The BELT Biorefinery project

The first Canadian renewable fuels biorefinery challenges and solutions .

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Outline

- Project conception and summary
  - Project context and background
  - Values: “no-compromise” strategy
- Main challenges
  - A “man to the moon” type of project: supply, logistics, technologies, economics, risk mitigation, social acceptability, ….
  - Approach & business model
- Status: from vision to a concrete/achievable project.

BELT - Vision 2023

Objective

- To 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 commercial trees cut for energy feedstock
- **Product:** "drop-in" quality (bio) renewable diesel **and/or** jet fuel
- **Agenda:** commissioning of commercial plant by 2023.
- **La Tuque:** site selected - facilities - strategic location (30 528 km² but only 15,000 inhabitants – historical Atikamekw territory)

☑ **Second most productive forest in Quebec**

☑ **Forest harvest residues unused !**

BioÉnergie La Tuque

First Canadian forest residues-based refinery

- **Capacity:**
  - Feedstock: forest residues 700,000 T (o.d.)/year
  - Production: **200+ ML/year** “drop-in” renewable fuel
  - Displaces ~ **5 %** of Quebec transport diesel consumption.
  - 470 MW bois ⇨ 290 MW diesel
  - CO_2 reduction **0.575 MT/y**
  - Vehicles off the road: **143,750/y**
- Capital investment: ≈ **1 G$**
- CO_2 capital cost index*: **70 $/T CO_2**
- Jobs created: **490**

*Calculated from capital invested and 25 years amortising

Project vision

A short history of a long pregnancy

- ***Fall 2009***: FPInnovations forest residues report
  - 650,000 Green Metric Tons/year opportunity of unused biomass
  - Forest landscape deteriorated as most biomass left on sites
  - " Let's do something with it…." (original idea)
- ***April 2010***: first presentation to La Tuque city council
  - Large (1 B$) innovative biorefinery project presented as a step-by-step long-term project.
  - Evaluation of about 30 "projects" implied a 15 years agenda from idea concept to mill commissioning…. brings us to 2024-2025….
- ***March 2011***: 1st trade mission to Scandinavia
  - Finland-Sweden reputation as "leaders" in the field
  - Federal sponsored trade mission helped to validate concept
- ***2013-2015***: evaluation of key technology & R&D providers
  - Meetings/visits - first pre-feasibility calculations

Natural Resources Canada | Ressources naturelles Canada

Forest Biomass Harvesting: Best Practices and Ecological Issues in the Canadian Boreal Forest

Evelyne Thiffault

Amélie St-Laurent Samuel

Rut Serra

Natural Resources Canada – Canadian Forest Service

Nature Québec

Fédération québécoise des coopératives forestières

Fédération québécoise des coopératives forestières

Nature Québec

Source: http://publications.gc.ca/collections/collection_2015/rncan-nrcan/Fo114-16-2015-eng.pdf

Project vision

A short history of a long pregnancy

- ***Dec. 2014***: Bioeconomy-Bioenergy (BEE) UQTR chair
- ***Feb. 2015***: BioEnergy La Tuque (BELT)
- ***May 2016***: FPInnovations as BELT key partner
- ***Sept. 2016***: A-team kick-off meeting of studies
- ***Sept. 2016***: Quebec government initial financial support (1.5 M$) for feasibility studies
- ***Jan. 2017***: Neste Corporation announced as partner
- ***March 2017***: Atikamekw Nation supports BELT project
  - August 2017: Atikamekw Nation representative joins BELT Board
- ***Jan. 2018:*** BELT headquarters moved to Wemotaci (Atikamekw territory)

BELT Values

Based on a "no compromise" strategy….

