

# La Tuque project:

*a strategy for stakeholders issues considerations.*

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*Director Economic and Forestry*

*Development, La Tuque*



# Outline

- ➡ The project context, background, and summary
- ➡ The main challenges:
  - ▶ Supply, logistics, technologies, economics, risk mitigation, sustainability, social acceptability, ....  
.... a “man to the moon” type of project...
- ➡ Proposed approaches for “no compromise” strategy solutions
  - ▶ From project vision to a feasible, realistic project.

# The Canadian landscape for biofuels

## *Reducing the national GHG emissions profile*

- ➡ Policy for a significant reduction of GHG + demand for “non-food” bio-renewable fuels
- ➡ Canada’s pulp&paper industry is already the largest generator of bioenergy → integrate biomass supply chain with forest industry operations
- ➡ Longer-term integration of biofuels into national fuel infrastructure is challenging, but...
  - ▶ Significant opportunities are in reach
    - Residues are available: long-term security of supplies to attract investments + incentives to attract project investors
  - ▶ Pull from industry players is becoming compelling
    - Bio-jet fuels ICAO (*International Civil Aviation Organization*) - Air Canada, Westjet, SkyNRG, GARDN...
    - RNG – Canadian Gas Association
    - Diesel – BioÉnergie La Tuque

# Quebec positioning

## Energy-wise

➤ Quebec energy demand (2014)

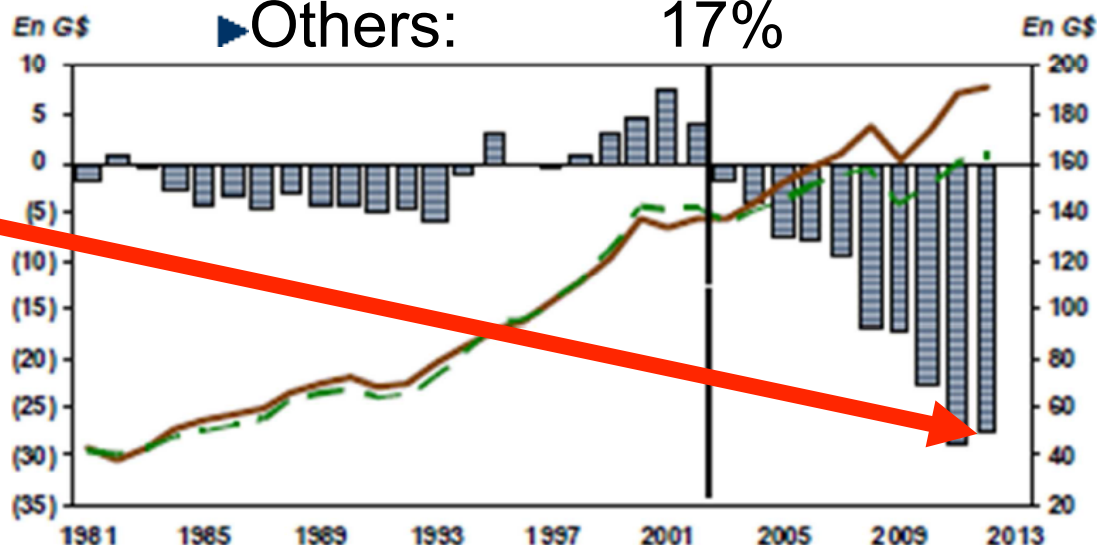
- ▶ 563 TWh
- ▶ 56% imported
- ▶ Value: 16 G\$

➤ Commercial deficit (trade balance)

- ▶ **-29.8 G\$** (2012)
- ▶ 54% due to energy import!

