

Bio-refinery commercialization:

Attracting investment through improved revenues,
reduced capital, & properly allocated risks

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Prepared by:

Jeff Passmore, CEO, Passmore Group Inc.

“Fueling the Bioeconomy”

What should we be trying to accomplish?

- Create the next industrial revolution?
 - EU28 bioeconomy is generating 18 million jobs, and euro 2.1 trillion in annual investment (EU5 = e1.27 trillion – Germany: e343 billion, France: e295 billion, Italy: e244 billion, Spain: e219 billion, UK: e171 billion)
- Maximize Canada’s appeal for bio-economy investment\$
(i.e., 10% of the world’s forests, stable macro environment,
But low demand - so focus on exports & electrification)
- Build an attractive environment for **Capital** – we are competing internationally
- Get bio-economy steel in the ground

Current Context 2015

In 2015, Global investment in clean energy hit a record \$US325 billion

Investment by country:

China - \$110 billion (up 17% from 2014)

USA - \$56 billion (up 7%)

Japan - \$44 billion (up 3%)

UK - \$23 billion (up 23%)

India - \$11 billion (up 23%)

In 2015, clean energy investment in Canada was \$US4 billion (down 46% from 2014)

Investment by technology:

Solar - \$161 billion

Wind - \$110 billion

Large Hydro - \$42 billion

Biomass & Waste - \$6 billion

Small Hydro - \$4 billion

Geothermal - \$2 billion

The majority of this investment was for the production of electricity

What's the 2016+ opportunity?

Canada committed to cut emissions by 30% below 2005 levels by 2030 (Paris agreement)
– i.e., ~208 mm tonnes of CO₂

Federal support:

“Clean technologies are a key component of the Government of Canada’s approach to promoting sustainable economic growth and will play a crucial role in Canada’s transformation to a low-carbon economy.” – NRCan Minister Jim Carr, June 2/’16

The Minister announced that Canada will seek to double its 2014–2015 funding of \$387 million for clean energy and clean technology research and development to \$775 million by 2020.

Also, this week, Minister Navdeep Bains (ISED) announced Canada’s Innovation Agenda making innovation a national priority

The Opportunity also includes:

1] Grid de-carbonization:

Saskatchewan and Alberta have both announced targets to increase renewable power production

2] Electrification of the wider economy (transport, buildings):

Ontario and Quebec – 80% reduction in GHG emissions across the economy by 2050

3] Exports:

Opportunity for de-carbonization of US electricity grid far greater than that of Canada



Opportunities for biomass

Traditional uses such as CHP, space heating, co-firing – don't leave all the new electrification to wind and solar

Innovative uses to include a combination of:

- Bioenergy
- Biofuels
- Biochemicals
- Bioplastics
- Bioproducts (paints, solvents, personal care products, detergents)

In other words a biorefinery that:

- converts cellulose and hemi-cellulose into fermentable sugars to produce:
 - building blocks for bioproducts and materials
 - transportation fuel
- burns lignin for onsite power generation



The opportunity is massive

“ The Bioeconomy will hit its stride in the 2025 – 2030 period with an estimated world market of between USD 2.6 and 5.8 trillion. At that time, bio-chemicals alone will reach 22% - 28% of the potential global chemical market of USD 2.2 trillion.”

