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Innovative Financing Scheme to Invest in Class 1 Nickel Smelter Using New Hydrometallurgical Technology

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Abstract – **World industries have been revolutionized by the emergence of renewable energy, and renewables-driven change continues with unprecedented speed. The growing demand for nickel-based lithium batteries for Electric Vehicles is forecasted to increase for many years to come. PT RTO (the Company) is a smelter and refinery company that established in 2009. Since then, the Company has built research and development activity to develop hydrometallurgical technology (Hydrotech) for nickel and cobalt extraction with an acceptable recovery rate. PT RTO is planning to run the Hydrotech into the commercialization phase (Hydro Project). However, the Company is not in the manageable condition of obtaining funding to build a Hydro Project. Therefore, an innovative financing scheme must be structured based on the valuation resulting from technology proprietary and Hydro Project. The valuation proposed into Scheme-A and Scheme-B for USD 120,288.0 and USD 91,162.3 at discounted rates of 10% and 14%, whereas the Payback Period 3.2 year and Internal Rate of Return of 30%. With initial investment amounted USD 40 million, Hydro Project is viable for commercialization scale. Nonetheless, the Company needs to maintain an initial majority share ownership when it comes to a mutually beneficial arrangement with the prospective equity investor.**

Keywords –**Equity, Valuation, Innovative Financing, Nickel Smelter, Hydrometallurgical Technology**

I. INTRODUCTION

A. General Overview

Indonesia has the largest nickel resources in the world, and the country holds 21 million ton of nickel or 22% of all resources in the world (US Geological Survey, 2021) as shown below on Table-1.

TABLE I
WORLD NICKEL PRODUCTION AND RESERVES

	Mine production 2019	Mine production 2020[e]	Reserves[6]
United States	13,500	16,000	100,000
Australia	159,000	170,000	[7]20,000,000
Brazil	60,600	73,000	16,000,000
Canada	181,000	150,000	2,800,000
China	120,000	120,000	2,800,000
Cuba	49,200	49,000	5,500,000
Dominican Republic	56,900	47,000	NA
Indonesia	853,000	760,000	21,000,000
New Caledonia[8]	208,000	200,000	NA
Philippines	323,000	320,000	4,800,000
Russia	279,000	280,000	6,900,000
Other countries	310,000	290,000	14,000,000
World total (rounded)	2,610,000	2,500,000	94,000,000

Indonesia has around 4.5 billion of laterite ore primarily scattered in the Province of Sulawesi and Maluku as proven and probable resources, where 80% consist of limonite ore (Indonesian Nickel Mine Association (APNI) Report, 2021). Since the current technology processes that able to extract nickel and cobalt from limonite ore is very limited due to high capital expenses, one of them namely High Pressures Acid Leach (HPAL), which has capital expense (capex) of around USD 65,000/ton (Septian, 2020), high operating cost USD 10,210/ton (Global Mining Research Report, 2018) and several downsides such as complexity process, downtime for maintenance, and only a few countries that success in operating HPAL technology. Therefore, the entry barrier remains high, according to the Minister of Mineral and Energy Resources (ESDM), there are only a few big companies in Indonesia that have plans to build a smelter using those technologies with capex in total USD 5.1 billion where one of them just begins production in the last May 2021. In Indonesia, the characteristics of laterite ore resources consist of Limonite (low-grade nickel) and Saprolite (high grade) as shown below on Table-2.

TABLE II
INDONESIA LATERITE ORE CHARACTERISTIC

Layer	Ore	Content (%)		
		Nickel	Cobalt	Magnesium
1	Ferric rete	-	-	-
2	Low-grade Limonite	0.4%-0.9%	0.04%-0.09%	0.5%-1.5%
3	Limonite	1.0%-1.6%	0.10%-0.24%	1.0%-4.0%
4	Saprolite	1.0%-2.4%	0.04%-0.08%	4.0%-16%
5	Bedrock	-	-	-

Known as one of the main materials for EV batteries aside from Lithium iron phosphate (LiFePo4), nickel price tends to increase along with cobalt price in line with the increment of EV sales forecast driven by the world regulations and policies related to the global emission reduction.