➤ Quebec energy supply (2014)

- ▶ Hydro: 34%
- ▶ Biomass: 8%
- ▶ **Petroleum: 41%**
- ▶ Others: 17%



## Quebec new 2030 energy policy

➡ The government has adopted ambitious, demanding targets to be achieved by 2030

❶ **ENHANCE** energy efficiency by 15%

❷ **REDUCE** by 40% the amount of petroleum products consumed

❸ **ELIMINATE** the use of thermal coal

❹ **INCREASE** by 25% overall renewable energy output

❺ **INCREASE** by 50% bioenergy production

# Strategy

## *Basic-simple model*

- ➡ Start with **ONE** product: ➡ renewable fuels
  - ▶ Actually it is more a range/category of products (diesel, gasoline, light fuels, ....) due to process
- ➡ **FOCUS, FOCUS, FOCUS....** and maintain focus
  - ▶ Various proposals for “add-on chemicals” to optimise economics
- ➡ **“DO IT RIGHT”**: ➡ learn from past-failures
  - ▶ Still an essential part of the challenge
- ➡ **“MAKE MONEY”**: ➡ risk management issues
- ➡ **“MAKE NO COMPROMISE”** on **ECONOMY** (risk management) and **ENVIRONMENT** (sustainability/social acceptability)
  - ▶ Diversify (if need be) but only at a later stage

# Vision La Tuque 2023-2025

## *Objective*

- ➡ To exploit/valorize the forest residues from harvesting of forest area 04 in Mauricie through the implementation of a large scale biorefinery

### ☑ First of the type in Canada

- ▶ No trees cut for energy feedstock (NGO issues)
- ▶ **Product:** “drop-in” quality (bio) renewable diesel **and/** **or** jet fuel
- ▶ **Agenda:** demonstration plant decision by end 2018 and commercial plant by 2023-2025 (!).
- ▶ **La Tuque:** 15,000 inhabitants but slightly larger than Belgium (30 528 km<sup>2</sup>)....

### ☑ Second most productive forest in Quebec

### ☑ Forest harvest residues unused !

# BioÉnergie La Tuque

*First Canadian forest residues-based refinery*

## ➡ Capacity:

- ▶ Feedstock: forest residues 1.2MT/year\*
- ▶ Production: **210 ML/year** “drop-in” renewable diesel\*\*
- ▶ Displaces **4.3 %** of Quebec transport diesel consumption.
- ▶ **233 MW** renewable diesel from 350 MW wood feedstock
- ▶ CO<sub>2</sub> reduction **0.575 MT/y**
- ▶ Vehicles off the road: **143,750/y**
- ➡ Capital investment: **≈1 G\$**
- ➡ CO<sub>2</sub> capital cost index\*\*\*: **70 \$/T CO<sub>2</sub>**
- ➡ Jobs created: **490**

\* Green Metric Tons at 40-50 % humidity

\*\* Bio-jet fuel considered – gasoline (by-product)

\*\*\* Calculated from capital invested and 25 years amortising





## Regional assets

### *Winning conditions 1/2*

- ➡ Strong **OVERALL** motivation & support
  - ▶ Project is on **TOP LIST** of both Quebec and federal governments agenda
  - ▶ Fully aligned with new Quebec 2030 energy policy
  - ▶ Strong business & community support
  - ▶ Committed partners
  - ▶ Already good social acceptability, including Atikamekw (First Nations)
- ➡ **A-team** secured for in-depth, due diligence techno-economic evaluation
- ➡ No competition for forest harvest residues
  - ▶ New Quebec policy will increase the available biomass level in area 04 significantly

