

From Byproduct to Benefit

A Comprehensive Guide to Financing Industrial Minerals Waste-To-Value Projects*

*By Nicholaus Rohleder, Co-Founder, Climate Commodities, USA**

In today's rapidly evolving industrial landscape, sustainability and resource efficiency have become pivotal. Particularly in the industrial minerals sector, projects aimed at converting waste into valuable commodities are gaining traction, not only for their environmental benefits but also for their potential to generate significant economic returns. However, the journey from concept to operational success in waste-to-value projects is fraught with complexities, especially when it comes to securing the necessary project financing. This guide delves into the intricate process of obtaining financing for such initiatives, emphasizing the critical aspects that can make or break the financing process.

Financing Industrial Minerals Waste-To-Value Projects: The 5 Key Parts of a Successful Project Financing

Investors in infrastructure projects, such as those converting industrial minerals waste to value, typically view these opportunities as a fixed-income proxy. While there are other participants in the investment community that will take more risk, the largest constituency of investors resides in the category that seeks stable, predictable returns comparable to those of fixed-income securities such as bonds. Therefore, the probability of successfully securing project financing on commercially reasonable terms is directly correlated to the level of contracted revenue with limited or manageable price risk.

Part One: Structuring the Feedstock Contract – Mitigating Waste Product Supply Risk

Feedstock contracts provide the raw material, often considered waste by others, that will be transformed into valuable products. It is crucial to structure these agreements to ensure a consistent and cost-effective supply of feedstock. The investment community seeks assurance that the feedstock supply is reliable and that the risks associated with its variability are well managed. This section of the guide will explore how to create robust feedstock contracts that can withstand market fluctuations and logistical challenges, thereby reassuring stakeholders of the project's feasibility.

Part Two: Structuring the Offtake Contract – Mitigating End Product Market Risk

Offtake agreements, which are contracts for the sale of the project's output, guarantee a market for the end product, making them a key element in securing finance. Structuring offtake contracts requires a strategic approach to risk management, ensuring that both price and demand risks are mitigated. This section of the guide will provide insights into negotiating contracts that appeal to the investment community by demonstrating clear and reliable revenue streams, which are essential for the project's long-term profitability and sustainability.

Part Three: Mitigating Technology Risk & Accelerating Innovation

Innovations in technology are at the heart of transforming industrial minerals waste into valuable products. However, the adoption of new technologies comes with inherent risks, particularly regarding performance and reliability. To attract financing, project developers must demonstrate that these technological risks are managed effectively. One increasingly popular method is through technology performance insurance, which provides a safety net by covering failures in technology performance. This section will outline how securing such insurance not only protects the project but also enhances its credibility with potential investors.

Part Four: Securing Cost Estimates & Managing Construction Risk

Ensuring the accuracy of capital expenditure (CapEx) forecasts and developing a sound plan to manage costs and avoid cost overruns is essential for any project to remain feasible from concept through operation. Structuring high-quality contracts with project managers or owner's representatives, followed by meticulous agreements with engineering, procurement, and construction (EPC) contractors, is fundamental to maintaining control over costs. This section of the guide will discuss strategies for crafting these contracts to ensure that all parties are aligned and that project costs are kept within budget, which is a critical assurance for lenders and investors.

Part Five: Navigating a Nascent but Rapidly Developing Capital Market

Exploring creative financing structures, such as tax-exempt municipal financing, is particularly critical in the realm of industrial minerals waste-to-value projects, largely because the capital market for these projects is still in its developmental stages. Traditional financing models often fall short in accommodating the unique risks and returns associated with waste-to-value projects, which can include unproven technology risks and variable revenue streams. Moreover, these projects typically require substantial upfront investment for technology development and infrastructure, with longer periods before achieving profitability.

Tax-exempt municipal financing can play a pivotal role in bridging this gap. By offering lower interest rates and potential tax benefits, such financing makes these projects more economically viable and attractive to investors who might otherwise be hesitant to commit capital to a developing market. This approach not only helps secure the necessary funds to bring these innovative projects to fruition but also fosters a supportive financial environment that encourages further investment and development in sustainable waste management solutions. This section of the guide will delve into how to navigate the capital market for waste-to-value projects and strategies for success.