It is forecast that Class 1 nickel demand would be ten times higher from 2020 where it would be around 100,000 tons to 1,000,000 tons in 2030 in line with the growing demand of EV battery. A deficit in Class 1 nickel has been estimated to start in 2024 for 120,000 tons then increase up to 400,000 tons in 2030. This could be an

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excellent opportunity for PT RTO (the Company) to fill the gap in the market with their contribution in the downstream process to support nickel Class 1 production with the Hydrotech process.

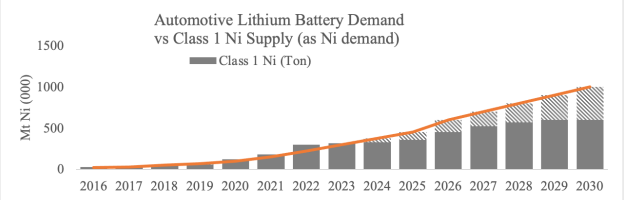

Fig. 1. Class 1 nickel demand and forecasted to deficit started in 2024
(Source: Roskill-jrc,2020)

B. Company Profile

PT RTO established in 2009, mainly focused on the smelter and refinery process for various metals and minerals. The Company has been developing Research and Development (R&D) activities specifically in hydrometallurgical technology since they founded and started to build pilot plant activity in nickel and cobalt processing in 2019. In order to get an acknowledgement as the nation product, the Company initiate to make collaboration with the research institution through The Ministry of Mineral and Energy Resources (ESDM) in collaboration with top Indonesian university and also get the technology audited by the Government through the Agency for the Assessment and Application of Technology (BPPT) to validate the technology process (Hydrotech) and provided several recommendations toward commercialization phase. The validation report was released in April-May 2021 with satisfactory results, where the range of nickel and cobalt recovery is around 89%-94% and 90%-95% respectively.

C. Problem Statement

Since the end of 2019, The Company has suffered operational loss caused by a lack of demand and supply from both customer and supplier. Furthermore, lead metal (Pb) as the main product has stagnant sales since companies (as one of the off-taker) experienced performance decrease amid pandemic covid-19. Looking forward to improvement, the Company uses a horizontal strategy to get another opportunity that focuses on the value chain of nickel-based lithium battery. However, the Company is not in the ability to fund its project independently. Therefore, an innovative financing scheme is required to run the Hydro Project by engaging potential private equity investors that will come into the mutually beneficial arrangement.

The Joint Venture Company will be formed through the equity fund raising that will come into the seed funding. 40 million of shares will be issued at the range of discounted price divided into Scheme-A and Scheme-B, where the both schemes have attractive offers that can be choose depend on the initial share ownership, and potential future benefit through the addition of share ownership to the prospective equity investor.

D. Research Objective and Limitation

The research objectives of this paper in search innovative financing scheme to invest in nickel class 1 smelter using the new hydrometallurgical technology that the Company has developed. Several objects should be identified towards the Company's valuation results, first is to ensure do-ability of Hydro Project eventually be determine economic viability outcomes altogether with key parameters that would likely be sensitizing the Company's value. The second is to define the valuation of Hydrotech that will be used for the Company as a base to raise the fund with potential equity investor. Lastly, the implementation will propose an appropriate deal structuring scheme that would be utilized to undertake an intensive period of engagement with potential private equity investor for the Hydro Project.

The limitation has found that Hydrotech only runs in pilot plant scale at the moment, as yet running in a commercial plant. Thus, there is no industrial historical report data used as a basis number for business projection. Furthermore, this is the new hydrometallurgy process in the related field, the Author has not found the same technology that available to be compared and has no benchmark for similar project. The closest technology process is HPAL which also use hydrometallurgical technology. However, the equipment and scheme process are totally different in compare to Hydro Technology.

II. METHODOLOGY

Quantity analysis was used as the methodology for this paper, through the uses Discounted Cash Flow (DCF) Valuation to define Net Present Value (NPV) of the technology and the project. During observation, several parameters that have a significant impact on the valuation were also explained in the sensitivity analysis. Secondary data were obtained from literature, scientific journals, presentation reports from trustable sources, and various resources from public domain websites for the official report, articles, and news.