## Regional assets

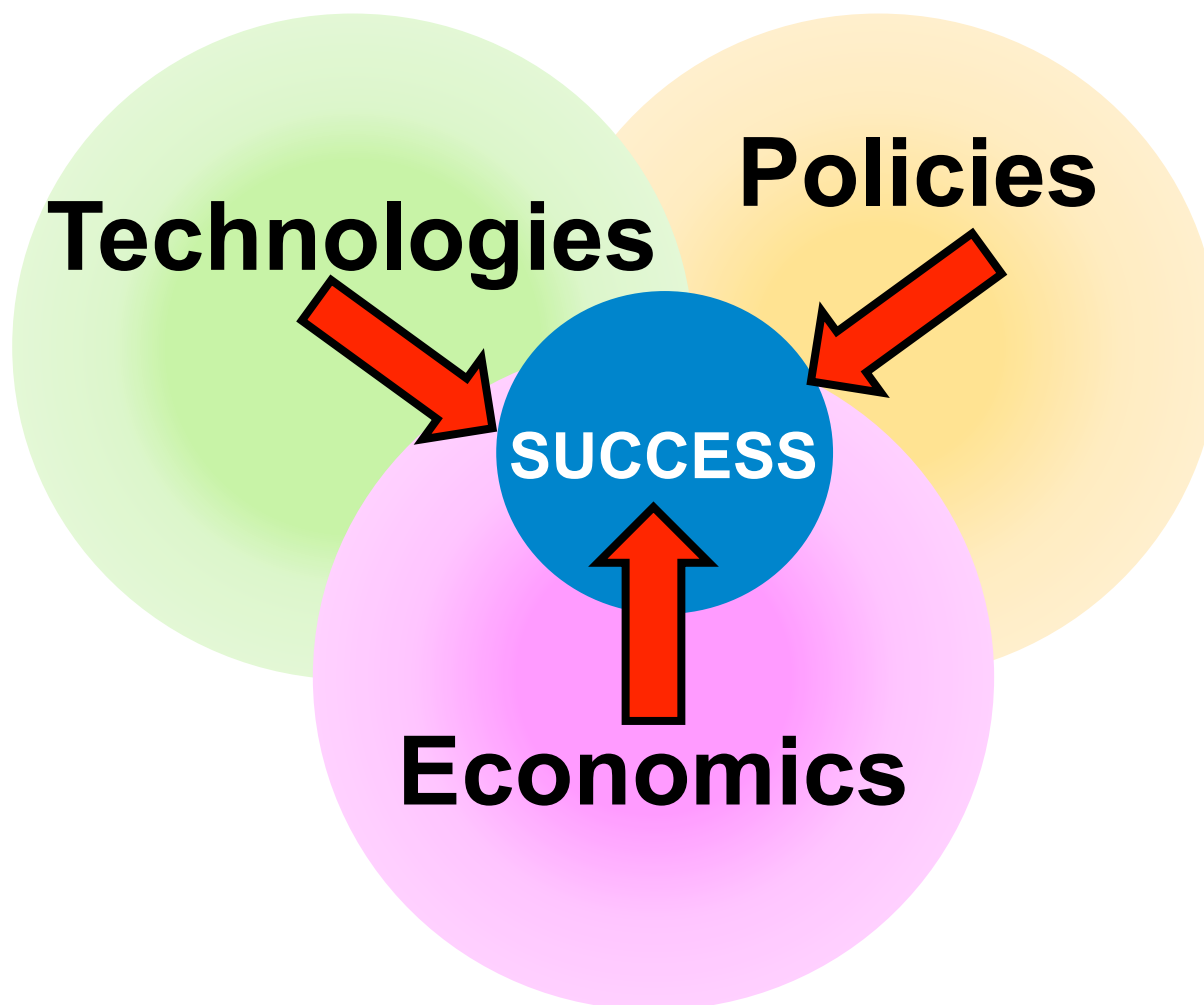
### *Winning conditions 2/2*

- ➡ Significant heritage bark landfill for 20 years (430 T/day)
- ➡ Reserved location for biorefinery: Vallières site
- ➡ 30 000 km of forest roads with no load restriction
- ➡ Natural gas station nearby (hydrogen)
- ➡ Railway across territory, down to Trois-Rivières (south of La Tuque, 160 km)
- ➡ Trois-Rivières commercial harbour has all facilities and storage capacity
- ➡ Validated implementation agenda