Putting It All Together: Achieving a Blueprint for Repeatability & Scalability

Securing project finance for industrial minerals waste-to-value projects requires a holistic approach, balancing risk management with strategic contract structuring. Each of the five key areas discussed forms an integral part of the financial tapestry that supports these pioneering projects. By addressing these areas comprehensively, project developers can not only enhance their chances of securing the necessary funds but also pave the way for successful, repeatable, and scalable project implementation.

Part One: Structuring the Feedstock Contract – Mitigating Waste Product Supply Risk

In the development of industrial minerals waste-to-value projects, securing a reliable and sustainable feedstock supply is a critical element that underpins the entire project. This section explores the principal risks associated with feedstock procurement and outlines strategic measures to mitigate these risks, thereby enhancing the project's viability and attractiveness to the investment community

Understanding Tipping Fees

In the waste management sector, tipping fees are essentially gate fees charged for the disposal of waste in landfills. These fees are crucial for waste-to-value projects because they represent a potential cost to waste suppliers and can incentivize the diversion of waste to more sustainable and value-generating alternatives. When waste-to-value projects can accept waste without charging a fee or even offer a lower fee than local landfills, they become more economically attractive to waste suppliers. In some cases, if the economics align, waste-to-value projects may even receive tipping fees themselves, turning what is traditionally a cost center into a source of revenue, which is highly attractive to the investment community.

Regional Variations in Tipping Fees

United States

In the U.S., tipping fees vary widely by state and locality, reflecting differences in landfill availability, local regulations, and the regional economics of waste disposal. Higher fees in densely populated or heavily regulated areas can drive waste generators to seek more cost-effective alternatives, such as waste-to-value projects. Conversely, in regions with lower fees, securing waste feedstock might be more challenging, requiring projects to offer additional economic or environmental value propositions to potential waste suppliers.

Europe

Europe's approach to waste management is heavily influenced by stringent EU directives aimed at reducing waste, promoting recycling, and minimizing landfill use. As a result, tipping fees are generally higher to discourage landfill use and encourage more sustainable practices. This regulatory environment creates favorable conditions for waste-to-value projects, as higher landfill costs make alternative waste processing options more appealing both economically and environmentally.

Asia

The situation in Asia is highly variable, with tipping fees ranging from very low in some developing regions to comparatively high in more developed areas like Japan and South Korea. In countries with low fees, waste-to-value projects must compete with inexpensive landfilling options, often necessitating higher efficiency or subsidies to attract waste feedstock. However, in areas where environmental regulations are tightening, there is increasing opportunity for projects that offer waste reduction solutions.

Latin America

Similar to Asia, tipping fees in Latin America vary widely. In many parts, landfill fees are low due to less stringent regulatory frameworks, which can pose a challenge for the economic viability of waste-to-value projects. However, urban areas with more developed waste management systems may see higher fees, which can drive interest in alternative waste processing methods that offer economic benefits over traditional landfilling.

Understanding the dynamics of tipping fees across different regions is crucial for developing effective feedstock procurement strategies in waste-to-value projects. Projects in regions with higher tipping fees have a competitive advantage in attracting waste suppliers looking to reduce disposal costs. Meanwhile, in regions with low tipping fees, waste-to-value projects may need to explore additional incentives or innovative business models to secure a consistent and economically viable feedstock supply.

Long-term Sustainability of Waste Supply

The cornerstone of any waste-to-value project is its ability to ensure a continuous supply of feedstock over the long term. A key risk is the depletion or reduction in availability of the waste material due to regulatory changes, market dynamics, or alternative uses becoming more economically attractive. To mitigate this risk, it is crucial to engage in long-term contracts with multiple suppliers to diversify sources and reduce dependency on a single supplier. Additionally, conducting thorough market research to forecast changes in waste production and exploring partnerships with waste generators can provide more control over feedstock supply.

Counterparty Credit Risk

The financial health of suppliers poses a significant risk, particularly if a supplier becomes insolvent and unable to fulfill their contractual obligations. Mitigation strategies include performing detailed due diligence before contract signing, monitoring the supplier's financial health continuously, and requiring security measures such as advance payments, bank guarantees, or letters of credit. These measures ensure that even if a counterparty fails, the project's feedstock supply and financial stability are not jeopardized.

