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## Project Liverpool pre-feasibility assessment

*Summary of the independent study conducted by AFRY Management Consulting*

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## 1 Assignment

AFRY Management Consulting Inc. ("AFRY", "we", "our" or "us") was engaged by Northern Pulp Nova Scotia ("NPNS") to conduct an independent assessment of the viability of the Liverpool NBSK pulp project ("the Project", "the Liverpool Project" or "Liverpool"). AFRY was tasked to review the critical success factors for the Project:

- The market dynamics and competitiveness of the Project;
- The key design criteria and capital cost ("CAPEX") estimate for the Project;
- The incentives and financial model.

The assignment was carried out in August-November 2024. AFRY's final report was issued on November 12<sup>th</sup>, 2024. This Report is a summary of the work performed by AFRY and our conclusions on the viability of the Liverpool Project.

## 2 Qualifications

Jose Gonzalez and Vincent Leon prepared this Report as independent experts, with assistance from other AFRY employees operating under their direction. Jose Gonzalez acted as project supervisor and Vincent Leon acted as project manager for AFRY's engagement. Jose Gonzalez is a Director at AFRY and Vincent Leon a Principal at AFRY, with respectively 25 and over 15 years of consulting experience dedicated to the wood products, pulp and paper industries in North America.

## 3 Terms of reference

AFRY's assessment was based strictly on the techno-economic feasibility of the Project and did not consider environmental, societal and broader economic impacts. It was assumed that the Project would have access to adequate water supply and other required infrastructure to operate a modern pulp mill.

## 4 Executive summary

The Liverpool Project capacity, 700,000 tons p.a., is a balance between the available wood resources in Nova Scotia and the critical scale needed to be competitive on the pulp markets. Conventional revenue from selling pulp and generating electricity is not sufficient to ensure the viability of greenfield pulp mills in North America. Initial modelling for Liverpool capped IRR below 6% for the conventional pulp mill concept.

Instead, the Liverpool Project would need to monetize the full value of fibre and become a state-of-the-art biorefinery producing pulp, electricity, biochemical by-products and capture carbon. Total CAPEX for the biorefinery was estimated around CAD 3.7 billion. With conventional and innovative revenue streams as well as Federal and Provincial investment tax credits, the Liverpool Project could reach up to 11% IRR.

Such a biorefinery concept would be unprecedented in North America and carry relatively high commercial and operational first-of-a-kind risks that call for an elevated IRR target. Based on commercially reasonable assumptions, AFRY found that the IRR for a new pulp mill in Liverpool, NS, does not meet or exceed 14%.

Furthermore, recent developments in global pulp markets point to a prolonged downcycle risk that would make the assumed selling price in the financial model unattainable, at least for the first years after the potential commissioning.

## 5 Key project attributes

As part of the settlement agreement with the Province of Nova Scotia, NPNS was mandated to conduct a feasibility study for a potential new kraft pulp mill in Queens County, in the vicinity of the former Bowater mill. The Project would have a capacity of 600,000 tons per year and produce NBSK pulp, mostly for export markets. Some variations were considered to improve the cost competitiveness of the Project and increase and diversify the revenue.

### 5.1 Increased capacity

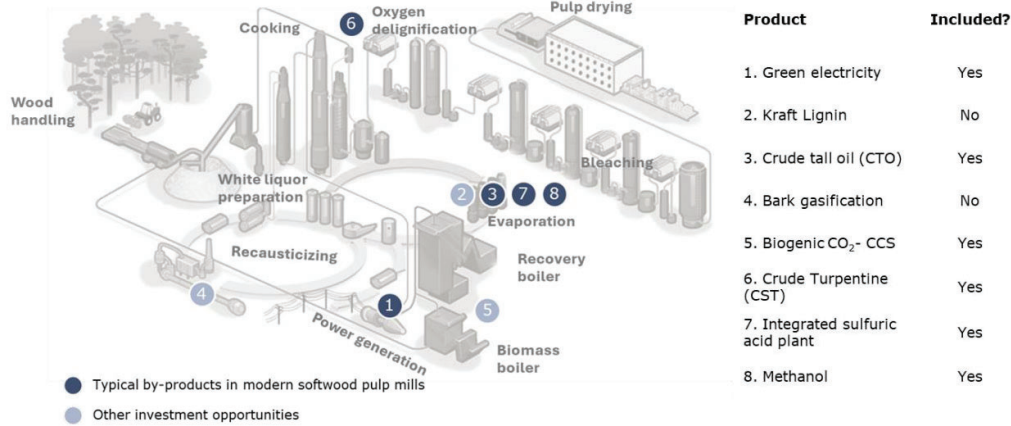
Preliminary modelling indicated that, at 600,000 tons per year, the initial capacity for the pulp mill was not optimal. Economies of scale are a strong vector of cost advantage, and increasing project capacity only marginally increases the investment costs. It was decided to set the new Project capacity at 700,000 tons per year by mobilizing all the softwood resources available in Nova Scotia and complementing the fibre mix with hardwood. While the initial concept was to produce 100% NBSK pulp (softwood pulp), the product mix with the increased capacity became 70% NBSK and 30% NBHK (hardwood pulp).