**☑ Project implemented by BioÉnergie LaTuque (BELT) as the sole and main promotor.**

# Challenges & Issues

*Pathways to success*



# Techno-politico-economic questions

*Locate main stakeholders...*

## ➡ Technologies (related to)

- ▶ Supply
- ▶ Process
- ▶ Products

## ➡ Economics (related to)

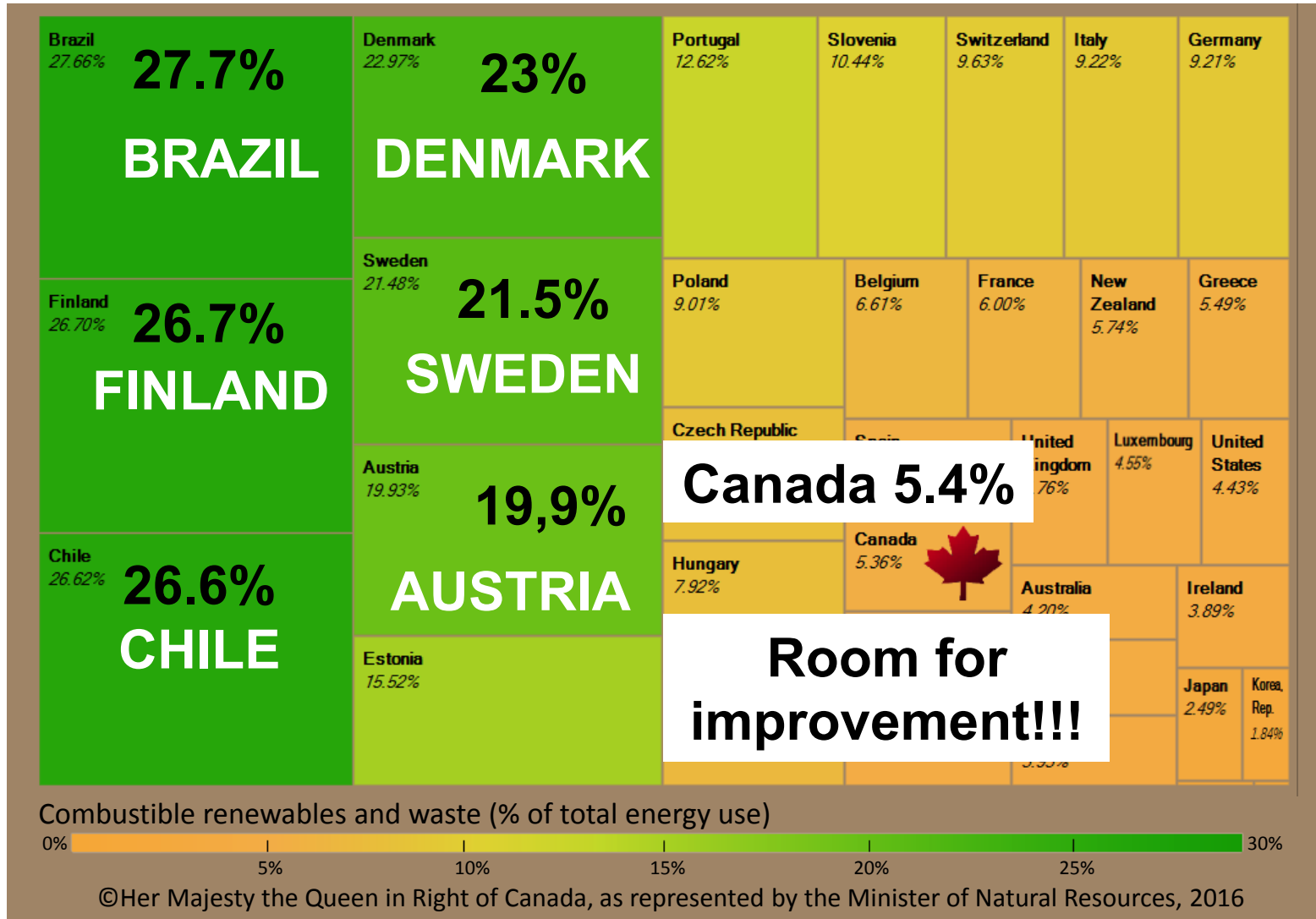
- ▶ Supply
- ▶ Process
- ▶ Products (markets)
- ▶ Distribution
- ▶ CAPEX and OPEX

## ➡ Policies (politics?)

- ▶ “New industry sector”
- ▶ Legislation/regulations
  - Mandate
  - Carbon tax, credits, standards,....
  - Environment (sustainability, carbon/water footprint, etc...)
- ▶ Social acceptability
- ▶ Provincial vs national vs international positioning

# On the potential issue

## *Canada bioenergy positioning*



Courtesy of Marzouk Benali, CanMetEnergy - NRCan

# Project implemented in 4 Phases

*Thru a comprehensive no compromise approach*

➡ **Phase 1 main objective** is to perform an in-depth thorough evaluation thru 12 studies by A-team from top level organizations...

