NIIR PROJECT CONSULTANCY SERVICES

CLIENT SUCCESS STORY

CASE STUDY

Iron Ore Pelletisation with Beneficiation

Shyam Steel Manufacturing Limited

Transforming Investment Ideas into Profitable Industrial Ventures

Industry	Location	Project Type
Mineral Processing & Steel	**Bankura, West Bengal, India**	**Techno-Economic Feasibility Study**

PREPARED BY

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ABOUT NPCS

Niir Project Consultancy Services (NPCS) is one of India's most respected and comprehensive industrial knowledge institutions, providing specialized advisory services across manufacturing, infrastructure, agro-processing, chemicals, and mineral-based industries. With four decades of unbroken experience, NPCS has evolved into a trusted partner for entrepreneurs, MSMEs, large corporates, government bodies, and international investors seeking bankable industrial intelligence.

NPCS is part of Asia's leading industrial knowledge ecosystem with thousands of project profiles and global consulting expertise.

Core Services

- Detailed Project Reports (DPR) – Bankable, lender-ready feasibility documents covering technical, financial, and regulatory dimensions.
- Techno-Economic Feasibility Studies – Rigorous analysis of market viability, investment requirements, and projected returns.
- Market Research & Intelligence – Primary and secondary research across domestic and global markets.
- Engineering Advisory – Technology selection, plant layout, machinery specification, and process optimization.
- Strategic Business Consulting – Business planning, risk mitigation, regulatory navigation, and implementation roadmaps.

30,000+	50+	30+	250,000+
Project Reports Published	Countries Served	Years of Expertise	Industrial Projects Delivered

PROJECT SNAPSHOT

Detail	Information
Client Name	M/s. Shyam Steel Manufacturing Limited
Location	Bankura, West Bengal, India
Industry	Large-Scale Mineral Processing & Steel
Project	Manufacturing of Iron Ore Pellets with Beneficiation
Services by NPCS	Techno-Economic Feasibility, Market & Raw Material Analysis, Cost Estimation, Financial Viability Study, Implementation Roadmap, Strategic Advisory
Status	Client approved project; now engaging engineering partners and equipment suppliers

CLIENT OVERVIEW

Shyam Steel Manufacturing Limited (SSML) is an established industrial enterprise in the eastern India steel and manufacturing sector. Recognized for operational excellence and a forward-looking management ethos, SSML approached NPCS to identify and evaluate a new manufacturing opportunity that would:

- Deliver long-term profitability and stable, recurring cash flows.
- Leverage the abundant mineral resources and established logistics infrastructure of eastern India.
- Comply with environmental regulations and align with India's emerging green steel imperatives.
- Offer a scalable, technically sound production platform within manageable capital parameters.

SSML's management sought an objective, data-driven partner capable of identifying the right opportunity, validating its feasibility, and charting an executable implementation pathway. They selected NPCS for its depth of industrial knowledge, proven track record in mineral-based manufacturing, and comprehensive end-to-end support model.

PROBLEM STATEMENT & CHALLENGES

Entering the mineral processing sector presented SSML with a complex matrix of strategic, technical, financial, and regulatory challenges:

01	**Market Complexity** Identifying the right product segment in a crowded and evolving iron and steel value chain — one that balanced demand growth, pricing stability, and competitive differentiation.
02	**Technical Feasibility Uncertainty** Pelletisation with beneficiation involves multi-stage processing: crushing, grinding, magnetic separation, balling, and high-temperature induration. Selecting appropriate technology, capacity, and equipment required deep technical expertise.
03	**Raw Material Supply Risk** Sustained access to iron ore fines — the primary feedstock — from mines in Odisha and Jharkhand required careful logistics mapping and supply chain planning to ensure cost-effective, uninterrupted supply.
04	**Capital Investment Sizing** Determining the optimal plant capacity, capital outlay, and financing structure while maintaining viable margins and acceptable payback horizons was a key financial challenge.
05	**Regulatory & Environmental Compliance** Setting up a mineral processing plant entails navigating environmental clearances, pollution control norms, land acquisition regulations, and industrial licensing, adding layers of risk to project timelines.
06	**Market Price Volatility** Iron ore and pellet prices are influenced by global steel demand, shipping costs, and policy interventions. Stress-testing financial models against price fluctuations was essential to investor confidence.