### 5.2 Revenue diversification

The Liverpool Project was initially conceived as a “conventional” pulp mill, generating revenue from selling pulp, excess electricity and by-product chemicals such as CTO and Turpentine. Preliminary versions of the financial model indicated that the Project would not be viable as a conventional pulp mill: the IRR was capped below 6%.

As a result, the Liverpool Project evolved into a biorefinery concept, combining conventional revenue streams, producing other biochemicals and, most importantly, capturing carbon emissions and selling carbon credits. There are a few examples of biorefineries (i.e., pulp mills generating a high share of revenue outside of selling pulp). Metsä in Kemi, Finland, for instance, has a diversified revenue portfolio and is reportedly considering adding carbon capture. Ence, a Spanish pulp producer, refers to its pulp mills as “biofactories” to account for their diversified revenue profile and adherence to sustainability principles. Yet, the full biorefinery concept, as conceived for the Liverpool Project, has not been implemented yet. The Project would be first-of-a-kind for Canada and the rest of the world.

The techno-economic analysis for the carbon capture concept can be only considered as very preliminary. AFRY developed a high-level outline for the technical concept, investment estimate and net revenue projection. Further diligence would be required to confirm the preliminary views developed in AFRY’s report.

**Figure 1: Summary of by-product opportunities for the Project**


Source: AFRY Management Consulting

## 6 Pulp market overview

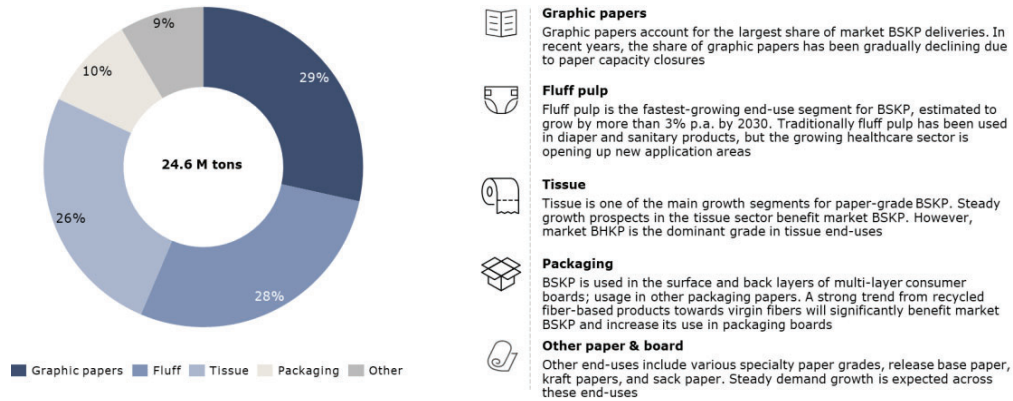
### 6.1 Demand size and main applications

Virgin pulp is a global commodity product. The market is subdivided into categories based on the fibre type and product attributes. Four main categories can be identified:

- Bleached Softwood Kraft pulp, referred to as BSKP or NBSK (Northern Bleached Softwood Kraft) depending on the location of the mills and the fibre species they use;
- Fluff pulp, which is a subsegment of BSKP mostly produced in the Southern U.S. and is used to manufacture hygiene products;
- Unbleached Kraft (softwood) Pulp referred to as UKP; mostly used to produce packaging grades and relatively small volumes available on the open market;
- Bleached Hardwood Kraft Pulp, referred to as BHKP, that targets the same applications as BSKP or NBSK pulps.

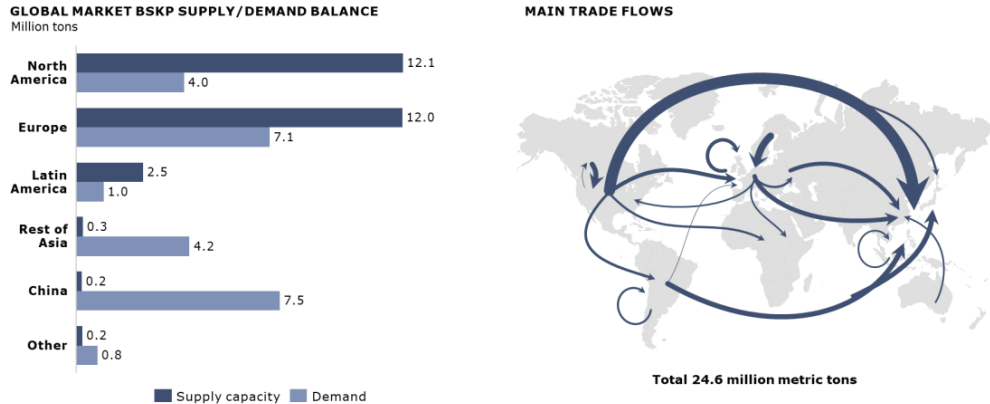
The Liverpool Project would produce NBSK and compete on the global BSKP market. Due to fibre properties, the Liverpool Project could not compete in the Fluff pulp market. Paper companies that buy pulp from the market typically blend hardwood and softwood pulps. Therefore, there is some overlap between BSKP and BHKP. As a result, it can be considered that changes in the BHKP supply and demand balance can impact the BSKP market dynamics, in which the Liverpool Project would compete.