In order to strengthen the assumption, several insights from the key person of the Company and inputs from the expertise in related field were obtained. All of data and

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information have been unified and compiled according to research needs that support the completion of this paper.

The Author use McKinsey Seven step of problem solving and decision as conceptual framework, where the chronological order defined as follows:

A. Define Problem

As previously mentioned in the Problem Statement section, the Company have no ability to fund the Hydro Project.

B. Business Situation and Analysis

The model of Porter Five Forces is defined as the external analysis of nickel industry.

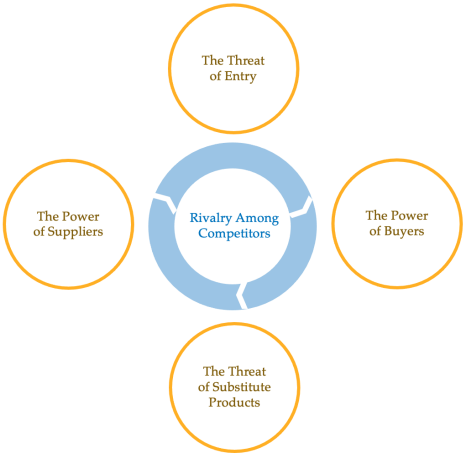

Fig. 2. Porter Five Forces
(Source: Rotharmael, 2017:73)

- *Rivalry Among Competitors: Medium*
  Not many players in the industry, however they have equal size each other with incumbent firms are highly committed to the business.
- *The Threat of Entry: Low to Medium*
  High entry barrier, with high capex, cash cost, and dependency to government policy and regulation.
- *The Power of Buyers: Low to Medium*
  Market-driven commodity, the product has standard price calculation based on commodity price.
- *The Threat of Substitute Products: Low*
  Supply market industry, not many other substitute products are easily will be able to find or produced.
- *The Power of Suppliers: Medium to High*
  High switching cost, mine location is only concentrated in one area.
  The Company mitigation plan on high risk:
  - Utilize Palu's SEZ
  - Build regional mine mouth smelter
  - Strategic alliance plan to secure supply chain

C. Prioritize Issue

In search innovative financing scheme to build smelter plan (Hydro Project).

D. Plan the Analysis

Discounted Cash Flow (DCF) valuation is demonstrated to determine the value of Hydro Project. It is necessary since the numbers will be used for the Company as fundamental based negotiation with potential private equity investor. According to (Ross, Waterfield, Jordan, 2013: 131) in a book titled *Fundamentals of Corporate Finance* chapter 5, mentioned that DCF Valuation have several types to calculate the Present Value (PV), the common type is using perpetuity formula:

$$\text{PV} = \frac{C}{1+r} + \frac{C}{(1+r)^2} + \frac{C}{(1+r)^3} + \cdots$$

Ross, Waterfield, Jordan, also defines Net Present Value NPV is *"a measure of how much value is created or added today by undertaking an investment"* (2013: 267). To create value for the Shareholders, beneficial investments can be addressed with positive net present values. Below is the formula:

$$\text{NPV} = \sum_{t=1}^{t=N} \left(\frac{CFt}{(1+r)^t}\right) - \text{Initial Investment}$$

Another important parameter to define is the discounted rate which can be interpreted through Capital Asset Pricing Model (CAPM). As mentioned by Damodaran in a book titled *Applied Corporate Finance* chapter 4, *"The cost of capital is a composite cost of financing that includes the costs of both debt and equity and their relative weights in the financing structure"* (Damodaran, 2015: 44). CAPM formula can be defined as follow:

$\overline{R}$	=	R_F	+	β	×	$(\overline{R}_M - R_F)$
Expected return on a security	=	Risk-free rate	+	Beta of the security	×	Difference between expected return on market and risk-free rate

Net cash flow to the Firm has determined for the next 25 years forecasted Cash Flow. Begin from EBITDA and decreased other operating expenses (taxes, working capital, and capital expenditure). Working capital required based on the calculation of Days Sales Outstanding (DSO) for 30 days Account Receivable, Days Payable Outstanding for 15 days, and Days Inventory Outstanding (DIO) for 90 days Inventory. Since the new Joint Venture (JV) Company that will be hold by PT RTO and prospective equity investor will not have a credit facility

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or debt from any sources, the calculation will immediately generate net cash flow.

