ANGREN FERROTECH

Industrial Project for the Production of Ferroalloys in the Angren Free Economic Zone

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Section 1.

INTRODUCTION AND STRATEGIC JUSTIFICATION OF THE PROJECT

Strategic Resource, Global Market, and Uzbekistan's Opportunities

The project for establishing a ferroalloy production facility within the Angren Free Economic Zone (FEZ) is a strategically sound and internationally endorsed initiative that aligns with the key priorities of Uzbekistan's industrial development policy.

At the Uzbek-Slovak Business Forum held on June 9, 2025, in Tashkent, the Prime Minister of Uzbekistan, Abdulla Aripov, officially identified ferroalloy production in the city of Angren as one of the priority areas of cooperation between Uzbekistan and Slovakia. This statement serves as a direct political signal in favor of the project's high-level significance and as a strong indicator for international investors, financial institutions, and relevant government bodies.

The project, designated for implementation within the Angren FEZ, offers a range of systemic advantages:

- Existing industrial infrastructure (electricity, gas, rail and road logistics);
- Tax and customs incentives available to FEZ residents;
- Direct proximity to the Angren coal basin, a critical resource for metallurgical production;
- Opportunity to implement European technologies and quality standards in partnership with Slovak and other international companies.

The development of this business plan serves a dual purpose:

1. To act as an investment attraction tool, particularly in cooperation with European industrial companies specializing in ferroalloy smelting equipment and technology;
2. To provide a well-substantiated argument for the Angren FEZ Directorate, the Ministry of Investments, and relevant state institutions in support of initiating practical implementation of the project — in line with political will, economic rationale, and export-oriented objectives.

Alignment with Uzbekistan's Strategic Priorities:

- Supports import substitution (the country imports up to 40,000 tons of ferroalloys annually);
- Creates an export-oriented industrial cluster;
- Generates employment and tax revenues in an industrial region;
- Lays the groundwork for long-term cooperation with the EU in the metallurgical sector.

Technological Foundation and Global Trends

Ferroalloys are alloys of iron (Fe) with one or more alloying elements such as manganese, silicon, chromium, vanadium, etc., used in metallurgy for the production of various types of steel and cast iron. They serve the following key functions:

- Alloying of steel (to improve strength, hardness, corrosion resistance);
- De-carbonization and removal of impurities from molten metal;

- Enabling the production of stainless, structural, tool-grade, and heat-resistant steels with special properties.

According to **Grand View Research**, the global ferroalloy market was valued at **$45 billion in 2023**, with projected growth exceeding **$70 billion by 2030**. The main producers include **China, India, South Africa, Russia**, and **Brazil**. The rise in global demand is driven by the expansion of **construction, mechanical engineering, energy**, and **defense industries**.

Raw Material Potential of Uzbekistan

Uzbekistan has access to the key resources required for the production of ferroalloys:

Component	Availability in Uzbekistan	Notes
Quartzite / Silicon	☑ Yes	Navoi and Jizzakh regions
Coal / Coke	☑ Yes	Angren coal basin
Limestone / Fluxes	☑ Yes	Kashkadarya and Surkhandarya regions
Manganese Ore	⚠ Limited	Namangan region; partial import required
Chromite	❌ No	Imported from Kazakhstan and Turkey

Thus, the country is fully self-sufficient in raw materials required for **ferrosilicon** production. For **ferromanganese** and **ferrochrome** production, cost-effective sourcing from CIS countries is possible.

Import Substitution and Export Rationale

Currently, Uzbekistan imports between **30,000 and 40,000 tons of ferroalloys annually**. At the initial stage, the proposed project (12,000 tons/year) will be able to **cover up to 35% of domestic demand**. Upon expansion, the facility will be capable of achieving **full import substitution** and developing an export-oriented product flow.

Target Export Markets:

- **Kazakhstan, Iran, Turkey** — logistically advantageous and politically stable trade partners;
- **China** — despite being the global leader in production, **border regions** (Xinjiang, Yunnan) may still import ferroalloys under favorable pricing and contract conditions, especially for **special-grade products**.

