

Blended Finance for Impact: Financing the Nambo Waste Treatment Facility Through Innovative Infrastructure Finance Scheme

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Keyword	Abstract
Blended Finance; Project Finance; Waste Infrastructure; Public-Private Partnership; Concessional Debt; Risk Mitigation	The Nambo Intermediate Treatment Facility (ITF) in West Java, a critical waste-processing infrastructure project, has faced prolonged delays due to financial and institutional barriers. Despite being tendered as a public-private partnership (PPP), the project failed to achieve financial closure due to equity shortages, uncertain revenue streams (particularly from Refuse-Derived Fuel, RDF), and limited access to long-term debt. This study investigates how blended finance—combining concessional and commercial capital—can enhance the project’s financial viability and bankability. Using data from the 2015 Final Business Case and 2022 Feasibility Study, six financial scenarios were modeled to evaluate the impact of debt-equity ratios, RDF pricing, loan terms, and concessional instruments. The analysis applied the DFI Enhanced Principles to ensure alignment with blended finance best practices. Findings reveal that baseline assumptions yield marginal viability, but conservative market conditions render the project unfeasible. However, introducing concessional debt (3% interest) and a credit guarantee reduces the weighted average cost of capital (WACC) to 6.14%, elevates the internal rate of return (IRR) to 6.47%, and generates a positive net present value (NPV), even with low RDF prices (USD 40/ton). The optimized structure also achieves a debt service coverage ratio (DSCR) above 1.4x, meeting lender requirements. The rese concludes that blended finance mitigates key risks—sponsor equity constraints, revenue volatility, and high borrowing costs—while crowding in private investment. It offers policymakers a replicable framework to finance high-impact infrastructure in emerging sectors like waste management, aligning with SDGs 6, 7, 11, and 13. Recommendations emphasize layered financing structures, long-term offtake agreements, and DFI engagement to bridge Indonesia’s infrastructure gap sustainably.

INTRODUCTION

Infrastructure development and provision are the backbone driving sustainable economic growth in Indonesia, requiring significant capital (Berthelemy et al., 2021; Kuncoro, 2019). Both infrastructure development and access to financing are two of the four critical aspects needed for Indonesia to escape the middle-income trap (Agenor & Moreno-Dodson, 2013; Kuncoro & Utomo, 2018). Over the past 10 years, the Government of Indonesia (GoI) has vigorously promoted infrastructure development and initiated various measures to encourage private participation in boosting infrastructure growth (Baker et al., 2020; Soelistyo et al., 2022). Based on the results of the national development evaluation during the 2015–2019 period, the total investment achieved for infrastructure development is estimated at IDR 4,795 trillion (Sundararajan & Sembiring, 2021; Andrianto et al., 2020). Of this total investment, the private financing portion accounts for 37% or around IDR 1,751 trillion (Putra & Pratama, 2021; Sudjiono & Tan, 2022).

According to a study in the 2020–2024 National Medium-Term Development Plan (*RPJMN*) document prepared by the National Development Planning Agency (*BAPPENAS*), the total infrastructure financing need during this period is projected to reach IDR 6,445 trillion (pre-pandemic study). To meet this target, an infrastructure funding framework has

been prepared, dividing funding sources into three broad categories: (1) 37% or IDR 2,385 trillion financed by the State Budget, including *Anggaran Pendapatan dan Belanja Negara (APBN)* and *Anggaran Pendapatan dan Belanja Daerah (APBD)*; (2) 21% or IDR 1,353 trillion financed by State/Regional-Owned Enterprises (SOE); and (3) 42% or IDR 2,385 trillion sourced from private financing, such as through public-private partnership (*PPP*) schemes (BAPPENAS, 2020).

Based on the framework prepared by BAPPENAS in Figure I.1, it can be observed that the largest portion of financing sources is expected to be met by the private sector (Lionsng, 2025; Puteri, 2023). However, it is important to note that not all infrastructure projects can be immediately offered to or attract financing from the private sector, considering that private financing sources have a cost of capital or expected return on investment at a certain minimum value (Karwowski, 2021; Kim, Fallov, & Groom, 2020). This means that the type of financing for an infrastructure project depends heavily on the characteristics and business case of each unique project (Gatti, 2023; Weber et al., 2016).

The low level of private participation in infrastructure financing is believed to be due to the absence of a systematic mechanism and procedure to identify the most optimal financing modality while minimizing risk to a level acceptable to the private sector (Kim, Fallov, & Groom, 2020). One study addressing private sector participation in infrastructure financing is the Infrastructure Sector Assessment Program (*InfraSAP*) by the World Bank in 2018. One of its recommendations was to develop innovative financing mechanisms and structures to support projects so they can be implemented and financed by the private sector (World Bank, 2018). One solution is to adopt an innovative financing approach and attract concessional or non-commercial funding sources through implementing a blended finance scheme.

A critical analysis of previous research highlights gaps in the current understanding of blended finance for infrastructure projects. Ferza et al. (2019) examined *PPP* models in waste management in West Java, focusing mainly on institutional and regulatory challenges and overlooking innovative financial mechanisms to address funding constraints. Their study concluded that limited equity capital from sponsors was a major barrier but did not explore blended finance as a solution. Similarly, Kim, Fallov, and Groom (2020) analyzed private sector participation in infrastructure financing and identified the absence of systematic risk mitigation mechanisms as a key issue. However, their research lacked practical recommendations for structuring blended finance instruments to attract private investment. These gaps underscore the need for a study that integrates financial innovation with risk mitigation strategies to unlock funding for high-impact infrastructure projects.