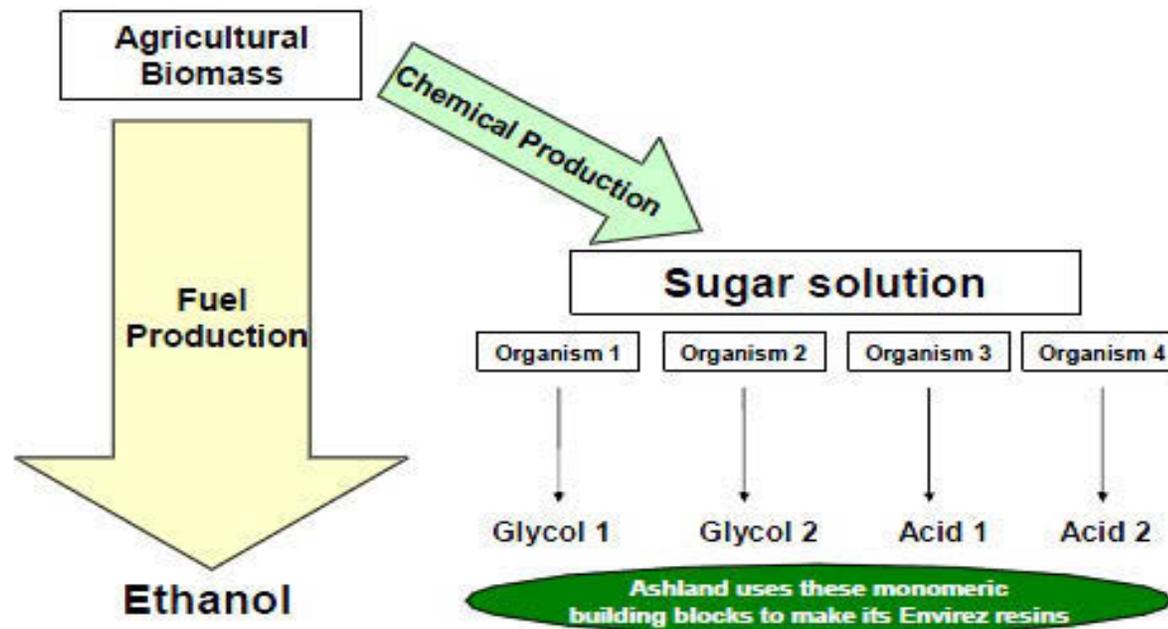
- OECD Bioeconomy 2030 report

We know how to reduce GHGs in power and transport. Canada will not reinvent the wheel here - we should, and will, import proven technologies

But technologies in the bioeconomy space are just emerging and there is an opportunity to be at the leading edge by forming strategic partnerships

So what might a cost competitive bio-refinery look like? (Not unlike the oil refinery model)

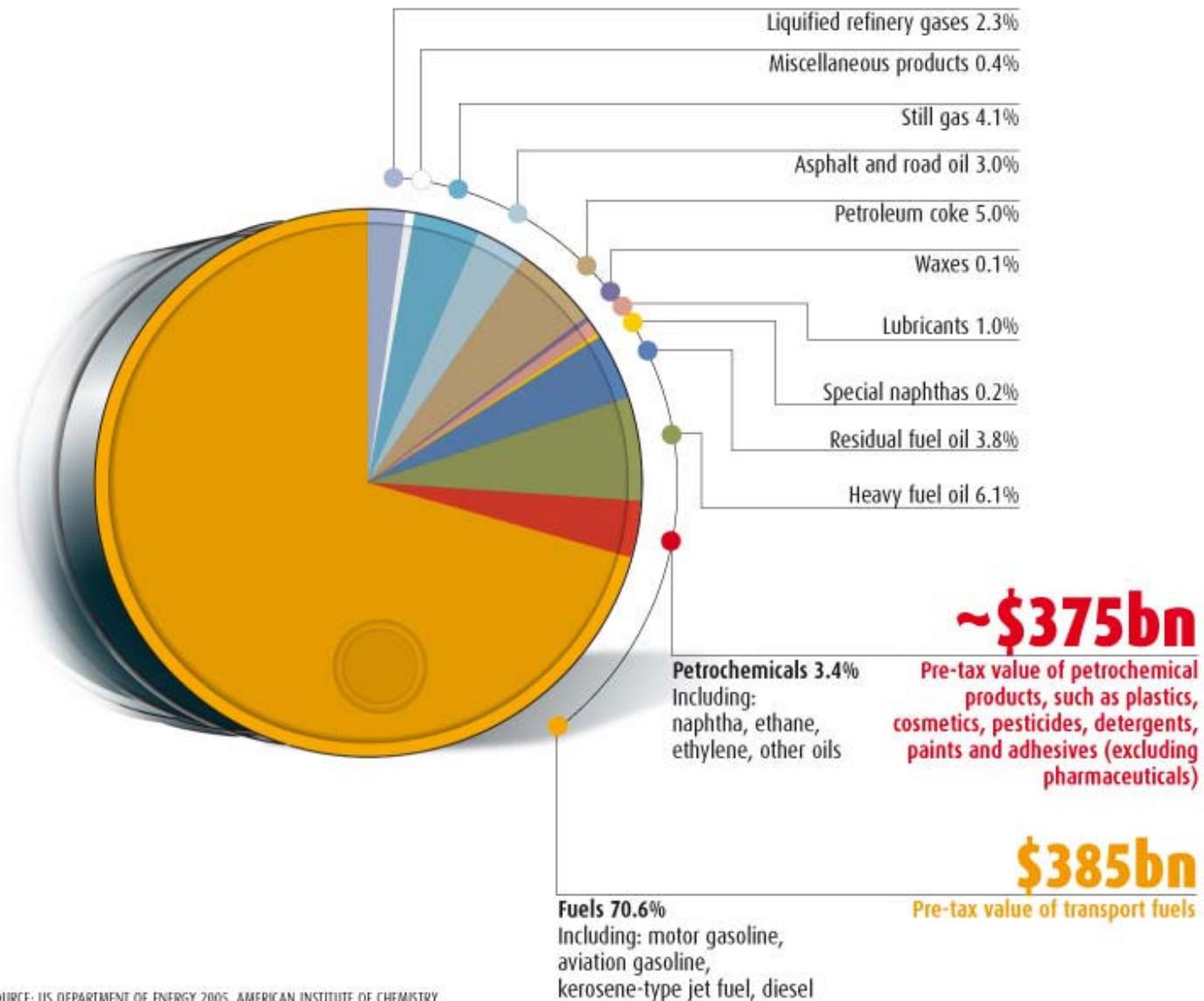
Vision for Chemical Production at an Ethanol Biorefinery