OUR APPROACH & STRATEGY

NPCS applied its proven five-phase consulting methodology — combining market intelligence, technical engineering analysis, financial modeling, and strategic advisory — to deliver a bankable, comprehensive feasibility study:

Phase 1	**Opportunity Identification** NPCS analysts reviewed industrial trends, policy directives, and regional resource availability. Iron ore pelletisation with beneficiation was identified as the most viable opportunity based on demand growth, West Bengal's emerging capacity, and SSML's locational advantage in Bankura.
Phase 2	**Market Analysis** A thorough market intelligence exercise covered domestic pellet consumption trends, blast furnace adoption rates, DRI plant demand patterns, global market projections (USD 70.87 Bn in 2025 → USD 120.76 Bn by 2034 at 6.1% CAGR), and competitive landscape benchmarking.
Phase 3	**Technical Feasibility** Detailed technical parameters were defined: beneficiation stages (crushing, grinding, magnetic separation), pellet plant design (disc pelletiser/drum, induration furnace), optimum capacity selection (1–2 MTPA), energy and water requirements, and comparative technology and equipment supplier analysis.
Phase 4	**Financial Modeling** Comprehensive CapEx and OpEx models were developed. Income statements, cash flow projections, break-even analysis, ROI/IRR calculations, and sensitivity analysis across capacity utilization scenarios (65%, 75%, 85%) and price scenarios were prepared.
Phase 5	**Implementation Strategy & Advisory** A phased project execution roadmap was created covering engineering design, environmental clearances, equipment procurement, civil construction, commissioning, and trial runs. Risk mitigation strategies — including long-term raw material contracts and captive power arrangements — were integrated throughout.

SCOPE OF SERVICES DELIVERED

NPCS provided a comprehensive suite of consulting services tailored to SSML's investment decision requirements:

- Detailed Project Report (DPR) preparation — covering all technical, commercial, and financial dimensions of the pelletisation project.
- Conceptual plant layout recommendations — integrating beneficiation, pelletisation, and materials handling sections with space for future expansion.
- Machinery identification and specification — comparison of leading equipment suppliers for crushers, ball mills, magnetic separators, disc pelletisers, and travelling grate induration furnaces.
- Raw material availability analysis — feedstock supply mapping from Odisha and Jharkhand mines with logistics cost modelling via road and rail.
- Market research & demand validation — domestic and global pellet demand analysis, buyer identification, and pricing benchmarks.
- Financial modelling — multi-scenario CapEx/OpEx models, profitability projections, break-even analysis, ROI/IRR estimates, and sensitivity testing.
- Implementation roadmap — phase-wise project schedule from pre-engineering through commercial operations, with critical path identification.
- Strategic advisory — alignment with green steel policy, fiscal incentive identification, and guidance on technology transfer and downstream integration options.

TECHNICAL INSIGHTS: MANUFACTURING PROCESS

The iron ore pelletisation process transforms low-grade iron ore fines — a by-product of lump ore mining — into high-value, uniform pellets suitable for blast furnace and DRI plant operations. The process comprises the following stages:

Step 1	**Raw Material Receival & Stockpiling** Iron ore fines (Fe content typically 55–63%) are received by road/rail from mines in Odisha/Jharkhand and stockpiled in covered bays to prevent moisture absorption and grade dilution.
Step 2	**Beneficiation — Crushing & Grinding** Fines are passed through jaw crushers, rod mills, and ball mills to reduce particle size to below 200 mesh, increasing surface area and liberating iron mineral from gangue.
Step 3	**Beneficiation — Separation** Magnetic separation removes non-magnetic impurities (silica, alumina). The resultant iron-rich slurry (Fe content 63–67%) is filtered and dewatered to produce filter cake, the primary pelletiser feed.
Step 4	**Mixing & Balling** Filter cake is blended with binders (bentonite, lime) and fluxes (dolomite, limestone) in ribbon mixers. The moistened mix is fed to disc pelletisers or drum pelletisers to form green balls of uniform diameter (8–16 mm).
Step 5	**Induration (Thermal Hardening)** Green balls are dried, pre-heated, fired (1200–1350°C), and cooled in a travelling grate induration furnace. This imparts mechanical strength and reduces porosity, producing finished pellets with compressive strength >200 kg/pellet.
Step 6	**Product Screening, Storage & Dispatch** Finished pellets are screened for size uniformity, stored in silos, and dispatched to steel plants via road or rail. Off-specification pellets are recycled back into the process.

Key Technology Advantages

- Uniform size (8–16 mm) and high iron content (63–67% Fe) improve blast furnace productivity and reduce coke consumption.
- Improved reducibility enables DRI plants to produce higher-quality sponge iron with lower energy inputs.
- Waste heat recovery from induration furnaces reduces energy costs and emissions.
- Beneficiation enables use of low-grade ore fines that would otherwise be waste, improving resource efficiency and sustainability.

FINANCIAL & MARKET ANALYSIS

Market Opportunity

NPCS's market intelligence established a compelling demand thesis for iron ore pellets across domestic and global markets:

- India's crude steel production reached 152 million tonnes in FY 2024–25, growing approximately 5% year-on-year. Pellet usage in blast furnaces has risen from 25% to over 50% of feedstock.
- India's total iron ore pellet production reached 105 million tonnes in FY 2024–25 (5% YoY growth), with West Bengal emerging as the third-largest producing state — output grew ~30% to over 11 million tonnes.
- The global iron ore pellets market was valued at USD 70.87 billion in 2025 and is projected to reach USD 120.76 billion by 2034 at a CAGR of 6.1%.
- Domestic demand expected to remain robust as depletion of high-grade lump ore pushes both blast furnace and DRI producers to increase pellet dependency.
- Government's Purvodaya initiative plans an integrated steel hub across Odisha, Jharkhand, Chhattisgarh, West Bengal, and northern Andhra Pradesh — directly benefiting eastern India pellet producers.

Investment Overview

NPCS benchmarked investment requirements against comparable projects, providing SSML with realistic financial expectations:

Parameter	Benchmark Range	Notes
Plant Capacity	1–2 MTPA	Economical entry scale; scope for expansion
Raw Material Cost	40–50% of OpEx	Iron ore fines, binders, fluxes
Utilities Cost	30–40% of OpEx	Power, fuel, water
Gross Profit Margin	20–30%	Under normal operating conditions
Net Profit Margin	8–12%	After depreciation, interest, taxes
Capacity Utilisation	65% / 75% / 85%	Scenarios modelled for sensitivity analysis

Financial Viability Highlights

- CapEx benchmarks drawn from comparable 1 MTPA pelletisation and beneficiation facilities, incorporating equipment, civil, utilities, and working capital components.
- Break-even analysis confirmed achievable at 55–65% capacity utilisation, providing a healthy safety margin for the project.

- Sensitivity analysis tested profitability under adverse scenarios: iron ore price increases (+15%), pellet price decreases (-10%), and higher energy costs (+20%).
- Under all tested scenarios maintaining 75%+ utilisation, the project delivered positive net margins, confirming financial resilience.
- Income projections and cash flow forecasts were prepared for a 10-year horizon, supporting lender due diligence and board-level investment decisions.