- BELT adheres to a **no compromise** implementation of project on
  - a) economic risk,
  - b) environmental impact, and
  - c) social acceptance.
- **(a)-(b) implies NO** set mind for technology-process line solution from an economic stand-point
  - Best technology solution not necessarily equivalent to lower techno-economic risk solution
    - We learned that **NO** technology will provide **THE BEST** solution if considered **SEPARATELY**
    - Obligation to continuously re-think and evaluate the whole process steps and progress.
- **(c) to gain**/secure people support for success.

The Canadian landscape for biofuels

Reducing the national GHG emissions profile

- Policy for a significant reduction of GHG
  - Plus demand for “non-food” bio-renewable fuels
- Canada’s pulp&paper industry is already the largest generator of bioenergy ⇨ integrate biomass harvest with forest industry operations
- Longer-term integration of biofuels into national fuel infrastructure is challenging, but significant opportunities are in reach
  - Long term biomass supply security may be guaranteed to attract investments
  - Pull from industry players is becoming compelling
    - Bio-jet fuels ICAO (*International Civil Aviation Organization*) Air Canada, Westjet, SkyNRG, GARDN…
    - New policies – legislations to be implemented in the near future (RFS2/LCFS type)

Agreement, alignment, and support

Requires constant attention

- Promotors often place too much focus on techno-economics while missing the "support-social acceptability" part of such innovative projects. **New translates in "public concerns".**
- Strong **OVERALL** motivation & support should be obtained: it is long, hard but valuable work. One should not underestimate the power of people and media
  - Project is now on **TOP LIST** of both Quebec and federal governments agenda (2018 recent quotes)
  - Frank Desrosiers, assistant deputy minister for energy at Natural Resources Canada: "*BELT project is one of our two top priority projects [in the field]*"
  - Honorable J. G. Carr, Natural Resources Minister: "*This is a project for the future of our children*"

Agreement, alignment, and support

Requires constant attention

- Project is fully aligned with new Quebec 2030 energy policy
  - We made sure that not only business community and City of La Tuque support the project but also La Tuque community and up to the whole of Quebec.
    - Regular updates to the La Tuque City Council
  - Including the Atikamekw Nation early on in the process was essential
    - New Canadian policy (under work) will make such approach practically mandatory
  - Social acceptability (SA) already good
    - Quebec white book on social acceptability
    - SA needs to be “verified” ⇨ independent evaluation
    - SA needs constant work to avoid “activists-placards syndrome” (for governments)

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

Quebec 2030 Energy Policy

Social acceptability in the host community

- "The legal framework that the government is proposing will offer an undeniable advantage from the standpoint of the social acceptability of projects in the host communities since it will explicitly reflect the values and principles of transparency, fairness (polluter pays), precaution, prevention and address that Quebecers cherish.
- It will focus both on human facets, the safety and health of workers and communities and the economic aspects of the projects."

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.

Canadian benefits

Why Quebec/Canada supports the project

- Developing and implementing the bioenergy of the emerging forest-based bio-economy relates to new policies
- Bioenergy will provide significant contribution to the transformation of the forest products industry
- The BELT project should position Quebec/Canada as world leaders in the renewable fuels economy
  - Attracts important capital investments
  - Create wealth and jobs
- Considerable contribution to climate change mitigation (federal CleanTech-Quebec Energy Transition/TEQ)
  - Reduction of fossils fuels consumption
  - Impact on trade balance (Quebec)

Challenges DO remain…

CAPEX and OPEX: the real issues

Long-term security of supply at low cost

Complex biomass supply & logistics chains

Lack of mandatory renewable fuels content

Techno-economics, competitiveness, and risk management

Approach for solutions

Implementation of a comprehensive project

☑ Project executed in Phases

- **Phase 1 main objective** is to obtain an in-depth thorough feasibility evaluation
  - A-team from top level organizations - 50 experts focusing on all project facets to obtain a first reliable level of techno-economics of selected process lines.
- **Phase 2 focuses** on screening technology process lines to produce “drop-in” high quality diesels.