- Ashland does not intend to build or operate a biorefinery, but we represent a strong downstream channel-to-market partner for bio-based chemicals.

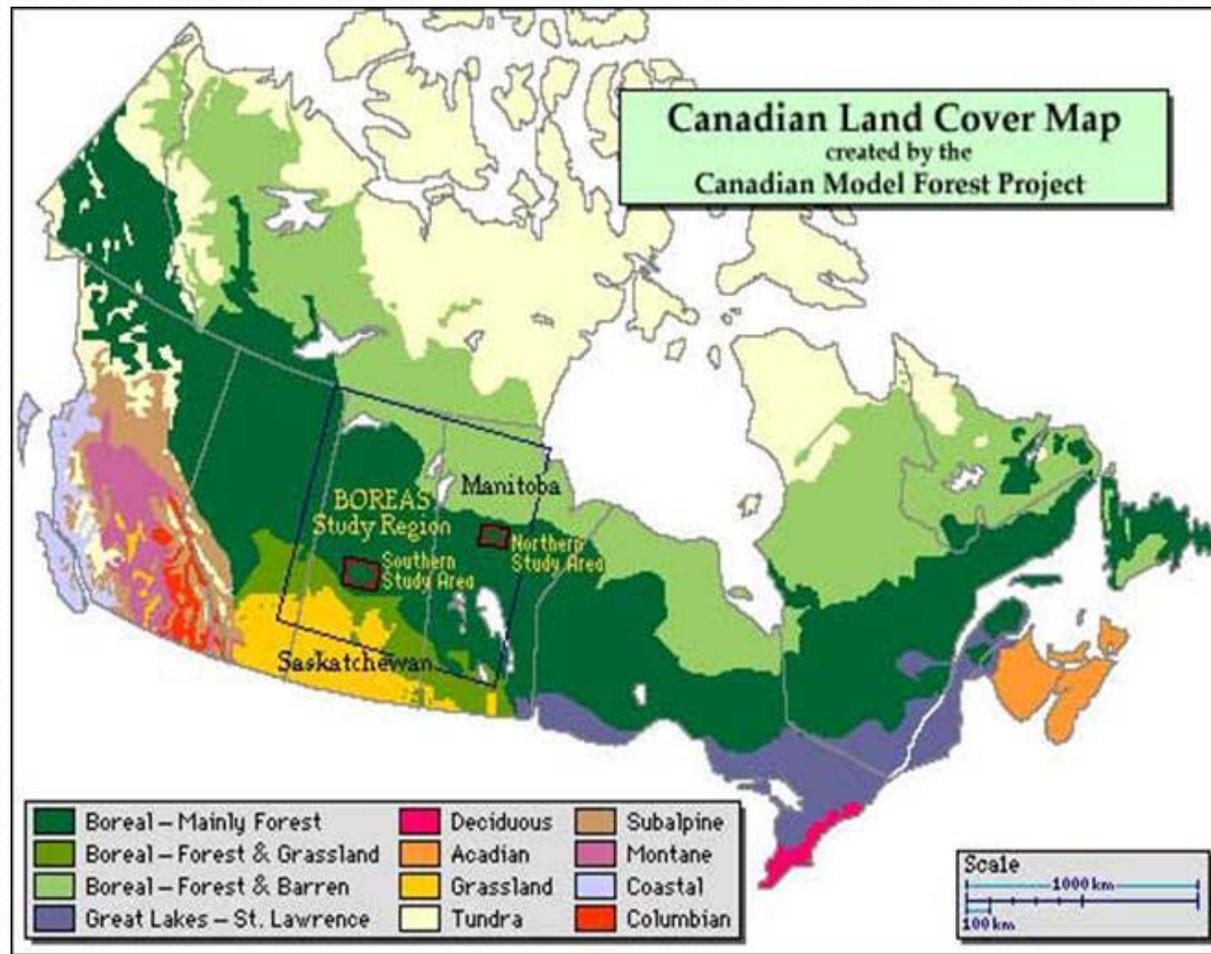
OIL BARREL BREAKDOWN

Despite consuming a small fraction of US oil compared with fuel, petrochemical products are worth more



What's Canada's potential?

Forest cover (348 million hectares)





If you want to consider a commercial project
in the bio-economy space, be aware that...

...Capital
will be the beginning and the end
of any discussion



Also, when proposing a commercial project
in the bio-economy space, remember...

“No single person, no single investor,
or banker, or consultant,
knows where all the money is.”

- John May, Managing Director, Stern Brothers & Co.

Assuming project sponsor(s) provide initial equity, where will other funds come from?

X Traditional lenders / Commercial banks:

- risk averse; need established track record, a balance sheet & collateral; how do the borrower's assets compare to the risk of non-repayment?

X Angel Investors:

- start-up capital in the millions from affluent individuals; motivation is often social good or mentoring entrepreneurs rather than ROI
- risk tolerance potentially high, but funds insufficient to support commercial plant

X Investment Grade Project Finance:

- if zero risk, then ~6% cost of capital; need proven technology / track record; minimum, B+ credit rating
- "zero risk" means no technology risk, no feedstock risk, minimal market risk (wind farms – totally de-risked, long-term off-take = 5.5% money)

X Private Equity/Merchant Banks:

- pension funds, private individuals; fall between VC and IPO; ~16% interest rate unless very low risk; "2nd of a kind" still not below double digit
- could offer up to \$100mm+, but looking for equity in an operational company - need a track record

X Sovereign Wealth Funds:

- invest in the hundreds of millions, but low risk tolerance (national pension funds); mostly equity
- technology needs to have material impact and high returns