The calculation of IRR is based on discounted cash flows (Gitman, Zutter, 2015: 453). Unlike the NPV rule, however, it takes into account the project's scale. It is the discounted cash flow analog to the accounting rates of return. Here is the decision rule for IRR independent project. In this Hydro Project case, IRR is computed as cash flow to Equity:

If IRR < Cost of Equity, means the project is feasible and should be accepted.

If, IRR < Cost of Equity, means the project is not feasible and should be rejected.

E. Conduct the Analysis

Propose two option of financing Scheme-A and Scheme-B. further explanation will be mentioned in Results and Discussion section.

F. Synthesis Funding

Further explanation will be mentioned in Conclusion section.

G. Communicate

Determine what is the most suitable scheme for the Company. Further explanation will be mentioned in Recommendation section.

III. RESULTS

A. Hydro Project Valuation

In calculating the NPV, offering options can make it more attractive from an investor's perspective. Therefore, two schemes have been defined that will be proposed later on:

- *Scheme-A, discount rate 10%, NPV at USD 120.288.0*
- *Scheme-B, discount rate 14%, NPV at USD 91,162.3*

This range of numbers is an acceptable limit from the Company's perspective by considering the valuation result and the potential for dilution of PT RTO ownership as the majority shareholder in the future.

B. Sensitivity Analysis

As part of the project viability, sensitivity analysis was conducted to determine the effect of key variables on the base case post-tax NPV of USD 120,288.0 thousand. The results of this analysis are shown in Figure 3 and Table III below.

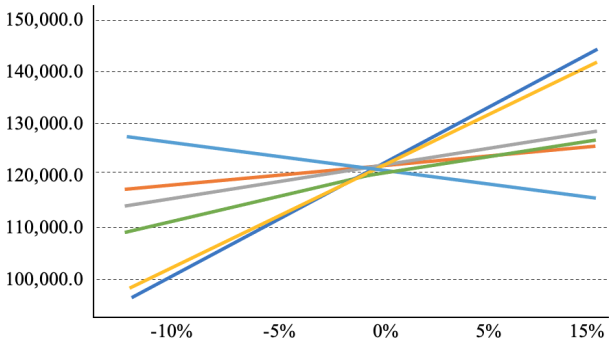

Fig. 3. NPV Sensitivity Analysis Graphic in USD Thousand

TABLE III
NPV SENSITIVITY ANALYSIS IN USD THOUSAND

Parameter	-10%	-5%	Base	5%	10%
Nickel Price	96,330.5	108,309.3	120,288.0	132,266.7	144,245.5
Cobalt Price	119,218.8	119,753.4	120,288.0	120,822.6	121,357.2
MgSO4	116,153.0	118,220.5	120,288.0	122,355.5	124,423.0
Recovery Ni	97,221.1	108,754.6	120,288.0	131,821.4	143,354.9
Sulphuric Acid	128,057.0	124,172.5	120,288.0	116,403.5	112,519.0
Nickel Content	99,088.5	112,190.9	120,288.0	118,051.7	123,452.2

From the graphic and table above, nickel and sulfuric acid price have the biggest contribution to the NPV sensitivity. JV Company should consider mitigation plans to avoid risk such as price fluctuation on the nickel ore price, and hedging strategy in commodity price could be one of the mitigation plans. In terms of sulfuric acid usage, technically would depend on the magnesium (Mg) content inside the ore. Lower Mg content will reduce sulfuric acid consumption. Conversely, the higher Mg content in laterite ore will consume much more sulfuric acid.