The global demand for BSKP, including Fluff pulp, was estimated at around 24.6 million tons in 2023. Graphic papers, tissue, and packaging are the main applications for paper-grade BSKP.

**Figure 2: Global BSKP market breakdown by application**


Source: AFRY Management Consulting

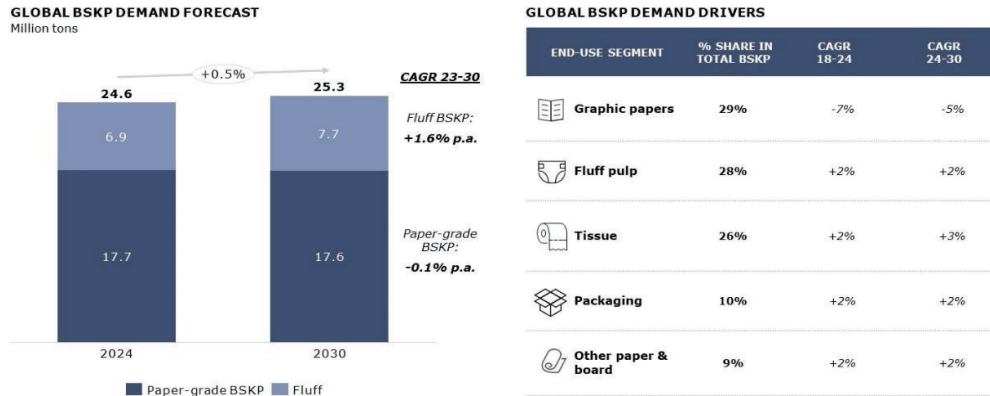
The global BSKP market is organized around major trade flows directed to China and other Asian countries, where most of the demand is concentrated, as evidenced below. Canada and the U.S. are net exporters of BSKP.

**Figure 3: Global BSKP supply/demand balance and trade flows**


Source: AFRY Management Consulting

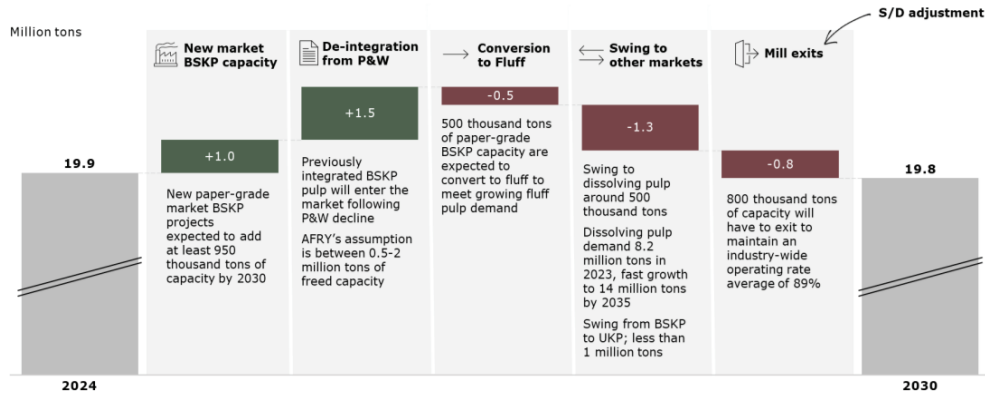
## 6.2 Market trends

Most of the global demand growth in the BSKP market is driven by the Fluff pulp segment. There is no demand growth in the paper-grade BSKP market, where Liverpool would compete. Large capacity development in the BHKP market is likely to create an imbalance between supply and demand, which could accelerate the shift from BSKP to BHKP and further deteriorate the demand forecast for paper-grade BSKP.

**Figure 4: Global BSKP demand forecast and demand drivers**


Source: AFRY Management Consulting

In this context, the Liverpool Project would need to replace incumbent mills to secure market entry. As a large-scale and modern mill with access to relatively low wood costs, Liverpool would be a first-quartile producer.