☑ **Result: selection of top 3 most promising, risk-free (mitigated), process lines.**

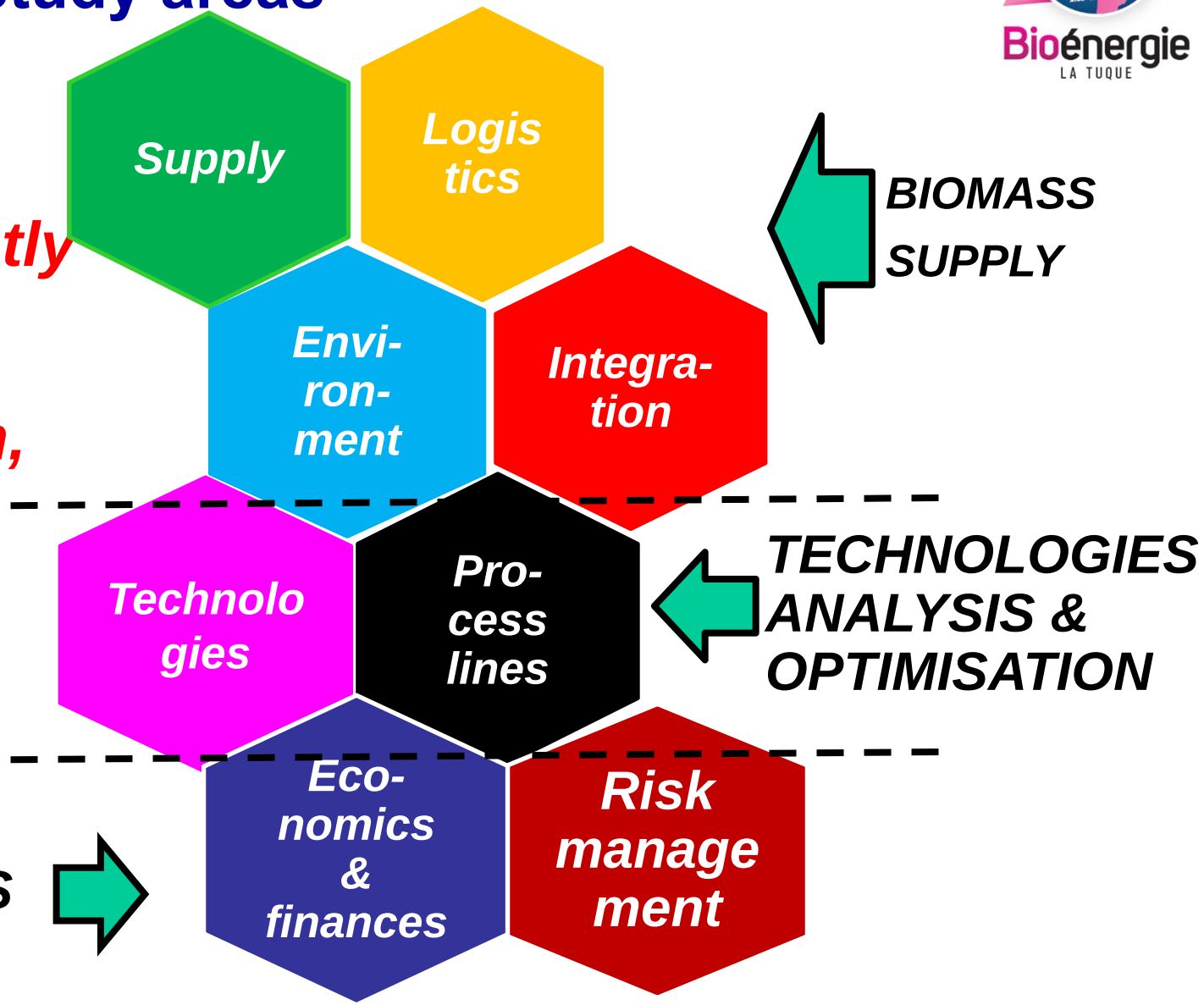
- **Phase 3 objective** is the due technology diligence and Level IV economic **assessment** of the 3 pre-selected process lines for **final selection by investor(s).**