Inflation Risk

Fluctuations in economic conditions can lead to inflation, which in turn impacts the cost of feedstock. To manage this risk, contracts can be structured with built-in price escalation clauses that are tied to inflation indices. This arrangement ensures that the feedstock costs adjust in line with inflation, thereby stabilizing expenses and maintaining project margins over time.

Pricing/Structuring to Achieve a Fixed-Income Proxy

Investors, as mentioned previously, often favor waste-to-value projects that offer returns resembling those of fixed-income securities, which are characterized by predictable and stable cash flows. To make the project appealing as a fixed-income proxy, structuring feedstock contracts with fixed or minimum price clauses can stabilize revenue streams. Furthermore, implementing take-or-pay clauses ensures that a specified minimum amount of waste is purchased regardless of the project's operational status, providing a guaranteed cash flow similar to fixed-income products.

Quality Variability Risk

Variability in feedstock quality can significantly impact the project's operational efficiency and output. Poor-quality feedstock may require additional processing, which can escalate costs and reduce efficiency. To mitigate this risk, it is essential to specify quality parameters in the contract and include penalties or price adjustments for feedstock that does not meet these specifications. Regular audits and quality checks of the supplied feedstock can further safeguard the project against this risk.

Regulatory and Compliance Risks

Compliance with environmental and industry-specific regulations is paramount. Changes in regulations can affect the availability and cost of feedstock. Engaging with regulatory bodies, staying updated on potential legislative changes, and incorporating compliance costs into the project budget are key strategies for managing these risks.

Transportation and Logistics Risk

The logistics of transporting feedstock can pose risks related to cost, timing, and environmental impact. Securing third-party logistics partners with robust capabilities and establishing contingency plans for transportation disruptions are critical to ensure steady feedstock availability.

Effectively managing feedstock risks through strategic planning, careful contract structuring and proactive risk management practices not only secures the supply chain but also boosts the project's credibility and financial appeal to investors, thereby laying a solid foundation for successful project execution and long-term sustainability.

Part Two: Structuring the Offtake Contract – Mitigating End Product Market Risk

Securing offtake agreements is a critical step in the development of industrial minerals waste-to-value projects, as these contracts directly influence the project's financial stability and appeal to the investment community. This section examines the key risks associated with offtake agreements and outlines effective mitigation strategies.

Strength and Depth of the End Market

A fundamental risk in offtake arrangements is the potential weakness or limited depth of the markets for the products derived from waste. If the end market is not robust enough, the project may face challenges in selling its output at forecasted prices or, in some cases, selling it at all. To mitigate this risk, it's important to conduct extensive market research to validate the demand and competitive landscape. Diversifying the product range to cater to multiple market segments can enhance market penetration and reduce dependency on a single consumer base.

Qualification Process To Sell Product Derived from Waste

Products derived from waste materials often need to meet specific industry standards or certifications before they can be marketed. The qualification process can be lengthy and costly, posing a risk to the project's timeline and budget. Addressing this, it's crucial to begin the qualification processes early and engage with regulatory bodies and potential customers to

understand their requirements fully. Securing pre-approvals or certifications can also be factored into the project planning phase to streamline market entry.

Counterparty Credit Risk

Similar to feedstock procurement, the financial stability of offtake partners is critical. If an offtake partner fails financially, the project may lose a crucial revenue stream. Mitigating this risk involves conducting thorough due diligence on potential partners, insisting on creditworthy counterparts, and securing financial guarantees or insurance products that protect against counterparty default.

Pricing/Structuring to Achieve a Fixed-Income Proxy

As mentioned previously, investors favor projects that offer stable and predictable returns. Structuring offtake agreements with fixed pricing, minimum purchase commitments, or take-or-pay clauses can provide predictable cash flows akin to fixed-income securities. These contractual elements assure investors of steady revenues, enhancing the project's financing prospects.

Managing Multiple Value Products

When waste conversion yields multiple products, prioritizing those that offer the most stable revenues is crucial. Analyzing each product's market dynamics, such as demand stability, price volatility, and growth potential, allows project developers to focus on contracts that maximize financial stability. Contracting products with reliable buyers for reasonably long terms with price protection enhances overall project viability, especially if one of the end products' markets does not work on long-term contracts or has a particularly challenged end market from a credit perspective.