Global Market: Trends, Volumes, Structure

(According to Grand View Research and the International Manganese Institute)

- In **2023**, the global ferroalloy market was valued at **$45 billion USD**.
- Projected growth by **2030**: **over $70 billion**, with a **CAGR of 6.2%**.

- **Key growth drivers**: rapid expansion in **steelmaking**, **construction**, **energy**, and **defense industries**.

Global Leaders in Ferroalloy Production

Country	Main Types of Ferroalloys	Market Share	Notes
China	FeMn, FeSi, FeCr	50–60%	World's largest producer and consumer
India	FeMn, FeCr	10–12%	Active global exporter
South Africa	FeCr	9–10%	Leading producer of chromium
Russia	FeCr, FeSi	~7%	Strong position in the CIS market
Brazil	FeMn	~5%	Supplies to the U.S. and European Union markets

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Strategic Advantages for Locating Ferroalloy Production in Uzbekistan

Resource	Availability Level	Remarks
Quartzite / Silicon	☑ Available	Deposits in Navoi and Jizzakh regions
Coal / Coke	☑ Available	Angren coal basin
Limestone / Fluxes	☑ Available	Found in Kashkadarya and Surkhandarya
Manganese Ore	⚠ Limited	Located in Namangan; partially meets domestic needs
Chromite	❌ Not available	Import required from Kazakhstan and Turkey

Thus, Uzbekistan can **fully support ferrosilicon production** using its own natural resources. For **ferromanganese** and **ferrochrome**, raw material imports from Kazakhstan and other CIS countries provide a **logistically efficient** diversification strategy.

Angren FEZ: The Ideal Location for the Project

- **Tax and customs incentives:** exemption from corporate income tax, VAT, and customs duties;
- **Guaranteed power supply at reduced tariffs** — a critical factor for energy-intensive metallurgical operations;
- **Direct export logistics** to Kazakhstan, Iran, China, and Turkey;
- **Availability of local coal resources and industrial utility networks**;
- **Strong state support** for FEZ initiatives and industrial policy alignment.

Import Substitution and Export Potential

Uzbekistan’s Current Imports:

- The country imports between **30,000 and 40,000 tons of ferroalloys annually**, primarily **ferrosilicon and ferromanganese**;
- **Domestic demand remains consistently high**, driven by:
  - **Almalyk Mining and Metallurgical Combine (AGMK)**,
  - **Uzbekistan Metallurgical Plant (Uzmetkombinat, UGMK)**,
  - and various metallurgical and machine-building enterprises.

Project Model

- At the initial stage (12,000 tons per year), the facility will cover up to 35% of domestic demand;
- Upon scaling up, the project will enable full import substitution and allow for the export of surplus volumes.

Planned Production Capacity

*At the initial stage, the project is designed to produce **12,000 tons of ferroalloys per year**.*

*This capacity is achieved through the installation of **three submerged arc furnaces**, each with a power rating of **5 MW**, operating **year-round** with consideration for technological load factors and smelting cycle durations. Based on technical calculations, and assuming an **average annual output of ~4,000 tons per furnace**, the facility will be capable of producing up to **12,000 tons of commercial-grade ferroalloys annually** (including various grades such as **FeSi** and **FeMn**).*

*According to market analytics, total domestic demand for ferroalloys in Uzbekistan is estimated at approximately **35,000–40,000 tons per year**. Therefore, the planned production capacity will enable the project to **cover about 30–34% of domestic demand already at the initial stage**.*

Target Export Destinations

- **Kazakhstan, Iran, and Turkey** — stable demand and accessible logistics corridors;
- **China** — despite being the world's leading producer of ferroalloys, certain **border regions** (e.g., **Xinjiang**, **Yunnan**) periodically experience **localized shortages** and show **interest in B2B procurement contracts**, particularly under favorable pricing conditions. Therefore, exports to China may be considered a **strategic optional market**, especially as production capacity expands.

Section 2.

PROJECT DESCRIPTION

Industry / Business Segment

The project is implemented within the **metallurgical industry**, specifically in the **ferroalloy production segment** — a critical supplier of alloying elements for the steel and machine-building sectors.
The activity qualifies as **energy-intensive and high-tech manufacturing** with a strong **export orientation**, aligned with the **industrial policy priorities of the Republic of Uzbekistan** and the specialization of the **Angren Free Economic Zone (FEZ)**.