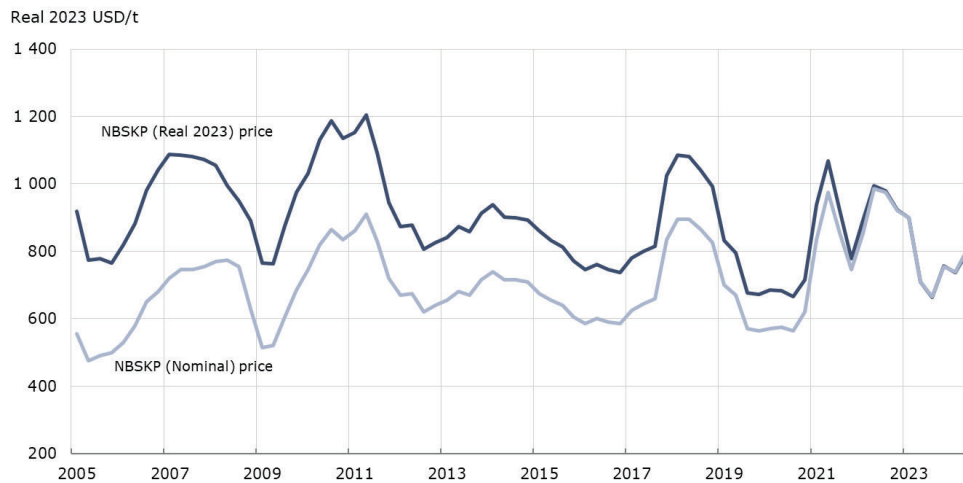
**Figure 5: Global paper-grade BSKP supply projection**


Source: AFRY Management Consulting

### 6.3 Price trends

NBSK pulp pricing is driven by Asia, and especially China, which is the largest pulp buyer in the world. Pulp prices in China are one of the key value drivers for the Project. Pulp prices in China are the main benchmark for global pulp prices. Pulp prices tend to be cyclical. At the time of AFRY's report (August-November 2024), Chinese pulp prices were recovering from a downcycle started in 2022-2023.

**Figure 6: NBSK pulp prices in China: historical development 2005-2024**



Sources: AFRY Management Consulting based on RISI prices

AFRY developed a long-term trend price forecast for NBSK pulp in China, Europe and the U.S. Long-term trend prices are projected based on supply-demand and cost analyses. The forecasting process focuses on analysing the anticipated changes in the supply and demand environment and the resulting implications on the cost position of the marginal producers and low-cost leaders. As paper-grade BSKP demand is expected to remain stable to slightly declining, new pulp mills will have to replace older assets to secure market entry. AFRY identified around 1 million tons of new BSKP capacity scheduled to come online by 2030, in addition to the potential Liverpool Project. As modern pulp mills are more cost-efficient than older assets, the marginal cost of supply is expected to decrease slightly. As a result, AFRY's long-term trend price forecast indicated a declining trend, as evidenced in Table 1.

**Table 1: Long-term trend price forecast for NBSK pulp (real basis)**

USD/ton	2025	2030	2035	2040
China	765	760	755	745
Europe	738	732	720	711
USA	781	776	770	756

Source: AFRY Management Consulting

Global pulp prices are published in USD. AFRY's price forecast in USD/ton was converted into CAD/ton using the 1.3 forex assumption in the financial model.

AFRY also modelled selling prices for NBHK (30% of the product mix), assuming a USD 150/ton discount compared to the net selling prices of NBSK. The price difference reflects the long-term pricing trends on the BSKP and BHKP markets. The price difference between hardwood and softwood pulps is what drives the shift away from softwood pulp as pulp buyers optimize their supply. Most pulp buyers blend hardwood and softwood pulps and can shift 5% to 10% of the pulp needs from one pulp to the other, depending on market conditions, while maintaining product properties.

## 7 Capital cost basis

The Liverpool Project has been conceptualized as a modern pulp and bioproducts facility. The plant design includes state-of-the-art fibre processing, oxygen delignification, bleaching, pulp drying, and energy generation infrastructure. It also integrates carbon capture and biochemical recovery systems, positioning the facility as a next-generation biorefinery.

The initial capacity was set at 600,000 tons per year but was subsequently increased to 700,000 tons per year to better utilize the available fibre base in Nova Scotia. Construction was projected to commence in 2026, with start-up targeted for the second half of 2029. A 2.5-to-3-year production ramp-up period was anticipated following commissioning, with the mill achieving full production in 2032.

Capital expenditure estimates vary depending on project configuration. At the preliminary pre-feasibility study stage, the accuracy level of the CAPEX estimates is  $\pm 50\%$ . A conventional pulp mill without advanced biorefinery elements is projected to cost approximately CAD 2.7 billion, or CAD 3,900 per ton of capacity. When carbon capture and biochemical revenue streams are included, total investment requirements increase to approximately CAD 3.7 billion. It is not possible to compare the biorefinery CAPEX in the absence of any relevant benchmark. The conventional mill CAPEX can be compared with recent pulp projects in Latin America and Europe. There has been no example of a large-scale greenfield pulp project in North America in the past 20 years.