C. Proprietary Valuation of Technical Patent

Regarding technology and R&D activity, PT RTO has committed to utilizing their capabilities and leveraging expertise know-how into several program development toward technology value creation. To ensure the R&D costs and operation activities, the Company set up the royalty costs for every smelter plant use Hydrotech. A guideline to determine the royalty fee was obtained from the historical technology industry, the existing market competitor in similar industry, and literate study. According to Intellectual Property Research Associates (IPRA) in a book titled *Royalty Rates for Technology, 2018,* Hydrotech can be defined as Amorphous Metal Transformer with range of royalty rate is USD 300,000.0 in advanced, plus 1% - 25% of sales. Considering several factors and limitations as the new technology player who expects to disrupt the industry, the Company has determined Hydrotech royalty rate which determined as follows.

- Advance Royalty = USD 50.0 / ton as nickel output

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Payment in advance will be used for technical development and improvement during smelter construction.

- Sales Royalty = 5% of Hydro smelter revenue

Based on the above parameter, the revenue projected USD 80,693.9 for the next 10 years, resulting in a robust EBITDA USD 68,350.0.

TABLE IV
HYDROTECH NET CASH FLOW PROJECTION

Year	EBITDA	Tax Expenses	Working Capital	Net Cash Flow
1	(548.1)	0.0	3.0	(545.1)
2	(739.3)	0.0	13.4	(725.9)
3	75.6	0.0	(70.1)	5.6
4	1,195.8	0.0	(104.6)	1,091.2
5	2,300.6	0.0	(104.4)	2,196.2
6	7,296.1	(729.6)	(427.3)	6,139.1
7	11,897.9	(1,189.8)	(389.2)	10,319.0
8	15,714.6	(3,142.9)	(320.6)	12,251.1
9	15,598.2	(3,119.6)	3.8	12,482.3
10	15,558.6	(3,111.7)	0.5	12,447.4
Total	68,350.0	(11,293.7)	(1,395.5)	55,660.8

In calculating DCF Valuation, Terminal Value (TV) has been applied using TV Perpetual Growth Method with the formula as follow *(Damodaran, 2015: 318)*:

$$\text{TV Perpetual Growth} = \left(\frac{CFt\ x\ [1+g]}{[\text{WACC} - g]}\right)$$

TABLE V
HYDROTECH DCF VALUATION RESULT

Year	Net Cash Flow	Discount Rate (10%)	Terminal Value	Present Value
1	(545.1)	0.909		(495.5)
2	(725.9)	0.826		(599.9)
3	5.6	0.751		4.2
4	1,091.2	0.683		745.3
5	2,196.2	0.621		1,363.7
6	6,139.1	0.564		3,465.4
7	10,319.0	0.513		5,295.3
8	12,251.1	0.467		5,715.2
9	12,482.3	0.424		5,293.7
10	12,447.4		305,974.6	117,966.5
Total	55,660.8		305,974.6	138,753.7

As shown on Table V above, the value of Hydrotech is USD 138,753.7 at 10% discount rate. That valuation will be used as a basis number for the Company to build a structuring deal with prospective equity investor. However, the discount factor will range up to 14% to accommodate potential negotiation that might potentially be happened.

IV. DISCUSSION

The Author constructed two options as a base case and low case scenario based on the determined range. The guideline to define the scenario is to retain the Company's majority shares from the beginning on financing structured.

A. Financing Scheme-A

Scheme-A is a base scenario that the Company must pursue, with the JV Company valued USD 138.8 Million, price at USD 1.2/share, and Hydro Technology will be valued at USD 80.3 Mn, PT RTO will have significant majority shares of 66.7%. Despite having potential dilute shares of 29.3% at par value that will be executed for the next 25 years, which is will conduct in many years to come.