Products / Services

The project envisions the production of the following core products:

Product Type	Application Area	Processing Level
Ferrosilicon (FeSi)	Steel deoxidation, casting, structural steel	High
Ferromanganese (FeMn)	Alloying, sulfur removal, construction-grade steel	High
Ferrochrome (FeCr)	Stainless and tool steels	High

In addition, the project allows for the **commercialization of secondary slag byproducts**, which can be reused in **construction and cement industries**, as well as the sale of **granulated residues** as auxiliary commercial materials.

Technological Features / Innovation

Production is based on the use of **electric arc submerged furnaces** (MW-class) utilizing smelting technology based on:

- **Local coal** from the **Angren basin** as a reducing agent;
- **Silicon**, **manganese**, and **chromium ores**;
- **Imported raw materials** (in case of chromite or FeMn) with **precise dosing and batch regulation**.

The project includes the following technological innovations:

- Deployment of **European (Slovak or German) dust collection and filtration systems** compliant with **EU environmental standards**;
- **Modular furnace configuration** allowing for scalable capacity expansion;
- Implementation of **automated melting control systems** (PLC/SCADA);
- **Heat recovery systems** for **pre-heating raw materials** through secondary energy utilization.

The project's **innovation value** is also demonstrated through its compliance with **international quality standards** — **GOST, ISO, DIN, and ASTM** — which opens access to global markets and **reduces entry barriers in international procurement tenders**.

Project Team Composition

Specialist Category	Qualifications and Experience	Comments / Recommendations
Technical Director	Metallurgical engineer with proven experience managing smelting operations.	Responsible for technology, safety, and overall production cycle management.
Project Engineer	Experience in designing and commissioning modular furnaces.	Involved in equipment integration, layout design, and commissioning.
Chief Power Engineer / Automation Systems Specialist (SCADA/PLC)	Expert in energy systems for electric arc furnaces; experience with SCADA, PLC, and safety systems.	Ensures energy efficiency and deployment of intelligent control systems.
Logistics and Export Consultant	Practitioner with hands-on knowledge of export logistics to Kazakhstan, Iran, Turkey, and China.	Develops the export strategy and calculates logistics costs.
Legal Counsel	Specialist in FEZ regulations, international contracts, and joint ventures.	Knowledge of FEZ residency registration and investment agreement procedures is essential.
Technology Partner (EU)	Slovak or German engineering firm (e.g., Stahlwerke Slovakia, Ferro Invest GmbH).	Potential for MoU signing, technology transfer, equipment supply, and technical supervision.

Legal and Organizational Structure

The project will be implemented through a **Limited Liability Company (LLC)**, registered in the Republic of Uzbekistan and obtaining official status as a **resident of the Angren Free Economic Zone (FEZ)**.

An alternative structure is possible in the form of a **Joint Venture (JV)** with a foreign investor, including potential partners from the **European Union**. This structure may provide access to **additional support mechanisms**, including:

- Dedicated financing instruments from the **EBRD**, **Uzbek Fund for Reconstruction and Development (UFRD)**,
- and participation in **investment subsidy programs**.

Section 3.

MARKET ANALYSIS

3.1. Overview of Target Markets (Domestic and International)

Uzbekistan demonstrates a consistently **high demand for ferroalloys**, particularly from **metallurgical and machine-building enterprises**. Key consumers include:

- **JSC Almalyk Mining and Metallurgical Combine (AGMK)**
- **JSC Navoi Mining and Metallurgical Combine (NGMK)**
- **JSC Uzbek Metallurgical Plant (Uzmetkombinat, Bekabad)**
- As well as various **machinery and heavy industry plants** located in Tashkent, Fergana, and other industrial hubs.