The new generation of pulp assets in Latin America brings a new scale to the market (mill capacity in excess of 1 million tons), which optimizes investment costs. As a result, the Arauco and UPM projects benefit from lower CAPEX per ton of capacity. Liverpool's CAPEX estimate is closer to recent European examples such as Metsä and Mercer's projects. Metsä's Kemi project was a brownfield project, which also optimizes investment costs compared to greenfield projects. If we were to inflate the CAPEX per ton of capacity for the Mercer project, which dates back to 2005, we would find it to exceed the estimated CAPEX per ton of capacity for the Liverpool Project.

**Table 2: Benchmark of recent pulp projects in Latin America and Europe**

	Country	CAPEX (CAD)	Capacity (tons)	CAD/ton
Liverpool, NS (conventional mill)	Canada	2.7 billion	700,000	3,900
Arauco Horcones (2023)	Chile	3.7 billion	1.6 million	2,400
UPM Paso de los Toros (2023)	Uruguay	3.9 billion	2.2 million	1,800
Metsä Kemi (2023)	Finland	2.7 billion	900,000	3,000
Mercer Stendal (2005)	Germany	1.8 billion	520,000	3,400

Sources: AFRY Management Consulting based on RISI data. Conversion from USD to CAD at 1.3 forex

## 8 Modelling assumptions

The financial model underpinning the Project includes a range of assumptions designed to reflect market realities and long-term commercially reasonable expectations. Once reaching full production, the Liverpool Project could generate CAD 1.1 billion of yearly revenue, with the following breakdown:

- Pulp sales: CAD 0.709 billion per year (65% of total revenue);

- Electricity sales: CAD 0.028 billion per year (3% of total revenue);
- Chemical by-product sales: CAD 0.055 billion per year (5% of total revenue);
- Carbon capture: CAD 0.299 billion per year (27% of total revenue).

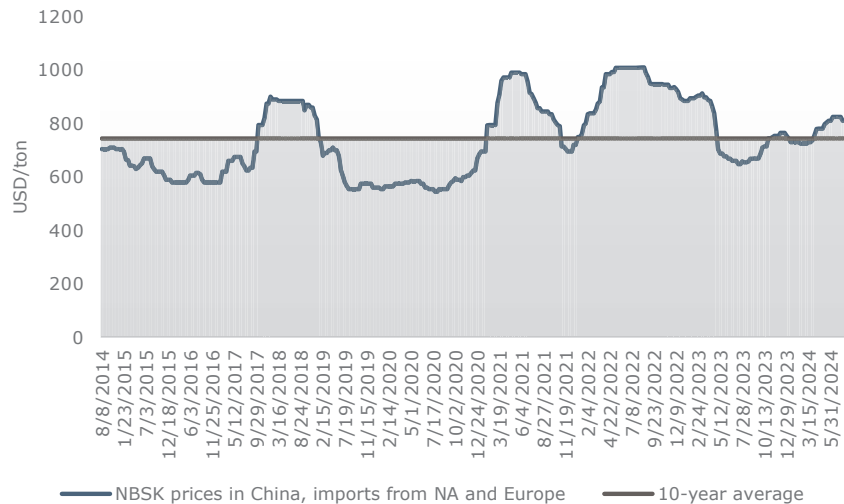
## 8.1 Pulp sales

The assumed market mix includes 80% of production destined for Asia, 10% for Europe, and 10% for North America. This allocation was revised from earlier assumptions that had overestimated European uptake, especially given the upcoming capacity expansions in Finland and Sweden.

In the model, pulp prices are forecast to remain stable on real basis. The inflation rate for pulp selling prices is set at 1.5%. Actual BSKP market prices do not simply follow PPI or inflation. Instead, BSKP market prices are driven by changes in supply and demand and temporary imbalances. AFRY's price forecast is based on trend prices that are mostly driven by marginal production costs. Marginal costs are inflated by 1.8-2.0% p.a. in AFRY's model. Once expressed as a percentage of selling price, the impact of inflation is closer to 1.5% per year.

With 80% of the production shipped to Asia, and 70% of the production focused on NBSK pulp, NBSK pulp prices in China are the main value driver in the model. The NBSK selling price in China was set at USD 800/ton for the first year in the model, and subsequently inflated by 1.5% per year, as explained above. Setting the NBSK price in China at USD 800/ton was in line with the market prices as observed in the second quarter of 2024, when AFRY started its work.

**Figure 7: NBSK prices in China (August 2014-July 2024)**



Source: RISI Fastmarkets

It can be noted, as evidenced above, that the model price for NBSK in China at USD 800/ton is above the actual average price over the past ten years (~USD 740/ton).