The research questions aim to examine the feasibility of project investment from a financial perspective and explore innovative financing structures, particularly through implementing a blended financing mix from concessional sources to support development. Specifically, this study addresses whether there are issues with the project's financial feasibility that have prevented it from achieving financial close using a project finance scheme, how changes in the debt-to-equity ratio (*DER*) may affect investment criteria and project bankability, and what innovative financing strategies and structures can be adopted by leveraging blended finance with concessional funds as a de-risking tool to enable the project to reach financial close. This research is an exercise in applying a blended finance scheme to infrastructure projects, with the ITF Nambo Project as a case study, which, despite its high

financial risks, offers positive development impacts for the community. The objective is to propose solutions for investment strategies and project financing that utilize blended finance from non-commercial or concessional sources. The scope of this research is limited to using data from the 2015 *FBC* and 2022 *FS* studies and other supporting documents from *JS* and *JBL*, without conducting analyses or offering solutions related to engineering or legal aspects beyond those recommended in the existing studies or documents. Additionally, the analysis, including modifications or adjustments, will focus solely on the financial aspects of the project, referencing economic and financial market conditions or other relevant information. This study is not intended to serve as a reference or official document for financing or transaction purposes.

METHOD RESEARCH

This research adopts the conceptual framework outlined in Figure II.9 as the foundation for constructing a systematic research workflow, ensuring that calculations and analysis are performed accurately and effectively. The stages are designed as a sequence of interrelated steps involving data identification, processes, and input/output mapping, as depicted in Figure III.1. Phase 1 focuses on data collection, covering both project-specific and complementary data, such as information related to the financing market. This data will serve as the foundation for conducting an initial analysis of project conditions and market dynamics, followed by the identification of existing problems and their root causes. Phase 2 continues by developing a solution hypothesis derived from the previous analysis, which is then translated into scenarios with adjusted parameters. These scenarios are used to perform financial structuring through a quantitative model, using the Feasibility Study (*FS*) results as a benchmark. In Phase 3, the scenarios are tested through calculations, with iterative feedback loops to Phase 2 if adjustments are needed. Phase 4 involves analyzing the calculation results by comparing them to the base model, with the flexibility to revise or terminate scenarios if deemed irrelevant. Finally, Phase 5 concludes the research by synthesizing solutions to the identified business problems and drawing conclusions that integrate findings across the entire study.

The data collection method is structured based on the categories defined in the research workflow diagram. Project data will be sourced from *IBE*, project sponsors, and *GCA* as key stakeholders. The primary sources of information are two major studies: the Final Business Case (*FBC*) conducted in 2015 by the West Java Provincial Government during the project preparation phase, and the 2022 Feasibility Study (*FS*) carried out by *JBL* to update the project's financial conditions in response to significant changes in legal, technical, and financial parameters since 2015. These studies will be supplemented with additional supporting documents when necessary. In addition, supplementary data will be obtained from official and credible sources, such as interest rate data, *RDF* price data, and other financial market indicators, to ensure accuracy and minimize bias. The author will rely entirely on secondary data and will not collect primary data.

For the data analysis method, at least three analytical approaches will be applied, reflecting the research workflow outlined in Figure III.1 and grounded in the theoretical and literature review presented in Chapter II. The first analysis focuses on the project finance structure and parameters, using a typical *PPP*-based project finance model to examine the contractual relationships between *IBE* and stakeholders, with an emphasis on financial linkages

and their impact on achieving financial close. A risk matrix will be developed to map out potential risks, contract mechanisms, and mitigation strategies, supported by the *DFI Enhanced Principle* to evaluate blended finance opportunities for the ITF Nambo Project. Key financial parameters will also be analyzed, including equity capital (with particular attention to sponsor capital constraints), debt financing (interest rates, tenor, and debt service), project revenue structures, operational and capital expenditures, and investment ratios such as *WACC*, *FIRR*, and *NPV*.

RESULT AND DISCUSSION

Project and Financial Structure

The existing project structure is generally the same as the recommendation of the Final Business Case study conducted in 2015 which became the basis for conducting the PPP tender. Over the years there have also been various dynamics, both internal and external to the project, which have caused slight changes to the project structure.

The project structure as described in Figure IV.1 above have the following explanation:

- (a) Regional Cooperation Agreement between the West Java Provincial Government and Bogor Regency, Bogor City, Depok City, and South Tangerang City;
- (b) PPP agreement with a Build-Own-Operate-Transfer (BOOT) scheme between the West Java Provincial Government and PT Jabar Bersih Lestari;
- (c) Shareholder Agreement or Joint Venture Agreement (including capital contribution) between PT Jasa Sarana and Prospective Strategic Partners;
- (d) Product Sale and Purchase Agreement (RDF, compost, and recycled materials) between PT Jabar Bersih Lestari and offtakers;
- (e) Financing Agreement between PT Jabar Bersih Lestari as debtor and financial institutions as creditor;
- (f) Agreement between PT Jabar Bersih Lestari and the EPC contractor(s) as well as O&P contractor(s).