Major Metallurgical and Machine-Building Enterprises of Uzbekistan

Metallurgical Plants:

- **JSC Almalyk MMC (AGMK):** The country's largest producer of copper and non-ferrous metals; includes mines, beneficiation plants, metallurgical shops, and a pipe plant.
- **JSC Navoi MMC (NGMK):** The leading producer of gold, uranium, and non-ferrous metals in the Navoi region.
- **JSC Uzbek Metallurgical Plant (Uzmetkombinat, Bekabad):** Engaged in metal scrap recycling and production of rolled steel; partially integrated with the machine-building sector.

Machine-Building and Repair Plants:

- **Tashkent Metallurgical Plant:** One of the leading producers of flat-rolled steel serving the Tashkent region and neighboring countries.
- **JSC TQXTZ (formerly Tashkent Tractor Plant):** Producer of agricultural machinery, tractor fleets, and spare parts.
- **JV LLC Uz Truck and Bus Motors (MAN Auto-Uzbekistan):** A joint Uzbek-German venture for the assembly of MAN-brand trucks and special-purpose vehicles.
- **Tashkent Locomotive Repair Plant (TashTRZ):** Specializes in overhaul and maintenance of locomotives, electric trains, and freight wagons.

Additional Regional Industrial Players:

- **Foton Plant (Tashkent):** Engaged in microelectronics and equipment manufacturing (not directly relevant to ferroalloys but demonstrates industrial potential).
- **Equipment and Metal Trading Companies:**
  - **Evrasia Metal** (rolled metal products)
  - **BVB-Alliance** (metal trading and logistics)

Market Analysis Summary

- **AGMK, NGMK, and Uzmetkombinat** are the **primary bulk consumers** of ferroalloys, forming the core baseline demand.
- **Machine-building sector** (TQXTZ, MAN Auto, TashTRZ, etc.) also represents **partial demand** for ferroalloys in foundry processes.
- **Regional industrial clusters** are generating **additional demand** due to growing industrialization.

Export Market Opportunities

- **Kazakhstan, Kyrgyzstan, Tajikistan, Iran, and Turkey** have **stable demand for ferroalloys** but **limited domestic production capacity**.
- Uzbekistan benefits from **established logistics corridors**, including:
  - **Tashkent → Saryagash → Aktobe (Kazakhstan)**
  - **Angren → Pap → Kokand → Fergana → Osh (Kyrgyzstan)**
- The **European Union** and **Gulf countries** have shown interest in imports of ferroalloys **compliant with European standards**, especially in the case of strategic partnerships with Slovak technology providers.

3.2. Market Volumes and Trends

Indicator	Volume / Value	Commentary
Global Ferroalloy Market (2024)	~46 million tons	CAGR ~4.2% annually
Major Producers	China, India, Russia, South Africa, Brazil	>70% of global production
Average Selling Price	$1,200 – $2,000 per ton	Depends on alloy type
Uzbekistan's Imports	30,000–40,000 tons/year	Primarily FeSi and FeMn
Uzbekistan's Export Potential	Up to 15,000–25,000 tons/year	At full capacity utilization and project expansion

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3.3. Competitive Analysis

Competitor	Country	Capacity (tons/year)	Specialization	Advantages	Vulnerabilities
Eurasian Resources Group (ERG)	Kazakhstan	>100,000	FeSi, FeMn	Scale, developed infrastructure	High operating costs
Tikhvin Ferroalloy Plant	Russia	~90,000	FeSi	CIS logistics proximity	Sanctions-related risks
IMFA	India	>120,000	FeCr	Volume, advanced technology	Export overdependence

Competitor	Country	Capacity (tons/year)	Specialization	Advantages	Vulnerabilities
Angren Start-up Project	Uzbekistan	12,000 (Phase 1)	FeSi, FeMn, FeCr	FEZ tax incentives, proximity to raw materials, low-cost energy	New entrant; requires strategic partners

3.4. Pricing and Consumer Preferences

- **Ferroalloy prices vary by grade:**
  - **Ferrosilicon (FeSi):** $1,200–$1,600 per ton
  - **Ferromanganese (FeMn):** $900–$1,200 per ton
  - **Ferrochrome (FeCr):** $1,800–$2,400 per ton
- **Industrial consumers prioritize:**
  - **Supply stability**
  - **Compliance with technical specifications** (Fe content, impurity levels)
  - **Efficient logistics and delivery timelines**
  - **Availability of quality certificates and supporting documentation**