The gap between the model price and the actual NBSK price in China is now wider after market prices dropped by 10% in the second quarter of 2025. Latest reported price for NBSK in China is below USD 720/ton. The price correction is related to

potential overcapacity and slowdown of the domestic demand for pulp in China. The slowdown of the Chinese demand for pulp has a conjunctural reason with the overall slowdown of the domestic economy and a structural reason with paper mills in China becoming increasingly integrated to pulp, instead of buying it from the market. This structural explanation for the low price level could create a prolonged downcycle. If the model were to be run today, the selling price assumption for NSBK in China would most likely be lower than the USD 800/ton level used for the assessment.

**Figure 8: NSBK prices in China (August 2024-July 2025) and model price**

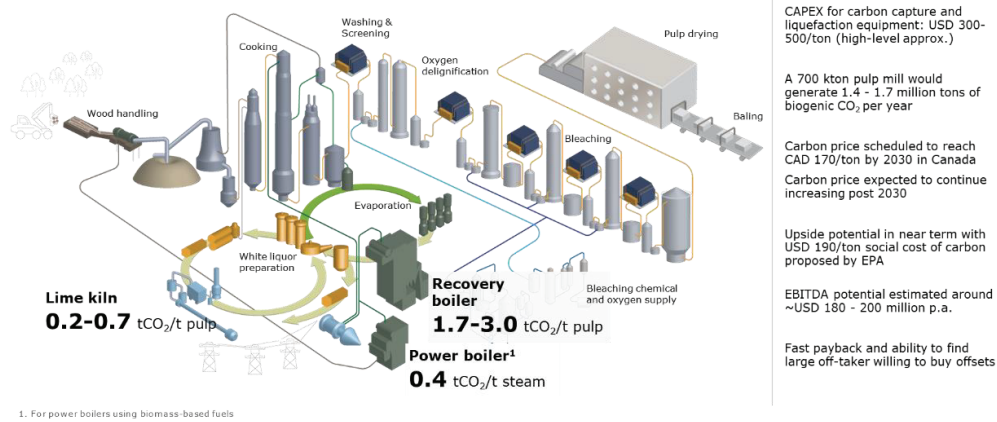


Source: RISI Fastmarkets

## 8.2 Other revenue

Electricity and by-product chemicals contribute marginally to Project revenues. Biomass-generated electricity is priced at CAD 130/MWh under a premium power purchase agreement. Chemicals such as CTO and Turpentine are sold at market price.

Carbon capture contributes more significantly to Project revenues. With the proposed concept, Liverpool would capture and liquefy carbon emissions. It was assumed that a partner would handle carbon storage and usage. Liverpool would earn revenue from selling up to 1.7 million carbon credits per year. The model value for the carbon credits was set at USD 190/ton, in alignment with the estimated social costs of carbon by the U.S. Environmental Protection Agency (EPA).

**Figure 9: Liverpool's carbon capture concept**


Source: AFRY Management Consulting

### 8.3 Operating costs

The main operating costs included in the financial model are the following:

- Manufacturing costs (fixed and variable);
- Delivery costs;
- Selling, General and Administrative (SG&A) and other costs.

Liverpool's operating costs were estimated by NPNS and reviewed by AFRY. Fiber costs were modelled at CAD 338/ADMT for softwood and CAD 270/ADMT for hardwood (CAD 321/ADMT for the weighted average). AFRY concluded that the assumptions for wood consumption were consistent with the industry average for BSKP and found the fibre cost estimates to be in line with expectations. Additional comments on the wood supply model can be found in Section 9.

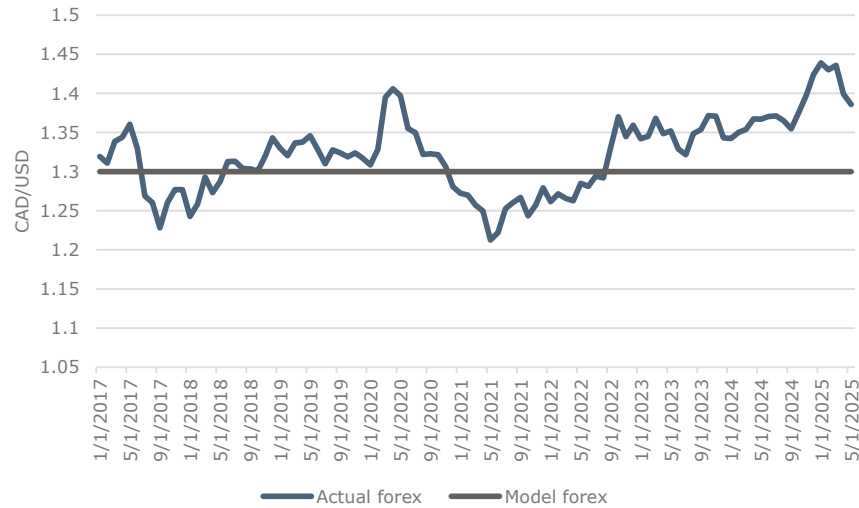
Other manufacturing cost estimates by NPNS (conversion costs such as energy, chemicals, labour and maintenance) were also in line with our views. AFRY successfully reconciled NPNS's estimates with its own manufacturing cost models.

