Biorefinery Evaluations for Quesnel – Cariboo

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DISCLAIMER

- In brief, all thoughts and opinions discussed in this presentation are of the presenter (Matyas). Any correlations, connections to the Company I currently work for (West Fraser Mills Ltd.), Directions, Disclosures on decarbonization, biorefineries, bioeconomy, scale-up of processes etc. are limited to those shared in openly accessible Company documents, the presenter has no agency representing the Company or Company's opinion, and it is not his goal to do so.
- This presentation can be shared, again, with the caveat that the goal of the presenter is to support the Quesnel Future of Forestry Think Tank in discussions about the nascent bioeconomy in our region. References are open source, and don't represent any company's philosophy, directives, etc.

Currently, in Quesnel, “Shot in the dark”

- Will we have fiber supply?
- Some support on Capital, so high-cost product initially subsidized?
- Primary industry running well (BC Value-Add Accelerator), AND
- Primary industry can share resources (feedstock, energy) and treat side-products?

- Sorry, this needs too much luck…

OBJECTIVE – Quesnel Biorefinery

- Thinking back from end-goal:

5. Biorefinery in Quesnel, using forest residuals, preferably, softwood bush-grind and underutilized hardwood,

4. Infamous “valley of death”:

   a) Demonstration facility built and operated successfully,

   b) Extensive piloting studies completed, and all front-end due diligence proved economically feasible.

3. Finding supply chain partners to support and fund the project through piloting and demonstration.

2. Large scale evaluation study examining, comparing and combining biorefinery concepts to identify best 1-2 options.

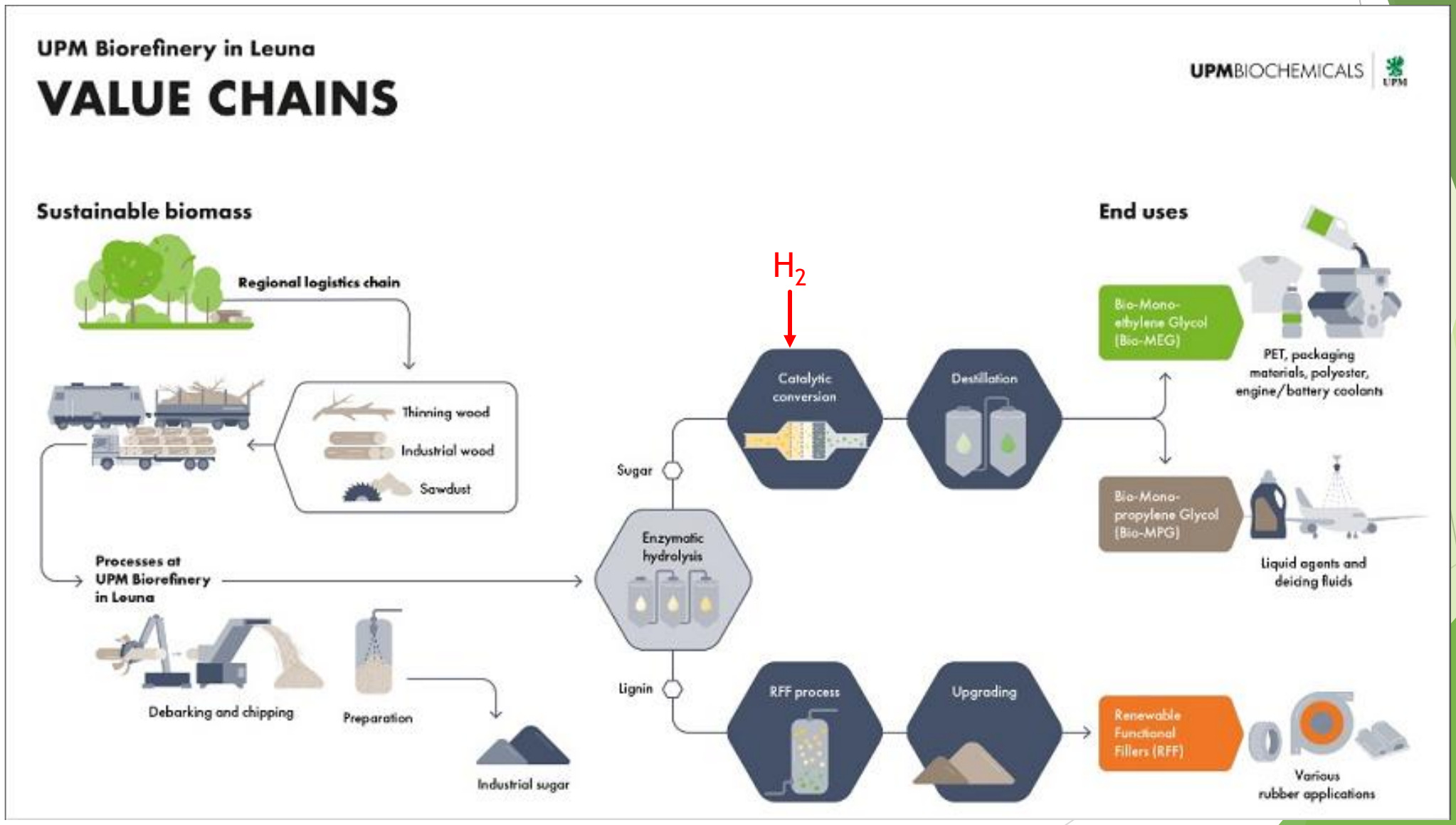
1. Evaluating the volume and chemical composition of forestry residuals in the Quesnel area.