x? Venture Capital:

- early seed capital max out at ~\$10 - \$20 million; later rounds (if you can get them) max out at \$100mm (sufficient for commercialization?)
- binary bet = win all or lose all; accept risk but need high rates of return (early stage = 10 - 100x)
- exit strategy / time horizon (3 - 8 years)

x? Going public / IPO:

- is the market ready, and will the IPO raise sufficient funds to support both ongoing company operations and project financing?
- are you 'Capital Lite' - can you offer mid-double digit returns? (IPO should not be viewed as a substitute for project finance)
- is your technology development advanced enough to withstand this major distraction?

x? Investment Banks:

- are facilitators - do not have their own source of funds, so cost of capital and risk tolerance depends on who they bring to the table
- returns need to be competitive with the market; risks need to be off-loaded – likely need Government loan guarantee

? Large Corporate Strategics:

- more patient than VCs, and have large capital budgets, but are committed to core business and IRR of ~20%
- Cleantech/biorefinery investment returns not competitive with core business investments; low technology risk tolerance unless they own the IP
- need change of law protection / policy stability – have fear of stranded assets

• Sugar Daddies:

- finance initial project from "Corporate cash" – their own balance sheets; high risk tolerance and accept below market returns on this first facility
- may be recipe for one or two plants, but is it going to build an industry? One plant does not make next project "investment grade"

• Government:

- grants, loans, repayable contributions, loan guarantees can be stacked with private funds, but also need Policy stability
- preferable if project can work without Government on critical path

• Project Bond market:

- requires credit worthy project sponsors and (in the energy space) offtake contract; no interest in technology risk (Government loan guarantee could help?)

So you want to build a plant – what are you facing?