Delivery cost assumptions in the model were based on actual quotes received by NPNS. SG&A and other costs were modelled based on comparable examples from NPNS. AFRY did not identify any material differences with its own models.

### 8.4 Currency

Currency assumptions play a critical role in project economics. The model is based on an exchange rate of 1 USD = 1.3 CAD, which is consistent with the average exchange rate since 2017, as published by the Bank of Canada (1 USD = 1.32 CAD, Figure 10).

**Figure 10: CAD/USD historical and model exchange rates**



Source: Bank of Canada

At the time of AFRY’s work, the exchange rate was closer to 1 USD = 1.37 CAD. As pulp is sold in U.S. dollar and most of the capital costs would be paid in U.S. dollar, a lower Canadian dollar increases revenue and capital costs at the same time.

For long-term planning, it is typical to assume an exchange rate in the range of 1.25 to 1.35 CAD per 1 USD, reflecting historical averages and considering moderate fluctuations in the currency market. 1 USD = 1.3 CAD is generally considered a conservative assumption. When reviewing the exchange rate in the model, AFRY also took in consideration third-party projections for exchange rates that suggest a gradual strengthening of the Canadian dollar against the U.S. dollar over the next few years.

## 9 Wood supply assumptions

### 9.1 Model construction

AFRY reviewed the model developed by NPNS to account for wood market balances in Nova Scotia, which uses an assumption of 500,000 ADMT of softwood pulp capacity and 200,000 ADMT of hardwood capacity. The model built a linear optimisation approach to balancing:

- Supply across the Province (including imports) for wood species (spruce/fir, other softwoods and hardwoods) and product classes (primary & secondary);
- Demand across different mills taking different species/product combinations.

The model also includes relatively detailed modelling of delivered costs (including contractor cost models), conversion factors and moisture contents. The wood cost for Liverpool is derived from the solution of the model, minimising costs for all facilities across Nova Scotia. AFRY concluded that it was a suitable modelling approach to assess wood availability and estimate wood cost. This approach is aligned with leading practices for wood cost estimation.

## 9.2 Wood availability

Wood availability results from the model indicated that all assets in Nova Scotia could meet their demand with the available supply in the province and some imports. With the Liverpool Project operational, there would be a minimal surplus of softwood roundwood (~1,200 GMT) and a surplus of ~1 million GMT of hardwood roundwood. All the sawmill chips, bark or sawdust available in Nova Scotia would be consumed. Consumption of the main wood buyers in Nova Scotia was estimated and included in the model. The largest wood buyers and their consumption are presented in Table 3.

**Table 3: Largest wood buyers in Nova Scotia and estimated consumptions**

Wood consumption estimates (GMT)	Asset	Roundwood	Woodchips	Bark/sawdust
Liverpool	Pulp mill project	2,268,064	399,499	278,872
Port Hawkesbury	Pulp and paper mill	446,901	32,892	82,500
Great Northern Timber	Pellet mill	-	-	24,030
Shaw Renewables	Pellet mill	-	-	21,600
Freeman Lumber	Sawmills	675,000	-	-
Irving	Sawmill	403,000	-	-
Scotsburn Lumber	Sawmill	350,000	-	-
Ledwidge Lumber	Sawmill	263,000	-	-
Elmsdale Lumber	Sawmill	123,000	-	-
Taylor Lumber	Sawmill	53,000	-	-

Source: NPNS estimates

The wood supply model is consistent with the core principles of the Lahey Model, which advocates for an ecological forestry approach, aiming to balance environmental sustainability with economic and social interests in forest management. The Lahey Model prioritizes forest health and biodiversity over maximizing timber yield. This approach emphasizes maintaining multi-aged, mixed-species forests that mimic natural disturbance regimes. The model proposes a three-zone framework for Crown land management:

- Ecological reserves: areas set aside for conservation without industrial activity;
- Ecological matrix: forests where ecological principles guide forestry practices;
- High production forests: designated zones for intensive timber production, subject to ecological guidelines.

## 9.3 Modelled wood prices

Optimisation results from NPNS's wood supply model estimated the average fibre cost at CAD 338/ADMT for softwood and CAD 270/ADMT for hardwood. The weighted average fibre costs for the Liverpool Project were estimated at CAD 321/ADMT.

The above fibre costs include stumpage fees, costs to harvest and deliver to the mill. No constraints related to harvesting and transportation were included in the model.