Feasibility study areas

12 studies performed concomitantly in close integrated cooperation,

focusing on

PROJECT SUCCESS



Studies

Logistics - Supply

FPI
E1-E2-E3-E4

E1 *Biomass availability*
E2 *Forest operation integration (3 scenarios)*
E3 *CAPEX/OPEX from 3 scenarios*
E4 *Integration of environmental impact assessment* (from study E12)

VTT
E5-E6-E7

E5 *Methodology validation (E1-E2-E4)*
E6 *Energy densification strategies*
E7 *In-situ densification feasibility evaluation*

Studies

Integration-Environment

For@c
E8

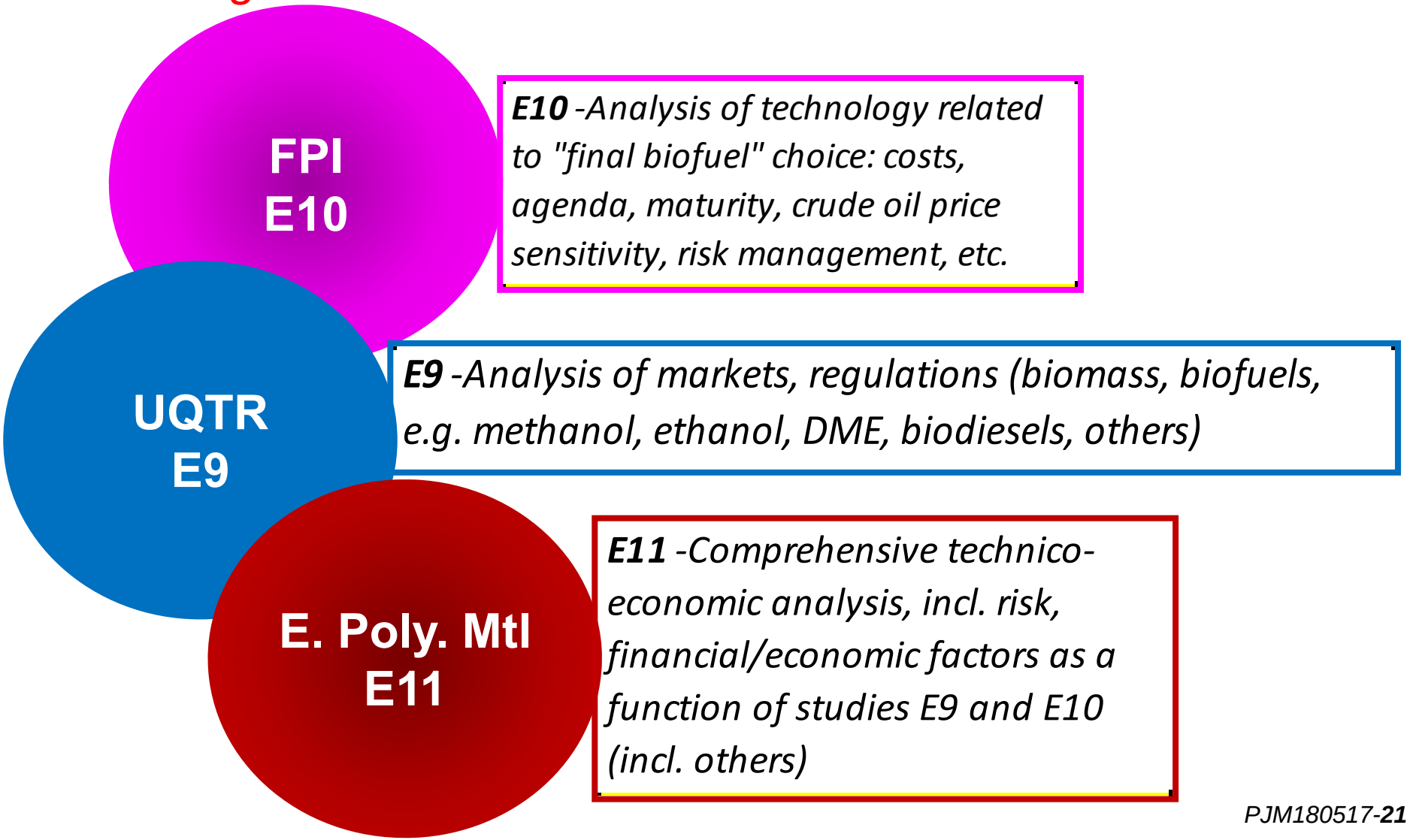
E8 *– Analysis of collaborative/integrated scenarios among operators (collaborative logistics, so-called M. Ronnqvist Swedish model, value chain management, and modelling)*