Where we are, what's next?

- Evaluation of available resources are underway, both for volume and chemical composition. (BDO Zone report – volume, and ongoing seasonal evaluation of both SW and HW residuals.)
- Step-2, the comprehensive study of biorefinery concepts and identifying the best option for our region is by far the most complex task and has the highest impact on success.
- Execution of Step-2, accordingly, should be looked at from many perspectives, so we avoid past mistakes, and impart good learnings.

UPM - Leuna, HYBRID BIOREFINERY

https://www.upmbiochemicals.com/about-upm-biochemicals/biorefinery-leuna/



A so far positive example, UPM - LEUNA

- Local supply chain consortium, feedstock suppliers (wood, hydrogen etc.), glycol, modified-lignin users – check,
- Adequate ROI – expected (we don't see these details),
- All TRL issues eliminated ("valley of death") – check,
- All partners are on website.

- MOST IMPORTANTLY:
- HYBRID SYSTEM (!) → Technologies combined from 3-4 different biorefinery concepts, adapted to locality perfectly (!)

How do we get there?

Holistic, big picture approach.

CURRENT REALITY TO BIOECONOMY

Current State

Sarcasm:
Next best thing since slice bread, if:

- 90 % subsidized on capital,
- Operators who were born trained,
- Willingness to move to the wilderness, build roads,
- End-user will figure out major product issues,
- Endless, cheap electricity.