High capital cost + tech innovation = difficult project financing

- average credit quality of first-of-kind ‘commercial’ facilities is typically **below investment grade**
- first-of-kind projects are therefore **not in the wheelhouse** of banks, VCs, or traditional project financing (too much capital deployed for uncertain returns)
- potential strategic investors, whether downstream (oil/chemical), midstream (enzymes) or upstream (feedstock) have **competing internal capital demands**. Do they need “optical advantage” over competitors?
- as public companies, strategics are looking for attractive returns that can demonstrate:
 - a 5-6 year simple payback
 - a cost advantage over current practices
 - a competitive edge over capital opportunities in other potential areas of investment
- strategics also concerned about market uncertainty, and potential “change of law” that would **strand their investments**
- speaks to possible “**syndicated approach**” to project financing, and the need for **public private partnerships**



So you want to build a plant...

Assembling project capital involves both equity and debt:

Equity:

- Is about the future – what are you promising to deliver?
- Comes in first and can range from 20% - 50% of project cost
- Needed to demonstrate project sponsor/proponent skin in the game
- Remainder from committed Strategic investors/Corporate balance sheets

Debt:

- Is about the past – do you have a track record?
- Comes in after equity
- Senior debt - Commercial banks – expect timely payment of principal and interest (think mortgage)
- Subordinated, non-recourse debt - Governments grants, loans, loan guarantees
(Typically last in - follows the private sector investment)



So you want to build a plant...

What are the responsibilities of the borrower?

To structure debt such that there is no recourse to any “parent” company (lenders can only look to the project for security), you must convince a lender/investor that risks can all be managed:

- technology risk (will it work)
- construction and operating risk (on time / on budget / on performance - EPC wrap)
- feedstock risk (guaranteed volumes at fixed price/time)
- offtake risk (purchase agreement(s) with a customer(s), hedging strategy)
- scale-up risk (independent engineering assessment)
- management team risk (degree of business acumen, management continuity)

Lender will assess risks, then price the debt (e.g., what interest rate does the lender need to charge if the facility only operates 65% of the time?)

The greater the perceived investment risk, the higher the cost of debt

Debt financing is the biggest challenge faced by new technologies seeking to build first-of-kind, or even second-of-kind, commercial facilities



So you want to build a plant...

Know your customer:

Renewable fuel customers will be looking for a fuel that is:

- high in octane
- low in GHG emissions
- cost-competitive with other alternatives
- meets obligations of government standards (LCFS or mandates)

Renewable chemical customers will be looking for:

- inexpensive, clean, competitive performance products

(Note: This may get your product on their potential list, but is no guarantee of uptake)

Ensure your brand is firmly set in your customers and prospective customers minds – including federal & provincial governments...

...Because you need customer preference for bio-products to drive demand quickly enough to generate cash for your business fast enough (Coca Cola)



So you want to build a plant...

Does your proposed facility have:

- ✓ Scale-up risk managed
- ✓ Construction risk managed
- ✓ Contracts in place for feedstock supply
- ✓ A ready (offtake) market for product(s) produced
- ✓ A proven management team that can deliver results
- ✓ Strategic partnerships
- ✓ Public support
- ✓ Government policy and program alignment
- ✓ A line of sight on how the project will be financed



So you want to build a plant...

Where you need to be for financial close...

(and also to be eligible for many government funding programs)

- ✓ Project debt and equity in place including construction and interests costs
- ✓ Working capital in place (to pay operating costs)
- ✓ Reserve fund in place (debt service, maintenance, soft costs)
- ✓ Feedstock agreements in place – price and volume
- ✓ A demonstrable market / offtake in place
- ✓ Contracts with experienced EPC contractor (including price guarantee) in place
- ✓ Completion guarantee by the project sponsor
- ✓ A line of sight on project cash flows
- ✓ More...More...More

(investors typically assume the worst case financial outcome and act accordingly)



Possible (Bio)Refinery model

Strategies for improving revenue, reducing capex, and allocating project risk:

Co-develop

- build strategic partnerships to spread risk (feedstock supplier, off-taker)

Co-locate with existing infrastructure (“brown field”)

- 1st and 2nd generation technologies
- bio-based with hydrocarbon based
- build smaller, less capital intensive ‘bolt on’ facilities

Co-produce fuels and chemicals

- extract the highest value products first (to generate cash flow)
- if possible, start with high margin chemicals, and evolve to fuels



So what is the role of Government? (assuming public/private goal alignment)

The public sector can play a material role in bio-economy commercialization success

What's needed are policy tools that stimulate the integration of new technologies into the mainstream economy – an economy that:

- has established interests with **sunk costs infrastructure**;
- is highly, and legitimately, **risk averse**;
- needs game changing **investment rewards** to alter direction.