Transportation and Delivery Risks

Ensuring the timely and cost-effective delivery of products is vital. Delays or failures in logistics can lead to breaches of contract and financial penalties. Developing robust logistics solutions, including contingency plans and partnerships with reliable transportation providers, mitigates these risks.

Regulatory and Compliance Risks

The sale of products derived from waste can be heavily regulated. Changes in environmental regulations or product safety standards could affect the ability to sell certain products. Proactive engagement with regulators and continuous monitoring of legislative changes is essential to anticipate and adapt to new requirements.

Effectively managing the risks associated with offtake agreements involves strategic planning and careful contract structuring. By ensuring the reliability and creditworthiness of offtake partners, diversifying product portfolios, and securing contracts that provide predictable revenue streams, waste-to-value projects can significantly enhance their financial structure and appeal to the investment community, thus securing the project's long-term success.

Part Three: Mitigating Technology Risk & Accelerating Innovation

Technology risk represents a significant challenge in industrial minerals waste-to-value projects, particularly as these projects often involve innovative processes to convert waste into usable

products. Effective management of technology risk is crucial for the successful implementation and operation of these projects. This section explores the concept of Technology Readiness Levels (TRL), the role of technology performance insurance, and other key risk mitigation tools.

Technology Readiness Level (TRL) Index

The TRL index is a system used to assess the maturity level of a specific technology. Originally developed by NASA, the scale ranges from 1 to 9, with 1 being the lowest level of readiness (basic principles observed and reported) and 9 representing the highest level (actual system proven through successful mission operations). In the context of waste-to-value projects, understanding and evaluating the TRL can help stakeholders, including investors and project managers, gauge the feasibility and reliability of the technology involved. Higher TRLs suggest a lower risk associated with technological failures, thereby enhancing confidence among financiers and partners.

Measuring Technology Risk

Technology risk in projects is typically assessed by evaluating the technology's complexity, stage of development, past performance in similar applications, and the expertise of the team involved in deploying the technology. Assessments often involve detailed technical due diligence, pilot testing, and third-party evaluations to validate the technology's performance claims. Higher risks are associated with lower TRLs, where uncertainties about scalability, operational reliability, and performance under commercial conditions prevail.

Technology Performance Insurance

This type of insurance is designed to mitigate the financial risk if the technology does not perform as specified. It covers the shortfall in expected performance outputs, which can crucially protect the project's revenue streams and its ability to meet financial obligations. The importance of technology performance insurance lies in its ability to provide a safety net for new and unproven technologies, making projects more attractive to investors who might otherwise be wary of the inherent risks.

Underwriting Technology Performance Insurance

Underwriting such insurance involves a comprehensive evaluation of the technology itself, including its design, operational history, and the credentials of the development team. Insurers will often require access to detailed performance data and may also involve external experts to assess the technology's TRL. The terms of the insurance, including premiums and coverage limits, are typically based on this assessment. The higher the perceived risk, the more stringent the insurance terms can be, which could include higher premiums or more specific performance criteria that must be met.

Other Technology Risk Mitigation Tools

Escrow Accounts and Performance Bonds

These can be set up to ensure that there are financial resources available to address any issues if the technology fails to perform as expected. Performance bonds provided by the technology suppliers can also reassure project developers and financiers.

Extended Warranties and Service Agreements

Arrangements with technology providers for extended warranties or maintenance and service agreements can help manage operational risks by ensuring ongoing support and maintenance.

Incremental Implementation

Phasing the technology implementation allows for mitigating risks by testing the technology in stages under actual operating conditions, which can help identify and rectify issues before full-scale deployment.

Partnerships with Technology Developers

Forming strategic partnerships with technology developers can provide access to expert knowledge and resources, reducing the technology risk. These partnerships can also involve shared risk agreements where the technology provider shares in the risk of technology failure.

Effectively managing technology risk is critical for securing financing and ensuring the success of waste-to-value projects. By combining thorough assessment methods, insurance products, and strategic risk-sharing mechanisms, project developers can enhance the reliability and appeal of their projects to potential investors and partners.