- ① Supply logistics, integration of forest residues harvesting to standard forest operations;
- ② Energy densification strategies to reduce biomass mill delivered costs, including CAPEX/OPEX;
- ③ Analysis of markets (e.g. P.E.T. Dorval airport), regulations, diesel type (e.g. jet fuel versus road transport) and quality/standards (e.g. ASTM,...) to define process manufacturing lines.
- ④ Techno-economic evaluation and screening of technology process lines to produce “drop-in” high quality diesels.

☑ **Selection of top 3 most promising, risk-free, process lines.**

# Implementing a “no compromise” approach

## *Due diligence – PHASE TWO*

- ➡ **Phase 2** consists of a **thorough technology assessment** or first level due technology diligence of the 3 pre-selected process lines for **final selection of demonstration plant design**.
- ➡ **Phase 2 objective** is two-fold:
  - ➊ Obtaining a design level 30 proposal for the demonstration refinery that constitutes Phase 3 of the La Tuque project by fall 2018.
  - ➋ Establishing a top level FPInnovations team with the necessary high level expertise to enable duplication of similar projects elsewhere in Canada.

# Implementing a “no compromise” approach: *PHASES THREE & FOUR*

## ➡ **Phase 3 objective: demonstration plant**

- ➊ Decision to go for a demonstration biorefinery plant
- ➋ Design level 10 proposal for the demonstration biorefinery.
- ➌ Built, commission, and operate.

## ➡ **Phase 4 objective: commercial plant**

- ➊ From data gathered in Phase 3 demonstration plant operation: decisions related to commercial plant investment
- ➋ Build, commission, and operate.