*Verified consumption data is available only for one enterprise — **JSC Uzbek Metallurgical Plant (Uzmetkombinat)**. Other major consumers do not publicly disclose annual ferroalloy procurement volumes. Therefore, the corresponding market estimates are based on indirect data and expert assessments, with clear source referencing.*

3.5. Average Annual Consumption of Ferroalloys (Ferrosilicon and Ferromanganese) by Key Enterprises

Consumer	Estimated Consumption (tons/year)	Comment and Source
JSC Almalyk MMC (AGMK)	–	No exact figures available; together with Uzmetkombinat, considered one of the largest consumers in the sector
JSC Navoi MMC (NGMK)	–	Combined consumption assessed jointly with AGMK based on overall industry demand
JSC Uzbek Metallurgical Plant (Uzmetkombinat)	> 7,000	Imports over 7,000 tons of ferrosilicon annually; localization plans up to 10,000 tons
Industrial Consumers (Metallurgy)	~15,000–18,000	
Industrial Consumers (Machine-Building)	~5,000–7,000	
Industrial Consumers (Small Industry)	~3,000–5,000	

Consumer	Estimated Consumption (tons/year)	Comment and Source
Total Domestic Market (Uzbekistan)	**20,000–25,000 tons/year**	In line with national import estimates (30,000–40,000 tons) and production scale-up potential

3.6. SWOT Analysis of the Project (Weighted Method)

Category	Factor	Weight (0–1)	Score (–5 to +5)	Index (Weight × Score)	Commentary
Strengths (S)	Access to preferential electricity rates in Angren FEZ	0.20	+5	**+1.00**	One of the main cost drivers in ferroalloy production; FEZ provides advantage.
	Government support and political priority	0.15	+5	**+0.75**	Project mentioned at international level, including with Slovakia.
	Import substitution potential in domestic market	0.10	+4	**+0.40**	Uzbekistan imports up to 40,000 t/year; domestic production can offset demand.
	Strong external demand for ferroalloys	0.10	+4	**+0.40**	Stable markets: Kazakhstan, Iran, Turkey.
	Local availability of raw materials	0.10	+3	**+0.30**	Access to domestic sources reduces logistics costs.
Weaknesses (W)	High initial CAPEX (from $15 million)	0.10	–3	**–0.30**	Requires external financing.
	Technological complexity of metallurgical production	0.05	–2	**–0.10**	Requires expertise and strategic partnerships.
	Limited pool of skilled labor	0.05	–2	**–0.10**	Training programs and personnel development needed.
Opportunities (O)	Attraction of EU investment and Slovak technologies	0.10	+5	**+0.50**	European partner line through Slovak Business Agency.
	Project scalability (2x–3x capacity expansion)	0.05	+4	**+0.20**	Strong rationale for expanding production base.
Threats (T)	Global price volatility for ferroalloys	0.05	–3	**–0.15**	Prices are volatile, especially in case of oversupply.

Category	Factor	Weight (0–1)	Score (–5 to +5)	Index (Weight × Score)	Commentary
	Risk of rising energy tariffs	0.05	–2	**–0.10**	Long-term energy pricing policies may shift.

Total Weighted Project Index: +2.90

Index Interpretation (CAAE Methodology, China)

Index Range	Sustainability Level	Interpretation
0.0 – 1.5	Low	Project is vulnerable and requires fundamental redesign or substantial state support.
1.6 – 2.5	Moderate	Average sustainability; feasible with partner support or subsidy programs.
2.6 – 3.5	Good	Economically viable, balanced, and attractive for investors.
3.6 – 4.5	High	Strategically stable; recommended for implementation.
4.6 – 5.0	Exceptional	Ideal investment profile (rare).

Section 4.