U.Laval
E12

E12 *– Environmental impact, including biodiversity, area/soil sensitivity to biomass harvesting,* ***<u>and social acceptability</u>***

Studies

Technologies-techno-economics-processes- risk management



***E10** -Analysis of technology related to "final biofuel" choice: costs, agenda, maturity, crude oil price sensitivity, risk management, etc.*

***E9** -Analysis of markets, regulations (biomass, biofuels, e.g. methanol, ethanol, DME, biodiesels, others)*

***E11** -Comprehensive technico-economic analysis, incl. risk, financial/economic factors as a function of studies E9 and E10 (incl. others)*

BELT Project Kick-Off Meeting

La Tuque – September, 2016

Some of the involved experts !

Key Issues & Features

- Project supports national and provincial carbon positioning with huge socio-economic potential
- Supply challenge #1 large volumes on large areas & #2 cost/ton mill delivered
- Choice of best technology from risk management and mitigation and sound economics
- Mandates for inclusion of biofuels to secure markets
  - Implies true open market competition without incentive needs (in theory)
- Large social and economic impact
  - Jobs – formation – region attractiveness - investments
  - Strengthening regional industrial infrastructure

Regulations – mandates

Transport (renewable fuels)

EU

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

USA

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

Finland

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

3 MEGA PROJECTS

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

France

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

Germany

- 6% GHG reduction by 2020

China

- 15% in 2020

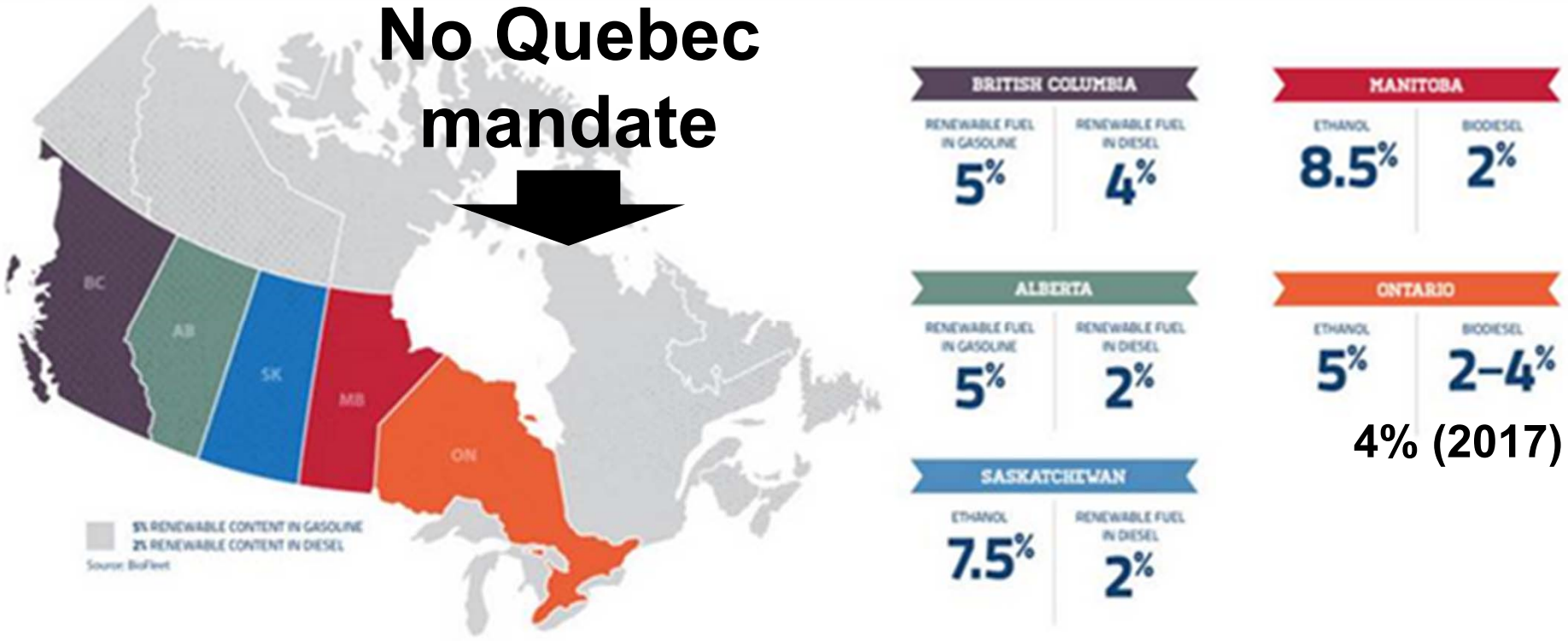
India

- 20% target in 2017

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.



Source : How harmonized regulations would improve the biofuel blending system , Canadian Fuels Association, Jan 28, 2016

Progress and status

Biomass supply chain

- Quebec forest are mainly government owned, harvest rights allocated for 5 years (X4), for a total of 25 years, residues remain government property ➔ **biomass supply is guaranteed for 25 years.**