Part Four: Securing Cost Estimates & Managing Construction Risk

In the development of industrial minerals waste-to-value projects, managing construction and project cost overrun risks is crucial for maintaining project timelines and budgets. This section provides a comprehensive overview of the front-end loading (FEL) process, the distinction between development capital and project finance, and the roles and responsibilities of project managers and EPC contractors.

Front-End Loading (FEL) Process

FEL is a structured project planning methodology used to define project scopes, estimate costs, and evaluate risks before significant capital is committed. It consists of three primary stages:

FEL 1 – Conceptual Planning

This initial stage focuses on evaluating project viability, including preliminary feasibility studies and market analysis. The main goal is to identify potential technical solutions and estimate rough investment costs.

FEL 2 – Feasibility

This stage involves more detailed feasibility studies and engineering designs. It refines project scope, improves cost estimates, and identifies key risks. This stage also includes securing necessary permits and initial stakeholder engagements.

FEL 3 – Detailed Engineering

The final stage before full project execution involves completing detailed engineering designs, finalizing project specifications, and firming up contracts and procurement strategies. This stage aims to minimize uncertainty and lock down precise cost estimates.

The importance of the FEL process lies in its ability to significantly reduce price risk by providing thorough project definitions and detailed cost forecasts. It allows project developers to make informed decisions about whether to proceed, modify, or halt a project based on detailed risk assessments and financial analysis.

Development Capital vs. Project Finance

Development capital refers to the funds required during the early stages of a project, covering expenditures from initial explorations through the completion of detailed project designs (typically covering FEL stages 1 and 2). These expenditures might include costs for feasibility studies, initial engineering work, and securing permits. In contrast, project finance kicks in during the later stages (post-FEL 3) and covers the bulk of the construction costs. It is structured based on the project's anticipated cash flows once operational, making it crucial to have accurate cost estimates established during the FEL process.

The Role of a Project Manager/Owner's Representative

The project manager or owner's representative plays a critical role in overseeing the project from concept through completion. They ensure that the project adheres to its scope, budget, and timeline and meets quality standards. Their oversight is crucial for managing communication between stakeholders, resolving conflicts, and ensuring that all parties adhere to contractual obligations. Effective project management helps mitigate risks associated with delays, cost overruns, and technical compliance.

Types of Engineering, Procurement, and Construction (EPC) Contracts

Lump Sum Turnkey (LSTK)

The contractor agrees to deliver the project at a fixed price. Benefits include cost certainty and reduced owner risk, but drawbacks can include high initial cost estimates as contractors price in risk.

Cost Plus Contract

The contractor is paid for all construction-related expenses plus a fee for profit. This can lead to better quality and more thorough project execution but may also result in higher overall costs due to less incentive for cost control.

Unit Price Contract

Payment is based on the quantity of materials used. This contract can be beneficial when project details are not fully known, offering flexibility in modifications. However, it may also lead to higher costs if material usage exceeds initial estimates.

Understanding these diverse contract types helps project sponsors choose an appropriate structure based on their risk tolerance, budget constraints, and project specifics. Each contract type offers different benefits and drawbacks, impacting the project's financial structure and risk profile. Managing these elements effectively is essential for the successful delivery of waste-to-value projects in the industrial minerals sector.

Part Five: Navigating a Nascent but Rapidly Developing Capital Market

Exploring creative financing avenues is pivotal in the development of industrial minerals waste-to-value projects, especially given the challenges of securing traditional financing due to the variable nature of these projects. This section delves into the nuances of financing projects at different equity levels, the critical role of high-quality contracts in securing non-dilutive project finance, the advantages of tax-exempt municipal financing, and regional variations in municipal funding.

Financing at Corporate vs. Special Purpose Vehicle (SPV) Levels

Financing a project can be structured at either the corporate equity level or through a subsidiary special purpose vehicle (SPV). At the corporate level, financing is based on the overall balance sheet of the company, encompassing all its assets and liabilities. This approach can be more straightforward but might dilute existing equity.

Conversely, SPV financing isolates the financial risks and rewards of the project, limiting them to the SPV itself. This isolation helps in attracting project-specific investors and lenders by providing a clearer picture of the project's risks and potential returns. SPV financing is particularly advantageous when the contracts within the project sufficiently mirror a fixed-income proxy due to stable pricing structures, making the project's cash flows predictable, as this avenue allows for non-dilutive growth.