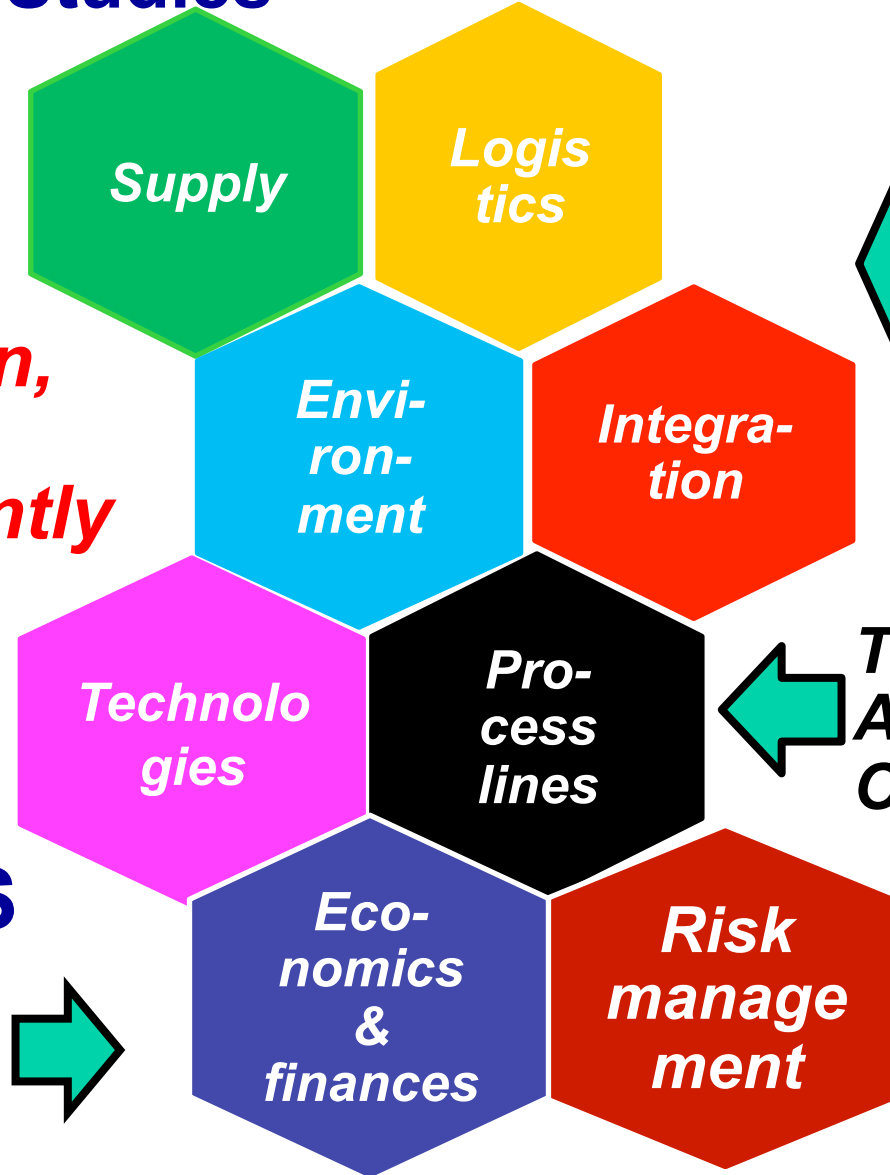
# Mandatory Studies

**Close  
integrated  
cooperation,  
performed  
concomitantly**

**for**

**SUCCESS**

**ECONOMICS**



**BIOMASS  
SUPPLY**

**TECHNOLOGIES  
ANALYSIS &  
OPTIMISATION**

# Team work...

*Selecting the A-team to ensure success!*

- ➡ BELT has succeeded in building a team of top recognized experts to develop and implement a world leading class forest biorefinery project.



Ressources naturelles  
Canada

Natural Resources  
Canada



# Selecting the A-team

*45 people*

20

Supply, logistics, environmental impact, social acceptability

FPInnovations – U. Laval – For@c – VTT  
+ Patrice Bergeron, SDÉF-BELT

25

Technologies, process selection, techno-economics, risk management

FPInnovations – CanmetENERGY – E.Polytechnique Montreal/UQTR  
+ Patrice Mangin, BELT/UQTR

# BELT Team Project Kick-Off Meeting

*La Tuque – September 6-8, 2016*



# Key Issues & Features

- ➡ **Solution pathway:** focus on “best available solution”
  - ▶ Supply of biomass to the refinery and process issues are here critical for economics
- ➡ **Addressing investors-banks criteria**
  - ▶ CAPEX-OPEX
  - ▶ Security of fibre supply: 25 years
  - ▶ Minimum mandate (long term) required
    - Credits (OK but not mandatory)
  - ▶ Based on use of residues: **fully sustainable**
  - ▶ Propose a “Bullet-proof solution”
    - **Does not yet exist BUT it is feasible to minimize and manage risk to acceptable levels.**



# Biomass issues

## *Quebec perspective*

- ➡ **Biomass** from saw mill operation **too expensive**: rate of loss too high, distances, operation costs,...
- ➡ Energy valorisation requests **long term supply security**, 25 years for high capital investments amortizing
  - ▶ Presently feasible with Quebec “forest regime; changes in regulations are presently tested before implementation
- ➡ Saw mill financial equilibrium linked to
  - ▶ a) US housing market,
  - ▶ b) Paper mills.... presently of high concern,
  - ▶ c) 6<sup>th</sup> Canada–United States softwood lumber dispute.
- ➡ Harvesting/logging operations: stumpage royalties to government on a m<sup>3</sup> basis ➡ need for a “cutting/logging” incentive but also a need for new customers