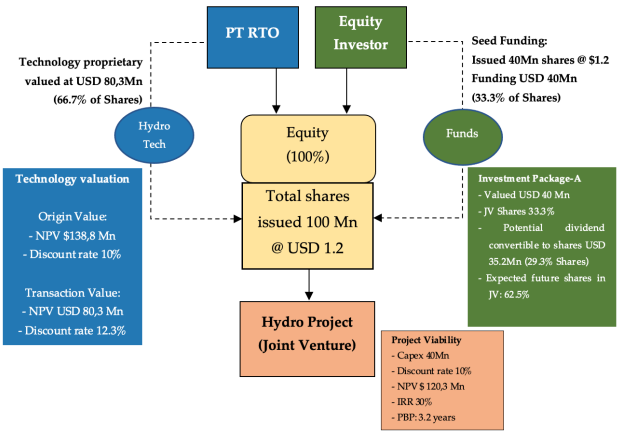

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Fig. 4. Financing Scheme-A

B. Financing Scheme-B

Assumed that the private equity investor has a good position and able to have more interest in the transaction process. Thus, the Company will increase the discount rate at a maximum range up to 14% for both JV and technology proprietary. The JV Company and Hydrotech will be valued at USD 91.2 Million and USD 51.3 Million, PT RTO will remain the majority shareholder of 56.1% with a price of USD 0.9/share.

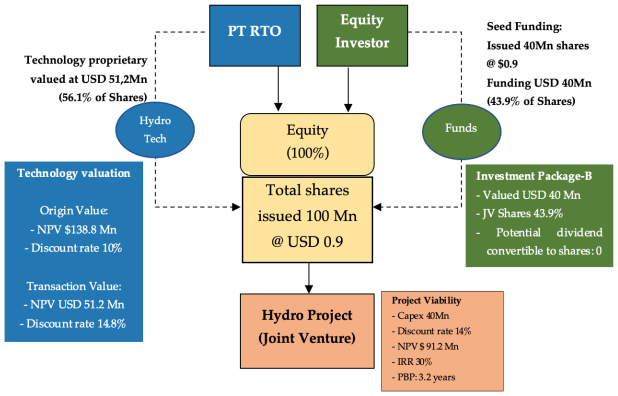

Fig. 5. Financing Scheme-B

V. CONCLUSION, RECOMMENDATION, AND IMPLEMENTATION PLAN

As previously shown in the result, Hydro Project will be feasible to scale up into commercialization scale. The economic outcomes expressed a robust number with two scenarios base case and low case adjusted by discounted rates between 10%-14%. The NPV resulted from each case is USD 120,288.0 thousand and USD 91,162.3 thousand with Profitability Index of 3.3x and 2.5x respectively. The IRR showed a viable rate of 30.0% above the discount rate, and PBP of 3.2 years considered for the next 25 years of life-mine resources.

The Company plan to maximize shareholders value by leverage their proprietary of Hydro Technology. Considering the growth of the nickel-based lithium battery industry for electric vehicles, the valuation resulted in viable numbers at USD 138,753.7 thousand at a 10% discount rate. The valuation number will be used as a basis for the Company to negotiate and remain the majority shareholder in the JV capital structure with the potential equity investor toward the mutually beneficial arrangement.

Looking forward to the opportunity and several limitations faced by the Company, the Author demonstrated an innovative financing scheme to attract the venture capitalists or equity investor. Two scenarios of an option will be proposed as a low and base case, where the Company recommended pursuing the potential investor to Scheme-A (base scenario), which provides more shareholding composition at 66.7% than the Scheme-B (low scenario) at 56.1%.

TABLE VI
IMPLEMENTATION PLAN OF HYDRO PROJECT

No	Activity	Duration	Year 0				Year 1				Year 2			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	Concept up to Basic Design Commence	9 months												
2	Environmental impact assessment & statement	9 months												
3	Pre-Feasibility Study	3 months												
4	Equipment Selection and Vendor Quotation	3 months												
5	DFS (Definitive Feasibility Study)	3 months												
6	BM/ BQ Estimation	3 months												
7	Capex Estimation	3 months												
8	P&ID Development to Finalization	6 months												
9	FID (Final Investment dicision)	3 months												
10	EPC Start	6 months												
11	Mass Production	3 months												
12	Ramp-up Activity	9 months								50%	100%	100%	100%	100%

The implementation for Hydro Project from the concept design to production ramp-up will require around two years. With as assumption that the construction will be seamlessly executed and no material concern that might affect the building progress, thus will need around six months to accomplish building a plant. The JV Company might start mass production later on, which will require around six months to get name-plate capacity. The flow process of implementation can be seen above in Table VI.

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