PRODUCTION PLAN

4.1 Description of Production Process and Technology

The production of ferroalloys (FeSi, FeMn, FeCr) is based on **electric arc smelting technology** using **submerged arc furnaces (SAF)**. The technological workflow includes the following stages:

1. **Preparation and batching of raw materials** (quartzite, carbonaceous materials, metallic additives);
2. **Charging** into modular electric arc furnaces (MEF);
3. **Electric smelting** at temperatures up to **1600 °C**;
4. **Tapping of metal and slag**;
5. **Cooling, crushing, and sizing of the ferroalloy**;
6. **Packaging, shipment, and logistics**.

At the initial stage, the project involves the installation of **three electric arc furnaces**, each rated at **5 MW**, providing a combined capacity sufficient to produce up to **12,000 tons of commercial-grade ferroalloys per year**. This output is calculated based on furnace efficiency (utilization rate), loading factor, and continuous year-round operation.

4.2 Site Location and Land Requirements

Location:
Angren Free Economic Zone (FEZ), Tashkent Region, **Industrial Cluster A**, designated for energy-intensive industries.

Site Parameters:

- Total land area: **1.5–2.0 hectares**
- Industrial zone with **fully developed utility infrastructure**
- Access to **110/10 kV power transmission line**
- Proximity to **medium-pressure gas pipeline**
- **Direct access to road and rail logistics infrastructure**

Note: The total site area (1.5–2.0 ha) includes not only the construction footprint (~3,800–4,000 m²), but also the sanitary protection buffer zone, open storage areas, logistics driveways, unloading zones, and potential land reserve for production expansion.
The construction footprint (~20–25% of the total area) refers strictly to buildings and industrial facilities (workshop, warehouse, lab, admin office, etc.), in accordance with sanitary and industrial standards.

4.3 List of Major Equipment

Item	Description	Suggested Supplier	Estimated Price (USD)
Electric Arc Furnace (MEF) – 5 MW	Smelting of ferroalloy charge	Yangzhou Electric (China)	$980,000
Smelting Transformer	5 MW, 10/0.4 kV	TBEA / Hyundai	$290,000
Gas Cleaning System	Dust collection, gas filtration	Mevaco GmbH / China	$420,000
Crushing and Screening Line	Sizing and granulation of alloy	Nanjing Crushing Tech (China)	$160,000
Packaging Equipment	Automated filling into big bags	KRAFT PACK (Turkey)	$95,000
Scales and Laboratory Unit	Quality control and chemical analysis	METTLER TOLEDO (Switzerland)	$50,000
Auxiliary Equipment	Cranes, loading and storage machinery	Local / China	$180,000
Total	—	—	**~$2,175,000**