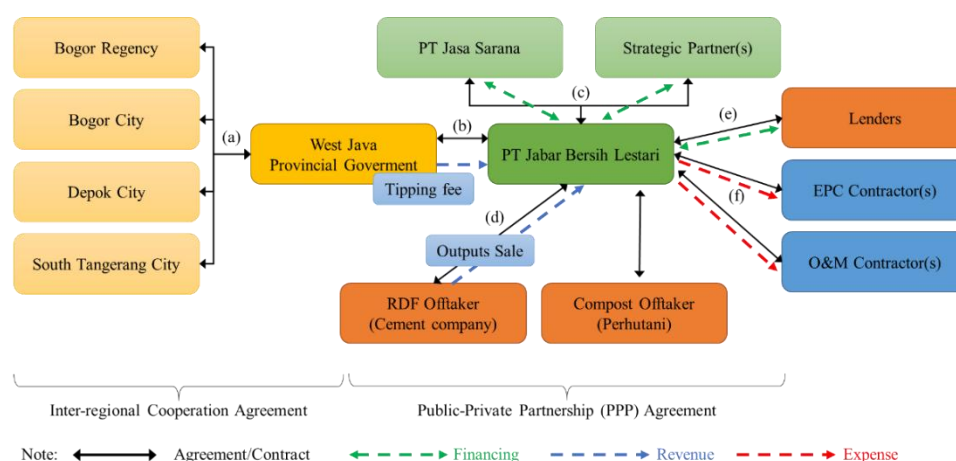


Figure 1. Existing project structure of ITF Nambo Project

Source: Adapted from Pemerintah Provinsi Jawa Barat, 2015; Feasibility Study, 2022

Based on the risk analysis described in the above matrix, there will be three main financial-related issues with high probability and impact that will be the focus of the study, namely:

1) Equity issues of project sponsor

Since JBL was designated as IBE in 2016, the West Java Provincial Government as GCA gave IBE 2 years target to obtain financing (financial close). However, this was not achieved so that the initial IBE consortium was reorganized and GCA decided to assign JS through the Private Sector Obligation (PSO) scheme to be involved as one of JBL's shareholders. However, after trying for several years and failing, JS decided to acquire all of JBL in 2022.

Based on the information, it is known that until now JS has spent around IDR 90 billion for various project needs which will later be calculated as equity participation. However, due to several reasons, JS does not have enough funds from the company's balance sheet to carry out further capital injection, especially to meet the 33% equity ratio of total investment according to 2022 FS.

2) Problems with revenue sources from RDF

In 2018, JBL has attempted to secure the final offtake agreement for the project output in the form of RDF with the cement company offtaker where this portion is expected to be the majority of the project revenue. However, until now the final RDF formula and price have not been agreed upon so that the project bankability is very low.

3) Difficulty obtaining long-term debt financing

Financial institutions, especially banks, tend to be reluctant to provide long-term loans, with a tenor of more than 10 years, especially those that are non-recourse or limited-recourse. In addition, high financial intermediation costs, i.e. high interest rates, in Indonesia also make the Weighted Average Cost of Capital (WACC) quite high. If the project cannot obtain long-term debt financing with relatively low interest rates, it will cause the annual debt service to be large so that the project is not feasible.

Blended Finance Analysis

To evaluate the appropriateness of using blended finance in the ITF Nambo project, this study applies the DFI Enhanced Principles for Blended Concessional Finance for Private Sector Projects as mentioned in Chapter II. These five globally endorsed principles guide the design and implementation of blended finance to ensure transparency, efficiency, and development impact.

1. Principle 1: Rationale for Using Blended Finance

The first principle requires that concessional finance only be used to address market failures or to mitigate specific risks that prevent commercially viable investment. The waste sector in Indonesia lacks a mature market for RDF and private investment due to uncertain revenue streams, absence of long-term offtake contracts, and underdeveloped regulatory frameworks.

In the context of ITF Nambo, private sector reluctance stems from unguaranteed RDF revenues, policy uncertainties, and weak financial metrics. The project's inability to secure long-term debt or equity under standard conditions highlights the presence of a clear market failure. Therefore, a well-structured concessional intervention—such as low-interest debt or a credit guarantee—is justified to overcome these barriers.

2. Principle 2: Crowding-In and Minimum Concessional

The second principle emphasizes using the smallest necessary amount of concessionality to attract commercial capital. The structure should ensure that private financiers assume most of the commercial risk while concessional instruments are applied only to close the bankability gap.

This project applies that principle by introducing layered financing: a senior tranche of commercial debt supported by a concessional loan and a guarantee facility. The blended structure should be designed to just meet (not exceed) viability metrics ($IRR > WACC$, $DSCR > 1.2x$), ensuring concessionality is targeted and minimized.

3. Principle 3: Commercial Sustainability

The third principle mandates that projects should be commercially viable and financially sustainable over time. In terms of financial parameters, it means that the project generates sufficient cash flow to repay debt and provide modest returns, satisfying the principle of long-term financial sustainability.

4. Principle 4: Reinforcing Markets

The next principle reminds stakeholders that blended finance should promote strengthening local systems and distorting market dynamics. Blended finance in ITF Nambo can support in catalyzing the RDF market development and aligns with the government's roadmap for waste-to-energy investment.

The blended finance structure for ITF Nambo supports RDF market formation, incentivizes standardization of tipping fees, and enhances creditworthiness for future projects. The inclusion of local financial institutions like PT SMI and PT IIF will also reinforce the domestic capital ecosystem, while involving DFIs ensures best practices in structuring and governance.

5. Principle 5: Promoting High Standards

Finally, the fifth principle calls for adherence to strong environmental, social, and governance (ESG) safeguards. The ITF Nambo project already incorporated an ESG framework aligned with national regulations and international standards, including AMDAL and IFC Performance Standards. Community consultations, land use agreements, and transparent governance mechanisms are key features, and would be reinforced further by DFI involvement through monitoring and reporting obligations.

