celulose e Papel SA (VCP-NYSE, US\$16.00, Not Rated)

Waste Management (WMI-NYSE, US\$28.50, Not Rated)

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SP	Sector Performer	Stock is expected to perform in line with the sector during the next 12-18 months.
SU	Sector Underperformer	Stock is expected to underperform the sector during the next 12-18 months.
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R	Restricted	CIBC World Markets is restricted*** from rating the stock.
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M	Market Weight	Sector is expected to equal the performance of the broader market averages.
U	Underweight	Sector is expected to underperform the broader market averages.
NA	None	Sector rating is not applicable.

**Broader market averages refer to the S&P 500 in the U.S. and the S&P/TSX Composite in Canada.

"Speculative" indicates that an investment in this security involves a high amount of risk due to volatility and/or liquidity issues.

***Restricted due to a potential conflict of interest.

Ratings Distribution*: CIBC World Markets Inc. Coverage Universe

(as of 20 Jan 2010)	Count	Percent	Inv. Banking Relationships	Count	Percent
Sector Outperformer (Buy)	115	44.4%	Sector Outperformer (Buy)	109	94.8%
Sector Performer (Hold/Neutral)	116	44.8%	Sector Performer (Hold/Neutral)	102	87.9%
Sector Underperformer (Sell)	19	7.3%	Sector Underperformer (Sell)	17	89.5%
Restricted	9	3.5%	Restricted	9	100.0%

*Although the investment recommendations within the three-tiered, relative stock rating system utilized by CIBC World Markets Inc. do not correlate to buy, hold and sell recommendations, for the purposes of complying with NYSE and NASD rules, CIBC World Markets Inc. has assigned buy ratings to securities rated Sector Outperformer, hold ratings to securities rated Sector Performer, and sell ratings to securities rated Sector Underperformer without taking into consideration the analyst's sector weighting.

Ratings Distribution: Paper & Forest Products Coverage Universe

(as of 20 Jan 2010)	Count	Percent	Inv. Banking Relationships	Count	Percent
Sector Outperformer (Buy)	3	18.8%	Sector Outperformer (Buy)	3	100.0%
Sector Performer (Hold/Neutral)	11	68.8%	Sector Performer (Hold/Neutral)	11	100.0%
Sector Underperformer (Sell)	1	6.3%	Sector Underperformer (Sell)	1	100.0%
Restricted	1	6.3%	Restricted	1	100.0%

Paper & Forest Products Sector includes the following tickers: ABWTQ, CAS, CFP, CFX.UN, CTL, IFP.A, LPX, MERC, NBD, SFK.UN, SXP.UN, TMB, TRE, TWF.UN, UFS, WFT.

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