  - Government harvest policy modified (?) to favour the development of the bioenergy sector.
  - Studies concluded that **4-5 $Can/GJ target is realistic**
    - Studies to reach the 4$/GJ with environmental conformity
    - **Very competitive** vs 7.5$/GJ in Europe.
- **5% mandate by 2019 with 10% target for 2030**
  - *Mandate obtained, target still in negotiation.*
- La Tuque secured as **BEST LOCATION** (reduced CAPEX/OPEX: services, low cost supply and logistics).

Progress and status

Technologies & (some) economics

- 700+ technology providers were evaluated using various criteria such as Technology Readiness Levels, Market Readiness Levels, firm reliability, markets, experience, existence of pilot, demo, or commercial, etc.
  - Mainly based on public and open literature information
  - 12 technologies were selected plus 6 on a “watch list”
- 9 process lines were developed based on selected technologies and using company information (NDA)
  - Criteria for process line selection have been established (confidential due to market implications)
  - Average CAPEX for BELT refinery is 1.1 B$ (± 22%) thus confirming initial (2015) evaluation

From vision to implementation

- Alignment of all parties (governments, industry & various stakeholders) attained : → **success probability ↗**
- A-team → **success probability ↗**
- Cooperation → **success probability ↗**
- Considering social acceptability as a project asset → **success probability ↗**
- Atikamekw Nation support → **success probability ↗**
- In conclusion, although not that obvious at project inception from governments and investors stand-points, the **no compromise approach** based on a university chair looking for regional bioeconomy/bioenergy development was not so foolish after all.

FPInnovations

Atikamekw Sipi

NESTE

B.E.L.T La Tuque Bioénergie LA TUQUE

POLYTECHNIQUE MONTRÉAL
LE GÉNIE EN PREMIÈRE CLASSE

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Association québécoise de la production d'énergie renouvelable

UQTR
Université du Québec à Trois-Rivières

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