Meanwhile, there are at least 8 components out of 17 SDGs that are closely related to this project, namely:

- SDG 6 Clean Water & Sanitation: Reduces leachate and landfill-related water contamination through better waste processing
- SDG 7 Affordable & Clean Energy: Converts organic waste into RDF to replace coal in cement kilns
- SDG 8 Decent Work & Economic Growth: Generates green jobs in waste sorting, operations, and logistics
- SDG 9 Industry, Innovation & Infrastructure: Develops sustainable infrastructure via PPP and introduces MBT/RDF technology

- SDG 11 Sustainable Cities & Communities: Reduces open dumping and supports integrated municipal solid waste management systems
- SDG 12 Responsible Consumption & Production: Diverts waste from landfill, promotes recycling, composting, and resource recovery
- SDG 13 Climate Action: Reduces GHG emissions from waste decay and fossil fuel substitution through RDF
- SDG 17 Partnerships for the Goals: Mobilizes public-private collaboration, international DFIs, and blended finance for infrastructure

Table 1. Summary of blended finance analysis using DFI Principles

DFI Principle	ITF Nambo Alignment	Conclusion
1. Rationale for Blending	Market failure in waste management and RDF (waste-to-energy) investment	Fully aligned
2. Minimum Concessionality & Crowding-In Private	Clear strategy to attract private debt with minimum DFI involvement; layered finance model used	Fully aligned
3. Commercial Sustainability	Project becomes bankable under blended structure; self-sustaining once operations start	Fully aligned
4. Reinforcing Local Markets	Catalyzes RDF (waste-to-energy) market development, and DFI-local financier collaboration	Fully aligned
5. ESG Standards	ESG framework adopted; compliance with AMDAL and IFC Performance Standards; support 8 SDGs	Fully aligned

Source: Analysis based on DFI Enhanced Principles, 2021; Author's own elaboration, 2024)

Based on the analysis of blended finance for ITF Nambo aligns well with all five DFI principles. The proposed blended finance structure using concessional debt and credit guarantee will be further detailed in financial modeling.

Financial Structuring and Modeling

Based on the three financial-related issues above and further analysis of the project's financial parameters (highlights can be seen in Sub-chapter 1.2.4 and Table I.3) found.), the financial parameters for each scenario is then determined based on data and information obtained from project documents, discussions, and external information, such as market conditions. The calculation is done in stage-by-stage approach and the results of the all scenarios are compared with the calculation results of 2022 FS as the Baseline Scenario (BL) to see the impact of changes in value on investment feasibility.

As explained in Section II.1.3, senior debt and guarantee are the two most frequently used blended finance instruments by DFIs. Debt is widely chosen because it has a revolving feature so that concessional funds invested in the project will still be returned and can be used for the next project. Blended finance also utilizing a credit guarantee instrument using concessional funds, either from DFIs or philanthropy, to cover the premium fee of the guarantee. The expected impact of the credit guarantee is to increase the creditworthiness of the IBE as a borrower so that it can lower interest rates. These two blended finance instruments

are included in 2 scenarios with a value that is estimated to be reasonable and use market reference to produce a project that is financially viable and bankable.

Financial modeling is carried out with the following basic assumptions:

1. JS will be the sole project sponsor meaning that all equity will be provided by JS.
2. Preparation and implementation of construction work takes 3 years.
3. Commercial operation of the project:
 - a. Demo Plant (50 Ton per day) in mid-year 3
 - b. Main Plant (2300 Ton per day) COD after 3 years of preparation and construction
4. Concession period 25 years from COD.
5. Waste supply of 2,300 tons/day is constant for 25 years and The waste supply of 2,300 tons/day is constant for 25 years and is immediately fulfilled in the first year (no ramp-up period).
6. Processing waste into RDF with an estimate of $\pm 35\%$ of the waste supply that can be processed into RDF.
7. Tipping fee at COD is IDR 125,000 per ton (excluding sales tax). The increase for payment of waste processing and RDF processing service fees is 6% per 2 (two) years.
8. The other output in the form of fertilizer will be given free of charge to the offtaker, i.e. Perhutani, so it will not generate revenue.
9. Depreciation costs for capital goods using the straight line method are calculated over a concession period of 25 years at 4% per year.
10. The principal installments of the loan are paid proportionally throughout the loan term.
11. Annual inflation of 3%.
12. The Rupiah exchange rate against USD is constant throughout the concession period at IDR 14,790.
13. The variables that are changed as input for each scenario include:
 - a. Financing Proportion between Debt and Equity
 - b. Initial RDF price during COD.
 - c. Terms of debt financing, namely interest and loan tenor.

The Scenario Baseline financial model is taken from the 2022 FS, as show in the following results and analysis of each scenario of the financial modeling will elaborate deeper on how the financial structure change through different mix of variables.

1) Scenario 1: High DER (leverage)

In this scenario, the capital structure of the project is changed where the equity portion is tried to be suppressed as low as possible to 15% of the total capital and the debt portion is 85% which is entirely from commercial lenders. This scenario is made to address the problem of limited funding for equity portion from the sponsor. By reducing the equity portion to 15%, JS as the project sponsor only needs to deposit IDR 193 billion in capital compared to IDR 421 billion in the Baseline scenario.