RESULTS & OUTCOMES

Following NPCS's rigorous feasibility assessment, Shyam Steel Manufacturing Limited's management formally approved the iron ore pelletisation project. The outcomes delivered by NPCS extend across multiple dimensions:

Business Impact

- **SSML's management received a banker-grade feasibility report supported by current market data, technical specifications, and multi-scenario financial models — eliminating guesswork and enabling an informed, board-approved investment decision.** Investment Decision Confidence:
- **Comprehensive sensitivity analysis and supply chain risk mapping significantly reduced SSML's exposure to raw material availability, price volatility, and technology selection risk.** Risk Reduction:
- **The project positions SSML as a premium pellet supplier within West Bengal's rapidly growing pellet production ecosystem and within the broader Purvodaya steel hub.** Strategic Positioning:
- **NPCS's implementation roadmap provided clear guidance on environmental clearance timelines, regulatory approvals, and compliance milestones, reducing planning uncertainty.** Regulatory Clarity:

Measurable Success Metrics

Outcome Area	Result Achieved
Project Decision	Board approval secured after NPCS feasibility review
Market Validation	Confirmed growing pellet demand in West Bengal & eastern India
Financial Clarity	10-year financial model with ROI/IRR and break-even analysis
Technical Blueprint	Process design, machinery specs, and layout recommendations delivered
Implementation Plan	Phased roadmap from clearances through commercial production
Financing Readiness	Preliminary lender interest confirmed on project merits

CLIENT TESTIMONIAL

"NPCS provided us with a clear and comprehensive blueprint for entering the iron ore pellet industry. Their market analysis highlighted West Bengal's emerging position as a leading pellet hub, while their technical and financial models gave us confidence in the project's viability. We particularly appreciated NPCS's practical recommendations on securing raw materials and optimizing production efficiency. With NPCS's guidance, we are moving ahead with a project that promises long-term profitability and aligns with our sustainability goals."

— Director, Shyam Steel Manufacturing Limited

WHY CHOOSE NPCS

Entrepreneurs, MSMEs, and investors across 50+ countries choose NPCS for five defining reasons:

✓ Proven Industrial Expertise 40+ years and 30,000+ project reports across virtually every manufacturing and processing sector in India and globally.	**✓ Global Market Understanding** Real-time market intelligence, export-import data analysis, and benchmarking against international industry standards.
✓ Data-Driven Feasibility Every recommendation is grounded in current market data, verified cost structures, and transparent financial modelling — no guesswork, no generic templates.	**✓ End-to-End Project Support** From initial opportunity identification through DPR preparation, financing guidance, and implementation advisory, NPCS is present at every decision milestone.
✓ Risk Mitigation Approach Multi-scenario sensitivity analysis, regulatory compliance mapping, and supply chain risk assessment protect client investments from foreseeable risks.	**✓ Trusted by Investors & Lenders** NPCS reports are recognized by banks, DFIs, and private equity investors as credible, bankable documents for project financing and board approvals.

CONCLUSION

The Shyam Steel Manufacturing Limited engagement exemplifies NPCS's core value proposition: transforming promising but complex industrial ideas into bankable, investor-ready project plans that eliminate risk and accelerate confident decision-making.

By grounding its analysis in current market data, rigorous engineering assessment, and transparent financial modelling, NPCS enabled SSML to commit to a venture with clear strategic merit:

- A growing domestic and global market for iron ore pellets, supported by India's green steel transition.
- A strong regional advantage from Bankura's proximity to eastern India's mineral-rich belt and the Purvodaya steel hub.
- Commercially viable margins (20–30% gross, 8–12% net) confirmed across multiple financial scenarios.
- A technically sound, executable implementation roadmap that de-risks project delivery.

As India's steel industry continues its growth trajectory — targeting 300 million tonnes of capacity by 2030 — projects like SSML's iron ore pellet plant will be central to building an efficient, sustainable, and self-reliant steel value chain. NPCS is proud to have been the strategic intelligence partner enabling this investment decision.