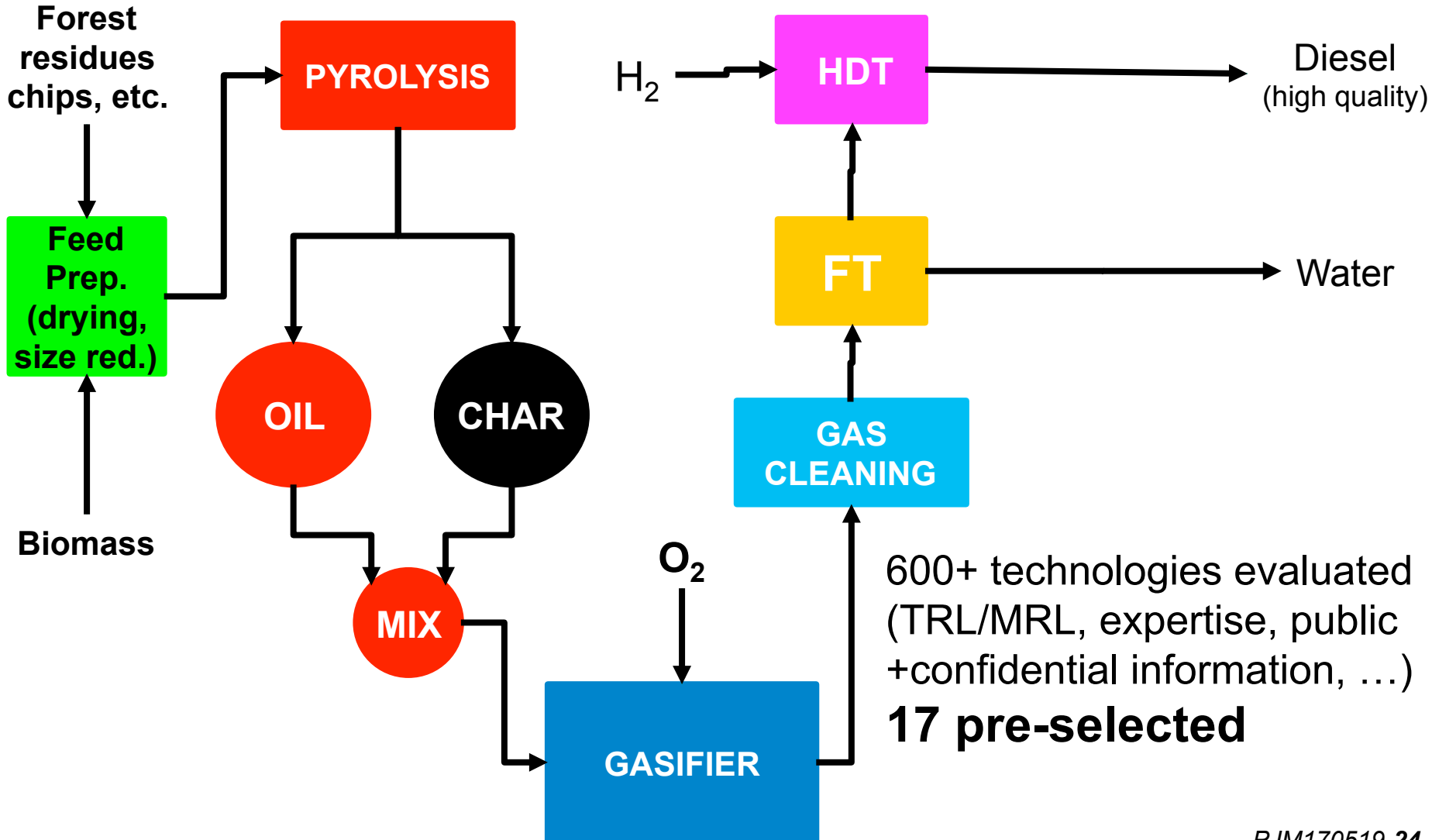
## Biomass challenges

- ➡ Reduce biomass supply cost delivered at mill: harvest, transport, and integration strategies,.... mainly.
- ➡ Pulp fibre supply in excess (drop in paper demand)
  - ▶ Energy system economy cannot pay traditional paper mills chip value (100-115\$/DMT)
- ➡ Ensure long term (25 years) security of supply; YES but
  - ▶ At a “reasonable (?)” cost (4-5\*\$/GJ)
- ➡ Due to integration needs, develop/propose an adequate share of costs/profits in integrated operation strategies
- ➡ Oil prices directly affect any biorefinery project...
  - ▶ Logging/harvesting operation costs + what user ready to pay
- ☑ **Think long term, GHG reduction, and carbon exchange market**

\*60-70\$/DMT (Dry Metric Ton)

# Technologies

*One of the “promising” standard process line*





# Demonstration plant challenge

## *Questions to answer (economics)*

- ➡ Actual required size
  - ▶ Private investors ➔ minimum size
  - ▶ Bankers ➔ at least 10% of commercial size
- ➡ Capital costs
  - ▶ Around 200 M\$ - amortizing?
- ➡ Operation costs
  - ▶ NO “break-even” operation potential
- ➡ Integration in commercial plant (or not?)
  - ▶ Demo plant disposal issue
- ➡ Solving bottlenecks and/or technology gaps.
  - ▶ Long term operating conditions – Mill overall operating efficiency