While the operation costs and profit remain remarkably similar to the Baseline, the increased debt leads to higher interest payments, even with the same overall interest rate. The higher loan principal repayment schedule in the initial concession years also means that while the project cash flow eventually mirrors the Baseline's growth trajectory, it starts from a slightly more constrained position. The calculation results show that with this scenario the WACC of

the project will decrease by 165 basis points (bps) from the initial WACC. The project's IRR decreases by 107 bps while the NPV from IDR 443,494 in the Benchmark to IDR 716,466.

The conclusion using Scenario 1 is that the project can fulfill the investment feasibility on the paper from the perspective of the project sponsor. However, this scenario may be considered too risky and unbankable by the lender because the equity portion is too small and the revenue generated using high RDF price is too optimistic and too risky. This scenario highlights the sensitivity of profitability to financing structures; a higher debt-to-equity ratio, especially with over-optimistic revenue, can significantly be considered unbankable due to lack of security.

2) Scenario 2: Low RDF price

Scenario 2 marks a significant departure from the previous models by introducing a substantial reduction in the RDF Selling revenue component without changing other financial parameters on the project cash flow. The author uses an RDF price of USD 40 at the beginning of the operation and increases gradually to adjust the annual inflation rate in the model. This price does not fluctuate like the price of coal which depends on demand and supply, and can be said to be a lower limit for the RDF price. While Tipping Fees remain constant, the overall revenue drops considerably. This decline in revenue has a cascading effect across the financial model. Despite maintaining the Baseline's financing structure (67.24% loan, 32.76% equity) and IDC, the reduced revenue forces a corresponding decrease in selling expenses, leading to a lower total operation cost.

The calculation results show that the lower RDF price changes have a significant negative impact on the project's financial viability. The Project's cash flow in this scenario is notably weaker, even showing negative values in the early construction phase, while NPV drops to negative with a value of IDR -463 billion and the IRR becomes 6.39% which is around 400 bps below the WACC. This scenario shows that the low RDF price is the most major factor in making the project fall below investment criteria, highlighting the severe impact of underperforming revenue streams on project solvency and attractiveness, thus making this structure unbankable.

3) Scenario 3: Combination of high leverage, low RDF price, and long term commercial debt

Scenario 3 combines the challenges of reduced RDF selling revenue (as seen in Scenario 2) with the higher debt burden and interest rate observed in Scenario 1, to see the interplay of these factors in influencing the feasibility of project investment. Scenario 4 produces a calculation where project's IRR = 4.96% and NPV = IDR -595,006 has the lowest value compared to other scenarios. The results show that the project is not feasible to invest in with this combination.

The combined effect of lower revenue and higher interest payments severely impacts profitability. On top of that, operation profit mirrors Scenario 3's decline. However, the increased interest further diminishes the Profit Before Tax, and the Net Profit, the lowest among all scenarios.

From the lender's perspective, this scenario also produces the lowest DSCR value where in the first three years of project operation it only has a DSCR value in the range of 1.01-1.16. This indicates the project's income barely covers debt service, with little margin for other expenses, thus financially unviable and unbankable.

The author considers that the biggest factor that makes a project have a low IRR and NPV is the RDF price which is the main component of the project's revenue. Scenarios 1 shows that high leverage will have a positive impact on the project where the project is worth investing in, but when the RDF price component is changed to low, it makes the project as a whole not worth investing in.

- 1) Scenario 4: Combination of high leverage, low RDF price, long term commercial and concessional debt

Scenario 4 is the first scenario where the Author includes a blended finance component in the form of concessional senior debt. The portion of concessional debt is made with a ratio of 1:1 to commercial debt, where a low interest rate of 3% per year and the same tenor of 15 years will be used.

In this scenario, the results show that WACC drops to a fairly low level compared to previous scenarios, which is 7.13%. Meanwhile, the project's IRR becomes 6.12% or increases by 118 bps from Scenario 4 where the project relies on commercial debt completely. The most significant aspect is the change in the project's NPV that improved to IDR -80,667 million compared to Scenario 4.

The above results happen because the total debt service factor is lower due to the blending of commercial debt with concessional debt. The calculation results show that with the same debt principal value, Scenario 5 has a total interest cost of IDR 613 billion while Scenario 4 is IDR 963 billion, or it can be said that the decrease in loan interest cost is around 34%. The lowest DSCR value of the project is also at 1.30 which is in the safe category because it is higher than the minimum of 1.25 which is usually required by lenders.

The use of one blended finance instrument in the form of a concessional loan with a rate of 3% resulted in the project's financial condition improving but still unable to meet investment feasibility. Actually, if the interest on the concessional debt is reduced to 0%, the project will be investment worthy, but in the financial structuring simulation in this study, the low interest rate of 3% is still used which is more widely applied in actual transactions.

- 1) Scenario 5: Combination of high leverage, low RDF price, long term commercial and blended finance using concessional debt and credit guarantee

Scenario 5 is the last scenario where the Author combines all variables in the financial model by adding one final variable in the form of a full credit guarantee on commercial debt. The simulated impact is that the credit guarantee will have the effect of lowering the lending rate by 300 bps to 8%. This has an impact on the project's WACC which has dropped to 6.14% or the lowest of all scenarios in the financial structuring simulation.

Adjustments made in the last scenario by including two blended finance instruments resulted in a project that meets investment feasibility. The project's IRR value of 6.47% is slightly above the WACC, which can be said that the project has reached the tipping point from financially unviable to financially viable. The project's NPV is also positive at IDR 168 billion.