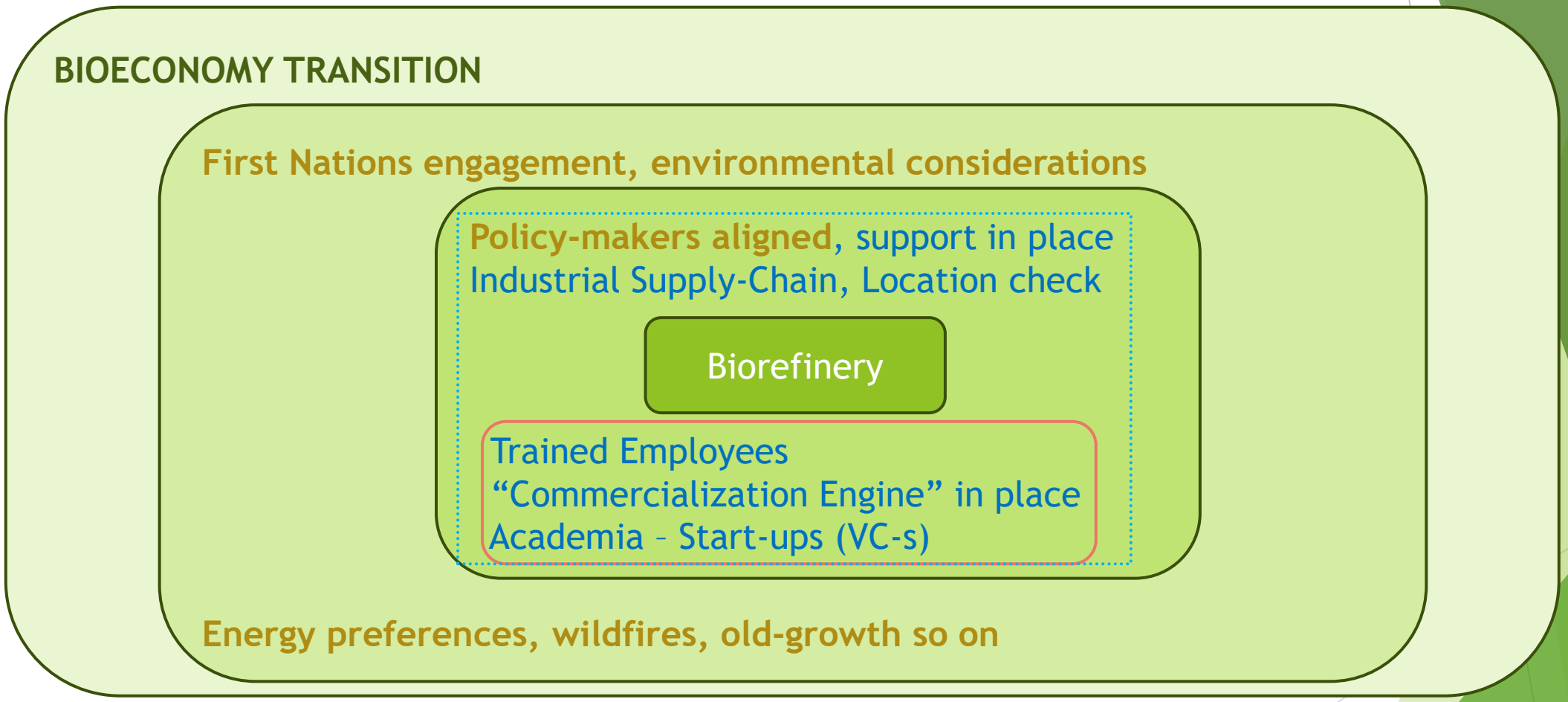
Goal

Sarcasm aside:
Expectations tuned to limitations:

- Supply-chain consortium established, product selected & SUPPORTED
- No shortcuts on Capital/Opex,
- “Hybrid technologies” investigated,
- Policy environment positive.

BIOREFINERY

“COMMERCIALIZATION ENGINE”



Academia is part of the “Commercialization Engine”, Concept Dev., & Trained Employees

Industry AND Government are also part, Positive Policy, Supply-Chain and INVESTMENT

CURRENT NICHE BIO-ECONOMY (BC) – MATYAS' PERSPECTIVE

INDUSTRY

- Decarbonization goals
- Forest tenures limited (vs. North EU)
- Derisking core-business & market growth
- Very limited interest in building and operating non-core business processes
- Selling residuals at good-value & long-term to a reliable off-taker
- Limited resources (R&D&I) & Gov't support

ACADEMIA & GOVERNMENT

- Not understanding industry practices
- Need for continued funding
- Poorly influenced R&D objectives (from practical scale-up perspective)
- Responsible spending can't be enforced
- Commercial applicability limited or missing
- Problems are very complex

VC-s & START-UPS

- Support from suppliers & off-takers allow operation
- Business costs, while not profitable
- Scale-up of complex processes
- VC-s would prefer proof of support from large industry
- Business needs return that is interesting to VC-s, high risk tolerance

INFLUENCE

- Similar to Bottom-Up or Top-Down approaches, we can look out from the Commercialization Engine or in from the Bioeconomy Transition perspectives.
- Independently of direction, the goal is Biorefinery building, to allow the transition to a Bioeconomy.

Perspective	Strong Influence	Limited Influence
Academia	Low TRL R&D guidance, Training Education of the public	Policy
Industry, incl. VC-s	Commercialization Investment Consortia Development	Policy, Location
Government	All the above + Policy	Alignment of all perspectives*

*There's significant effort, but the environment is very complex.

“Chaos” vs. Commercialization Engine

- “Chaos” – Sarcasm
  - Continued funding to concepts that are techno-economically challenged from the get-go
  - Misalignment between players (Industry-Gov’t-Academia-VC-s)
  - Immense amounts of various solutions none of which work alone, BUT
  - Components of concepts are great (e.g., a unique hydrolysis reactor design)
- Commercialization Engine
  - Support the full-alignment of players (better word: stakeholders), TO
  - Cut through chaos and organize options → identify hybrid biorefineries that actually work (!)
  - HOW?

Getting back to STEP-2, Example

- BC Hydro – Energy Engineers (EE) program,
  - We need to minimize energy use → higher efficiency
  - We need to eliminate wasteful processes
  - We need to switch energy sources to greener versions (gas -> electricity)
- Let's support industry directly with subsidies on hiring and employing EE's (!!!) → great use of $ with very much tangible returns.
- Similar program for Biorefinery Engineers?

PROPER STEP-2: COMMERCIALIZATION ENGINE (!)

- Great news → less expensive than demonstration of any/all biorefinery concepts!
  - Inexpensive but MASSIVE undertaking (!)
- Consortium of experts first evaluating the Biorefinery Landscape, THEN
- Generate hybrid concepts, specific for Quesnel's resources

1. Few industry experts needed with time and $ resource (Local Forestry, Lumber, Eng. Wood Industry, Engineering Firms, Academia)
2. Top 1-2 solutions selected for +/- 50 % econ. evaluation and shared with Government, First Nations etc.
3. Top 1 selected → TEA must work (!) (UPM example)

RECAP

- It is paramount to do a proper evaluation of the biorefinery concept landscape and generate hybrid concepts for Quesnel, so a supply-chain consortium has clear line of sight on execution through the “valley of death”.
- Gov’t could support local industry, research centers, investors and academia in forming a “commercialization engine” that in turn can deliver the proper hybrid concepts, including initial TEA.
- MUST HAVE: The commercialization engine needs the right experts with many years of industry expertise (BC HYDRO, UPM success).
  - NOT a pitch to hire me, there is a very limited number of industry experts willing to pay attention to this, next to day-to-day…

Thank you!

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