## 10 Capital structure assumptions

The capital structure for the project combined equity, Provincial and Federal Grants and debt, with the following breakdown:

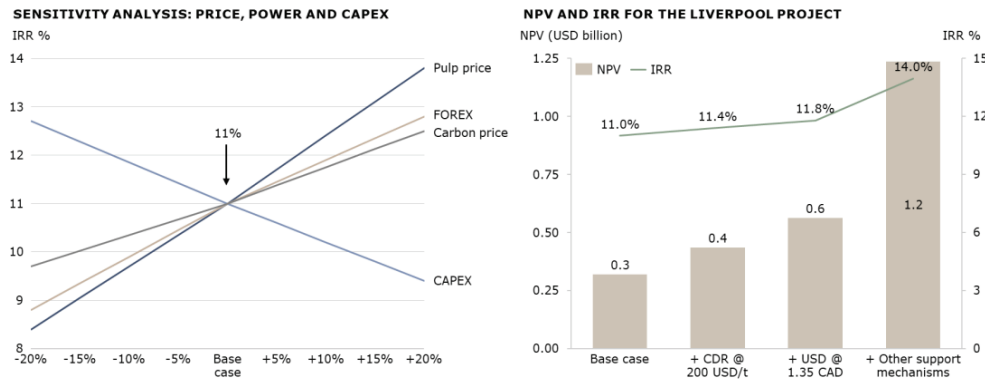
- Canadian Infrastructure Bank debt: CAD 2 billion (54% of Project financing);
- Nova Scotia Tax Credit (Grant): CAD 0.9 billion (25% of Project financing);
- Federal Tax Credit (Grant): CAD 0.6 billion (15% of Project financing);
- Equity: CAD 0.2 billion (6% of Project financing).

## 11 Calculation methods

Project returns were calculated using a 20-year discounted cash flow model. Internal Rate of Return (IRR) and Net Present Value (NPV) were both computed based on future cash flows and a terminal value to capture residual benefits beyond the model horizon. Cash flows were discounted using a 10% discount rate. Terminal value was estimated based on the perpetuity growth model that assumes that free cash flows grow at a constant rate indefinitely beyond the forecast period. The perpetual growth rate for the cash flows was set at 3% per year. The NPV gap to reach 14% IRR was estimated around CAD 0.8-1.2 billion (USD 0.6-0.9 billion) as shown in Figure 11. Sensitivity analyses were performed for the key value drivers in the financial model:

- Pulp and carbon credit prices;
- Capital expenditures (CAPEX);
- Forex.

**Figure 11: Sensitivity analysis, projected IRR and NPV**



Source: AFRY Management Consulting

AFRY found that the project would need a significant increase in pulp and/or carbon credit prices to reach a 14% IRR. Current market conditions are not supportive of such high price assumptions. Some upsides in CAPEX and Forex assumptions could be considered, but they would not be sufficient for the Project's IRR to reach 14%.

## 12 Conclusion

In summary, the Liverpool Project could succeed on the sluggish global BSKP markets and holds strategic competitive advantages as a next-generation biorefinery. However, under commercially reasonable assumptions, the Project falls short of the required 14% IRR. While the integration of carbon capture and biochemical by-products provides significant upside, these are not sufficient to close the entire viability gap.

## 13 Signatures

**Jose  
Gonzalez**

Digitally signed by Jose Gonzalez  
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ou=Users,  
email=jose.gonzalez@afry.com  
Date: 2025.07.08 18:02:10 -04'00'

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**Jose Gonzalez, Director**

**Vincent  
Leon jst641**

Digitally signed by Vincent Leon  
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ou=Users,  
email=vincent.leon@afry.com  
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**Vincent Leon, Principal**

## 14 Glossary of terms

<b>Reference</b>	<b>Description</b>
~	Approximately/around
<b>ADMT</b>	Air Dried Metric Ton (unit for pulp volume and capacity)
<b>BHKP</b>	Bleached Hardwood Kraft pulp
<b>BSKP</b>	Bleached Softwood Kraft pulp
<b>CAD</b>	Canadian Dollar
<b>CAPEX</b>	Capital expenditures (also defined as "capital costs")
<b>CO<sub>2</sub></b>	Carbon Dioxide
<b>CCS</b>	Carbon Capture and Storage
<b>CST</b>	Crude Turpentine (by-product)
<b>CTO</b>	Crude Tall Oil (by-product)
<b>EPA</b>	Environmental Protection Agency
<b>IRR</b>	Internal Rate of Return
<b>GMT</b>	Green Metric Ton(s) (unit for wood volume)
<b>Forex</b>	Foreign exchange (rate)
<b>Liverpool</b>	Project Liverpool (also defined as "the Project")
<b>MWh</b>	Megawatt hour (unit for power generation and consumption)
<b>NBHK</b>	Northern Bleached Hardwood Kraft (pulp)
<b>NBSK</b>	Northern Bleached Softwood Kraft (pulp)
<b>NPV</b>	Net Present Value
<b>P&amp;W</b>	Printing & Writing
<b>PPI</b>	Producer Price Index
<b>S/D</b>	Supply and Demand
<b>SG&amp;A</b>	Selling, General and Administrative
<b>Ton(s)</b>	Metric ton(s)
<b>UKP</b>	Unbleached Kraft Pulp
<b>USD</b>	United States Dollar