From the perspective of the project sponsor as an equity investor, the equity IRR value of 21.98% is greater than the required cost of equity. The NPV equity is worth IDR 278 billion which can be said to be good compared to the IDR 146 billion equity investment to the project. And from the perspective of a commercial lender, this project can be considered bankable with a credit guarantee and a minimum DSCR value of 1.46.

A comprehensive review of these scenarios reveals several critical insights for the ITF Nambo project. The Scenario 6 unequivocally presents the most attractive financial outlook, demonstrating strong profitability and robust cash flow under favorable revenue and financing conditions. Any deviation from this scenario, whether through increased debt reliance, higher interest rates, or, most critically, reduced revenue, significantly impacts the project's financial health. The summary of the model calculations for key financial parameters based on the calculation results above is described in the

The project's sensitivity to RDF selling revenue is particularly pronounced. Scenarios 2, 3, 4, and 5, all of which model lower RDF revenue, consistently show substantially diminished profitability and more strained cash flows. This highlights the critical importance of accurate market assessments for RDF and robust strategies to maximize its sales. Furthermore, the interplay between debt structure and interest rates is a significant determinant of financial viability. While higher debt percentages can amplify returns in favorable conditions, it also magnify risks when coupled with higher interest rates or lower revenues. Diversified financing, particularly with access to concessional loans, can provide a buffer against adverse market conditions. Ultimately, a successful Nambo project will necessitate a close adherence to baseline revenue projections, optimized financing terms, and proactive risk mitigation strategies to ensure its long-term financial sustainability.

Bankability Assessment

A critical dimension of evaluating project finance viability from financier's perspective, particularly under a PPP and project finance structure, is the project's bankability. Bankability refers to the degree to which a project is acceptable to commercial and concessional lenders based on its ability to generate sufficient cash flows, mitigate risks, and meet financial obligations over the loan period. In this section, a detailed assessment of ITF Nambo's bankability is conducted using scenario-based modeling outputs and benchmarked against standard financial metrics commonly applied by lenders.

The following table presents a comparative assessment of five financial structure scenarios that were modeled in previous section. The assessment is evaluated across key bankability indicators, both quantitatively and qualitatively, namely:

- 1) Revenue certainty, particularly from RDF sales
- 2) Equity capital from project sponsor
- 3) Net Present Value (NPV)
- 4) Internal Rate of Return (IRR)
- 5) Debt Service Coverage Ratio (DSCR)
- 6) Risk mitigation, particularly on credit risk

Business Solution

Overall, the financial modeling of the project with the three initial stages (S1, S2, S3) shows that the three main problems of the project, namely equity capital, output prices, and debt financing, cannot make the project to fulfill investment feasibility and bankability. The application of blended finance by bringing concessional funds in the form of debt instruments and guarantees shows positive results on the financial condition of the project.

Scenario 5 is the most optimal scenario where projects that were previously in financially unviable and unbankable conditions can become financially viable and bankable. The role of concessional funds as a blended catalyst in the financial structure produces returns for the private sector, both equity investors and lenders, which can still be considered fair and not excessive. In addition, the use of debt instruments with an interest rate of 3% for concessional funds also means that the funds will be returned and in terms of value will still withstand inflation.

The following is a more in-depth explanation of the proposed business solutions based on problems and strategy offered from the results of the financial modeling simulation:

1) Solution to equity capital difficulties

The large amount of funding needed to be prepared by JS as a project sponsor is the main constraint as concluded in the study by Ferza et al (2019). Simulations show that the project can proceed with equity capital at 15% of the total investment, meaning the nominal funding requirement is around IDR 193 billion. This equity capital figure is down more than 50% from the initial calculation of FS 2022. And as previously explained, JS has also spent around IDR 90 billion in the past few years for the preparation and construction of pilot infrastructure, meaning that around 40% of the equity capital requirement has been met by JS.

JS as the project sponsor can make several efforts to seek funding which can then be used as equity capital deposits to JBL as an IBE, including:

i. Regional government capital injection or Penyertaan Modal Daerah (PMD)

Considering that the ITF Nambo Project is one of the public infrastructure projects that has strategic value for the four cities/regencies in West Java Province, efforts can be made to request a regional government capital injection or Penyertaan Modal Daerah (PMD) to the West Java Provincial Government as the main shareholder of JS and GCA of the ITF Nambo Project itself.

ii. Corporate loan

JS can also looking for corporate loans to banking institutions where the funds are then injected as equity into JBL. Given that investment loans from banks tend to have short tenors (3-5 years), JS needs to make robust debt management approaches to be able to make interest and principal payments, including but not limited through refinancing of the loan itself.

iii. Bond issuance

JS can also issue bonds in the capital market to raise public funds which are then distributed as equity to the project. However, currently there is no information regarding the credit rating of JS as a corporation so it is also necessary to consider this because it will affect the size of the bond coupon. This must be managed to be lower than the cost of equity so that it does not affect the project's WACC.

2) Solution for RDF price

Financial modeling using Scenario 5 shows results that the project can still fulfill the investment criteria with an RDF price of USD 40. This price is far below the USD 70 calculated in FS 2022 which at that time referred to the coal price which was at its highest level.

The fact that the project is still feasible with a RDF price as low as USD 40 can be a reference in the process of developing an offtake agreement and negotiating prices with cement

companies targeted as offtakers. The strategy that can be done is to lock the price of USD 40 as the minimum limit and then the upper ceiling can be increased to adjust the coal price as a reference so that the project also has the potential upside to gain more profit if the coal price increases.