# On the economics

**Technology  
development plant  
BioTFuel-Dunkerque,  
France – 15 MW  
Cost ~ 190 M\$**

**Gasifier– 15 MW**

**Fischer-Tropsch**

**Syngas  
cleaning**

**LT demo plant  
30-60 MW ?**



**LT commercial plant  
600-700 MW**

**Biomass feed and size  
reduction  
3 storage silos**

# Regulations – mandates

## *Transport (renewable fuels)*



**EU**

- **10% in 2020**  
**(mandatory)**



**Finland**

- **10% today**
- **20% in 2020**
- **40% target in 2030!**



**France**

- 15% target in transport by 2030
- E10 available in 40% of gas stations
- E85 available



**Germany**

- 6% GHG reduction by 2020



**India**

- 20% target in 2017



**USA**

- RFS: 16 bn gallons 2G EtOH
- Low Carbon Fuel Standard (CA)
- Clean Fuels Program (OR)

### 3 MEGA PROJECTS

- ✓ Kaidi (China) 1,6 G\$ (announced)
- ✓ Kemijärvi (China) 1,15 G\$ (announced)
- ✓ Metsä, Äänekoski 1,75 G\$ (on-going)



**China**

- 15% in 2020



# Need for provincial mandate

*Essential !!!!*

- ➔ **Legislation:** a mandate is a key way to create a market to attract investors; presently renewable diesels cannot compete on markets; could be a “bridging scenario”.

**No Quebec  
mandate**



4  
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# Conclusions

1/2

- ➡ Quebec forest are mainly government owned, harvest rights allocated 25 years, residues remain government property ➔ **biomass supply long-term guaranteed!**
- ➡ Government harvest policy is being modified to favour the development of the bioenergy sector.
  - ▶ Studies objective of **4-5 \$Can/GJ target is quite feasible** and could reach the 4\$/GJ. **Very competitive.**

➡ **Required mandate: minimum 5% (2017) with a 10% target (2020) or better mandate before 2030**

- ➡ Alignment of all parties (stakeholders) is attained (but for **Quebec mandate**): industry, federal, and provincial governments, policy makers, and research organizations  
➔ **success probability ↗**

# Conclusions

2/2

- ➡ The project is structured for replication in Canada to maximize impact on Canadian (bio)economy.
- ➡ There will be **no compromise** on
  - ▶ a) economic risk,
  - ▶ b) environmental impact (all “recognised” aspects), and
  - ▶ c) social acceptance.
- ➡ **NO** set mind for technology-process line solution
  - ▶ Best technology solution not necessarily equivalent to lower techno-economic risk solution
    - **NO** technology can provide **THE** answer if studied **SEPARATELY**
    - Constant need to always go back and think, re-think, and re-think the whole process line, project steps, projects assets and facets.

# Last point on stakeholders...



## ATIKAMEKW NATION supports BELT project March 1, 2017

**Sitting: P. Mangin, BELT, C. Awashish, Atikamekw Nation Council Great Chief (CNA) – Standing: P. Boucher, consultant (CNA), D. Boivin, Grand Chief political advisor (CNA); D. Bouchard, general director (CNA); P. Bergeron, BELT; F. Fournier, FPInnovations.**





RÉSEAU  
**BIOFUELNET**  
CANADA



**NESTE**



Ressources naturelles  
Canada

Natural Resources  
Canada

Énergie et Ressources  
naturelles





# Economics & competitiveness

*think energy value...*

## Market value (\$Can/GJ)

Wood Pellets	10,7 \$
Diesel (Canada)	28,7 \$
Diesel (EU)	45,8 \$
Pyrolytic oil (EU)	13-17 \$
Crude Oil WTI	12,02 \$
Crude Oil Brent	12,69 \$
Natural Gas (Alberta)	2,50 \$

} At the pump!

← Nothing can compete...

## Forest residues

FOEX (March, 2017)	7,5 \$
3 studies	4,4-5,0 \$
PJ Mangin study - 2012 (3-5 mm, 10% Humidity)	4,8 \$

4-5 \$/GJ →  
60-70 \$/DMT