Importance of High-Quality Contracts

High-quality, robust contracts are essential to achieving non-dilutive project finance, especially through SPVs. These contracts need to clearly define terms and conditions, pricing, delivery schedules, and penalties for non-compliance to reassure investors and lenders of the project's viability and stability of returns. Such contracts enhance the project's creditworthiness and can help secure financing on more favorable terms by reducing perceived risks.

Benefits of Tax-Exempt Municipal Financing

Tax-exempt municipal financing is particularly beneficial for waste-to-value projects due to their alignment with public policy goals such as waste reduction and environmental sustainability. These financing instruments typically offer lower interest rates and tax-free returns to investors, reducing the overall cost of capital for the project. The waste re-processing component of these projects often qualifies them for such financing, as they provide tangible public benefits by diverting waste from landfills and converting it into useful products.

Regional Variations in Municipal Funding

United States

In the U.S., tax-exempt municipal bonds are a popular financing tool for projects that serve a public purpose, such as infrastructure or environmental projects. The tax-exempt status of these bonds makes them attractive to investors looking for tax-advantaged investment opportunities, thereby lowering the borrowing costs for the project developers.

Europe

European municipal funding often comes with stringent criteria related to environmental impact and sustainability. EU directives and national policies promote funding for projects that contribute to environmental goals, with various grants and low-interest loans available.

Asia

The availability of municipal funding in Asia varies widely by country, with some regions offering incentives for sustainable projects while others have less developed frameworks for such funding. Projects may need to align with specific government agendas to access public funds.

Latin America

In Latin America, municipal funding for environmental projects is growing but remains less developed compared to regions like Europe or North America. Projects often require significant alignment with national or local environmental policies to secure funding.

Navigating the complexities of project financing requires a strategic approach that considers both the structure of the financing and the geographical context. By leveraging high-quality contracts and innovative financing mechanisms like tax-exempt municipal financing, developers can enhance the feasibility and attractiveness of industrial minerals waste-to-value projects.

Achieving a Circular Economy for the Industrial Minerals Sector: Repeatability & Scalability

The process of financing industrial minerals waste-to-value projects, as detailed in this comprehensive guide, underscores the critical importance of successfully navigating the five key parts of project financing: structuring the feedstock contract, structuring the offtake contract, mitigating technology risk, securing cost estimates, and navigating a nascent but rapidly developing capital market. Each component is integral not only to securing the initial financing but also to ensuring the project's long-term sustainability and profitability.

The structured approach to each financing stage, beginning with robust contract management and extending through innovative financing solutions like tax-exempt municipal financing, highlights a pathway that is not only feasible but also repeatable and scalable across different regions and market conditions. By adhering to these strategic elements, project developers can replicate success in diverse settings, effectively turning industrial waste into valuable commodities while contributing to environmental sustainability.

This guide provides not just a blueprint for navigating the complexities of project financing in the industrial minerals sector but also a scalable model that can be adapted and replicated, ensuring

that the benefits of sustainability and resource efficiency are maximized. As more projects successfully implement these practices, it becomes increasingly feasible to envision a circular economy where waste is consistently transformed into worth, demonstrating a potent blend of ecological stewardship and economic viability.

** this article complements Nick Rohleder's presentation "Financing waste to industrial mineral value assets" given at IMFORMED's Mineral Recycling Forum 2024, Dubrovnik, 22-24 April.*



Nicholaus Rohleder, Co-Founder, Climate Commodities, USA

Nicholaus is the Co-Founder of Climate Commodities (CC), which is a climate economy-focused platform company with operating subsidiaries in physical trading, mineral processing & refining, transportation & logistics, renewable power, insurance, and financial services. He also serves as Independent Director at: Ardour Capital, EnergyLink, American Hydrogen, and Lone Cypress Energy Services. Outside of his professional commitments, Nick is as an Adjunct Professor at the University of Pennsylvania, where he teaches the course Climate Technology: Finance & Policy. He has a MSc in Major Programme Management from the University of Oxford, focused on financing and developing energy infrastructure and metals & mining projects in emerging markets, a MSc in Environmental Studies from the University of Pennsylvania, a MSc in Sustainability Management from Columbia University, and is a former Forbes 30 Under 30 honoree in the energy category.
nr@climate-commodities.com