So what is the role of Government?

Various policy and program options are open to governments

- Mandates – such as Renewable Fuel Standards in Canada and the US (volume and technology specific)
- Low Carbon Fuel Standards – such as that adopted in CA, BC (technology neutral)
- Carbon Tax – BC (\$30/tonne), Alberta (\$15/tonne)
- Production and/or Investment Tax Credits (governments fiscally constrained so keep it modest and demonstrate returns – jobs, tax revenues; Cost to Government only upon project success)
- Loan Guarantees (if proposed project meets Government policy objective, governments should assume a degree of market and/or technology risk)
- Grant Funding (focus is typically pre-commercial)
- Grower incentives

So what is the role of Government?

In April/'16, 200 Clean-tech companies wrote PM Trudeau asking for:

- \$1-billion loan guarantee program for early stage projects
- a \$500 million venture capital program
- another \$1.25-billion to expand and restructure the existing SDTC programs
- tax credits similar to what mining, and oil and gas industries enjoy

On June 1, 35 entities in the bioenergy space wrote ECCC Minister McKenna asking that:

- Canada establish a national bioenergy strategy **within a broader bioeconomy framework.**

Other thoughts include:

- A national Green Bank and/or Green Canada Savings Bonds to provide low cost debt

Must frame your 'ask' to compliment Government priorities



Government's must recognize that: **Certainty is the mother of investment**

Assuming bio-economy commercialization is a policy goal (jobs, economic diversification, GHG emissions reduction), governments need

to employ economic instruments that:

- offer **long term policy stability / certainty**
- are **flexible, not exclusive** (recognize that successful commercialization often demands co-production of multiple products – i.e., fuels and chemicals)
- properly **share and allocate commercialization risks**



Final thought re emerging technology commercialization

As we move to commercialization, the private sector should assume an increasing share of project risks such as:

- ✓ technology
- ✓ management
- ✓ project execution / engineering / construction
- ✓ product production / performance
- ✓ environmental sustainability
- ✓ project finance
- X “stranded asset risk”

To launch the bio-economy, the public sector should ensure:

- ✓ Future change of law protection (grandfathering) – i.e., assume Stranded Asset Risk

Closing thought:

Take advantage of unique and generous Canadian Govts' project support

(So build in Canada; export to global markets)

- **Scientific Research and Experimental Development (SR&ED) Tax Credits**
 - large Corporation can claim a tax credit on eligible research expenses
- **Sustainable Development Technology Canada (SDTC)**
 - Tech Fund: Development and demonstration grant funding (typically ~\$2 – 12m)
- **Agriculture Canada - Growing Forward Two**
 - up to \$10mm interest free loan (other financing / term sheets must be in place)
- **Ministry of State for Science & Tech**
 - SW Ontario projects - up to \$20 million interest free 10 year loan (includes R&D, engineering, labour and capital costs)
 - Western Economic Development (British Columbia, Alberta, Saskatchewan, Manitoba) - \$2 – 4 million interest free loan
 - ACOA – up to ~\$1 million
- **Export Development Canada**
 - loan for inbound foreign direct investment (partners with other financial institutions) – if 50% of production is exported
- **Ontario Ministry of Economic Development, Employment and Infrastructure (& Innovation)**
 - Jobs and Prosperity “New Economy Stream” for projects >\$10mm - Grants and loans up to 40% of eligible project costs
 - SW and Eastern ON Development Fund: Grant up to 15% of eligible exps to a max of \$1.5m + interest-free loans up to \$3.5m
 - Climate Change Action Plan includes support for research and commercialization of emission reduction and low carbon technologies. Industrial biotechnology has been identified as a priority area.
- **Alberta**
 - Climate Change and Emissions Management Corporation – Grants up to \$10 million
 - Alberta Treasury Branch – “patient” market based loans up to ~\$50mm; can invest (but not lead) outside the Province
 - Agriculture Financial Services Corp. - max \$5 million, 20 year loans at 3% - 5% interest

Contacts:

Email jeff@passmoregroup.ca
Web www.passmoregroup.ca
Mobile +1 613 614 8568
Land +1 613 821 0495