In the project finance scheme, the duration of the offtake agreement must also be locked for 25 years since COD to provide a certainty of project revenue. This is very important for the project to increase credit worthiness so that commercial lenders feel more secure in providing long-term loans.

3) Solutions for commercial debt

Long-term debt financing is a major obstacle in infrastructure financing in Indonesia because the financial market is still relatively underdeveloped. Most infrastructure is still financed with bank loans that tend to have short tenors so that they are not in accordance with the nature of infrastructure which is a long-term investment.

In the financial structuring simulation, financial parameters are used where the tenor duration is 15 years with a fixed interest rate of 11% so that the project becomes financially viable because the annual debt service on the principal and interest becomes lower, even though the project revenue falls with an RDF price of USD 40. Debt with a tenor of 15 years and a fixed rate of 11% tends to be very difficult to obtain from banking institutions.

However, there are alternatives to obtain debt financing through non-bank financial institutions (NBFIs), especially those that specifically operate in the field of infrastructure financing. Currently, in Indonesia there are at least 2 NBFIs that focus on infrastructure financing and can be explored to obtain long-term financing, namely:

- a. PT. Sarana Multi Infrastruktur (SMI)
- b. PT. Indonesia Infrastructure Finance (IIF)

4) Blended finance using concessional funds

Two forms of blended finance instruments that need to be incorporated into the financing structure so that the project can meet investment feasibility and be bankable:

a) Concessional debt

The use of concessional debt specifically has at least 3 benefits, namely:

- i. reduce the equity capital portion so that the burden for the project sponsor is reduced,
- ii. reduce the project's WACC so that the hurdle rate that needs to be achieved through the project IRR is also lowered, and
- iii. provide security to commercial lenders regarding the bankability of the project by having other lenders also involved in the project financing whereby the debt payment for commercial and concessional lenders shall be paripasu.

Concessional debt is usually provided by Development Finance Institutions such as the Asian Development Bank (ADB), International Finance Corporation (IFC), or philanthropic institutions that also have thematic financing products.

b) Credit Guarantee

In the structure proposed by the author, the credit guarantee is selected as a risk-sharing mechanism where a third party—typically development finance institution (DFI), multilateral development bank (MDB), or a specialized guarantee fund—promises to cover part or all of

the losses in case a borrower defaults on debt repayment. In the context of blended finance, this instrument uses concessional (public or philanthropic) funds to de-risk private investment. The main roles of credit guarantee are:

- i. Help turn non-bankable projects into bankable ones by lowering lenders' perceived credit risk of the borrower or project and enhancing the credit rating of the project (especially important in long-tenor infrastructure financing),
- ii. Reduced credit risk will lower the cost of debt, i.e. lower interest rate, as well as longer tenor,
- iii. allow higher DER ratios, in this financial modeling is 85:15, because lenders are more comfortable providing larger amounts of debt when repayment risk is shared.

The capital structure and project finance structure as the business solution that the author proposes can be illustrated in the following diagrams:

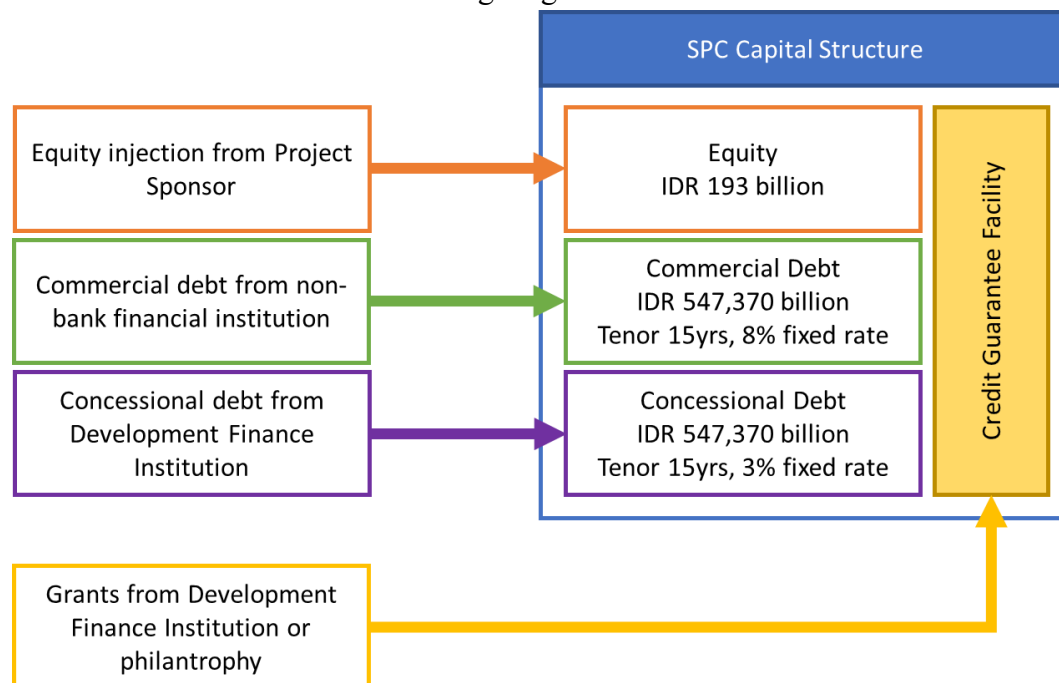


Figure 2. Proposed financial structure as the business solution for the project

Source: Author's own, 2024

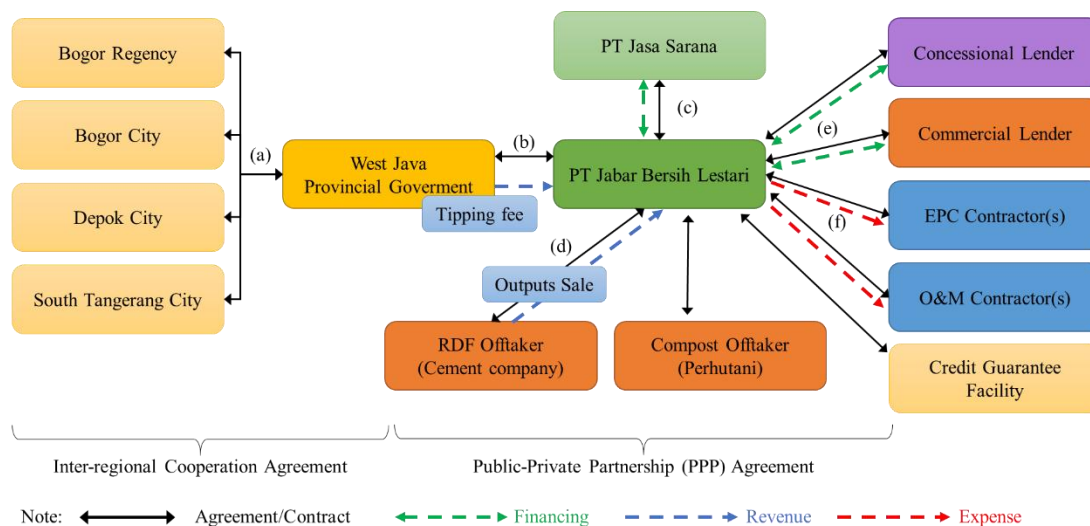


Figure 3. Revised project finance structure based on proposed business solution

Source: Author's own, 2024

Implementation Plan

The implementation plan for the business solution that the Author proposes is built based on the project finance and project management approaches as follows:

- 1) FS documents, especially financial feasibility, need to be revised and fine-tuned using the new financial structure which will be used as a reference document. In addition, all transaction documents must also be adjusted to the latest calculation results.
- 2) Based on data and information, there are still several pending issues that have not been completed, such as building permits, etc., which must be resolved immediately.
- 3) The project sponsor also needs to immediately seek additional funds that will be used as an equity portion for the project.
- 4) JS and JBL engage with DFIs or philanthropic institutions that have blended finance support facilities to obtain concessional debt and credit guarantees.
- 5) JBL needs to negotiate with the offtaker to finalize the documents as a requirement for submitting a long-term loan to a financing institution.
- 6) After all documents and pending issues are completed, JBL as a new IBE can submit to the lender to obtain long-term debt. The project finance financing process is generally longer than corporate financing, which can take 3-5 months or even more.

CONCLUSION

Based on the results of the financial model simulation, the project investment feasibility from a financial perspective indicates significant challenges that prevent the project from meeting investment criteria under a project finance scheme. Three key factors have the most substantial impact: (i) the limited equity capital injection capability from the current project sponsor, (ii) the decline in *RDF* price to a lower level, and (iii) the difficulty in securing long-term debt financing. These factors, whether individually or combined, result in financial metrics that fail to meet feasibility benchmarks, such as negative or too-low *NPV*, *IRR* falling below *WACC*, and *DSCR* levels that are unacceptable to lenders. The combination of weak equity contributions and unfavorable *RDF* prices further complicates the ability to achieve

financial close, as lenders require strong assurances of revenue generation to cover both principal and interest obligations, especially in non-recourse or limited recourse project financing schemes.

From an investment perspective, changes in the Debt-to-Equity Ratio (*DER*) significantly impact project bankability and investment criteria. A characteristic of project finance is its high leverage compared to conventional financing, with certain infrastructure projects, such as Batang Power Plant (*DER* 90:10) and Sarulla Geothermal Power Project (*DER* 85:15), serving as examples of successful high-leverage models. For the ITF Nambo Project, adjusting the *DER* to 85% debt and 15% equity (Scenario 1) reduces the *WACC* by 156 basis points. This reduction lowers the hurdle rate, making it easier for the project to achieve the required returns from both equity and debt sources. Such changes in *DER* have been shown to deliver more favorable outcomes than simply extending the loan tenor, underscoring the crucial role of an optimized capital structure.

To address these financial challenges, a blended finance strategy incorporating de-risking mechanisms is proposed. This approach aligns with the *DFI Enhanced Principle* and supports eight Sustainable Development Goals (*SDGs*), making the project well-suited for blended finance support. The strategy involves combining concessional and commercial financing instruments to achieve a risk-return profile acceptable to private sector players, including equity investors, lenders, and offtakers. Specifically, senior debt and guarantees—identified as the most common blended finance instruments according to the *DFI Working Group* report (2023)—are recommended to enhance project viability. The proposed structure includes reducing the equity share to 15% of total investment to minimize the burden on project sponsors, negotiating a long-term offtake agreement with a minimum *RDF* price of USD 40 per ton, and accessing green finance loans with a 15-year tenor and an 8% interest rate. The final optimized structure consists of 15% equity, 42.5% commercial debt, and 42.5% concessional debt, with a credit guarantee to improve creditworthiness and reduce the overall cost of commercial borrowing.

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