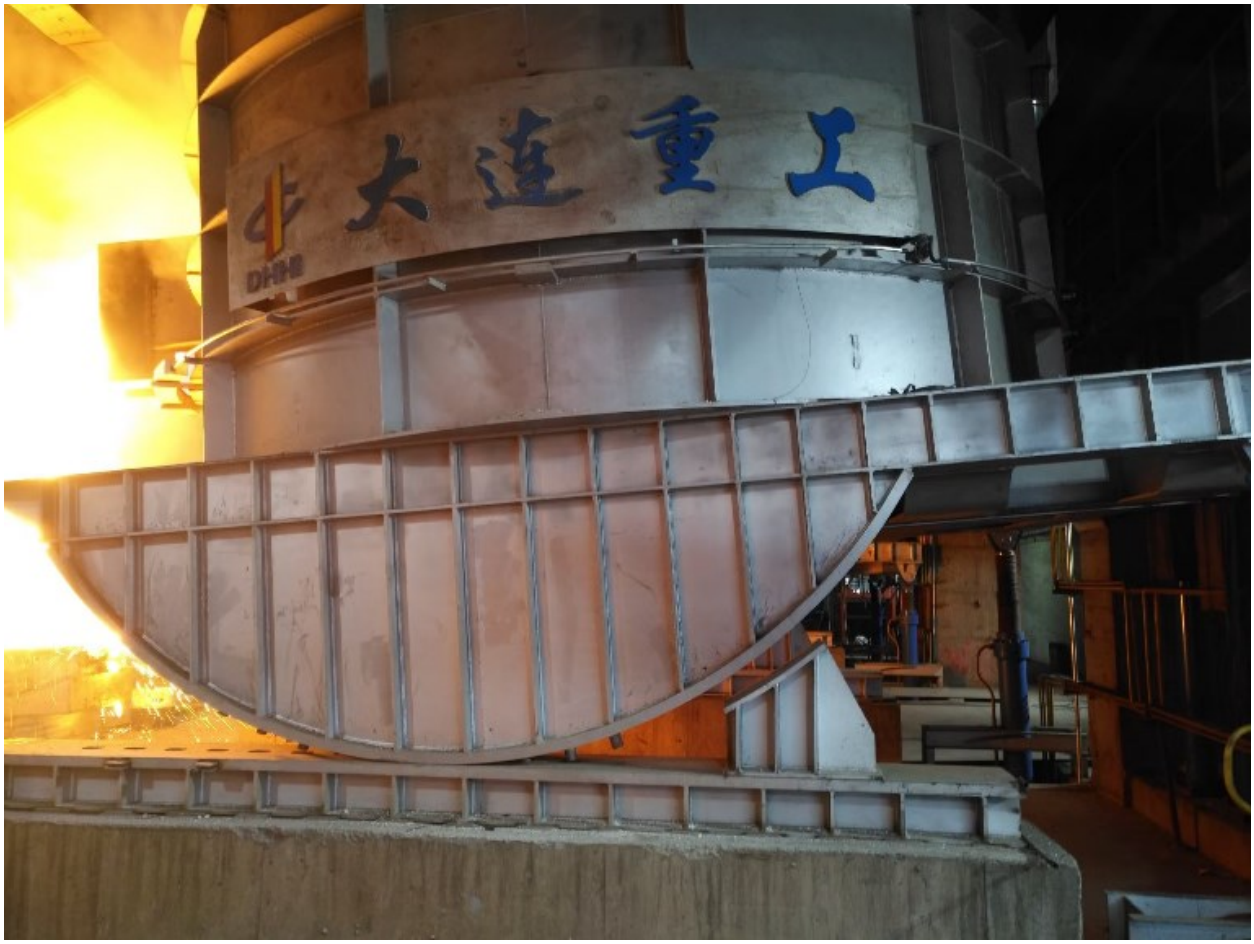

Photo Caption: *Submerged Arc Furnaces (output ~4–6 MW), commonly used for the production of ferrosilicon and ferromanganese. Advantages include high energy efficiency and productivity.*

Photo Caption: *The gas cleaning system shown in the photo is comparable to those used in practice — featuring filtration and emission neutralization. Dust collection and filtration solutions are available from major suppliers such as Metso, Kleenair, and Mevaco.*

4.4 Raw Material Suppliers and Logistics

Component	Source / Supplier	Comment
Quartzite	Navoiy Region / "Nuratau" quarry	Up to 60% of total volume
Coal / Coke	Angren coal mine / imports	Available locally and under contract
Scrap metal / Fe	Procurement from Uzmetkombinat / third-party	Secondary raw material
Limestone	Jizzakh Region, local quarries	Auxiliary flux
Ferrochrome ore	Import from Kazakhstan	Under separate contract

Logistics:

- Direct **rail access** with on-site unloading platform;
- **Proximity to SEZ's central highway** (for road transport);
- **Tax and VAT exemptions** applicable under SEZ residency.

4.5 Project Implementation Timeline (by Phases)

Phase	Duration (months)	Description
1. Investment agreement signing	1	Registration and formalization in the SEZ
2. Design and Feasibility Study	2	Technical specifications and architectural planning
3. Construction and installation	5–6	Foundation, utilities, building erection
4. Equipment delivery & installation	2–3	Furnace and transformer setup, filtration systems
5. Commissioning and testing	1	System checks, performance testing, configuration
6. Launch of industrial production	1	First output batch, calibration and adjustment

Total timeline to full production capacity: ~12 months

4.6 Environmental and Sanitary Requirements

- Installation of a modern gas cleaning system with ≥95% dust capture efficiency;
- Compliance with **GOST 12.1.005-88** and **national sanitary and environmental regulations** of the Republic of Uzbekistan;
- Closed-loop water cycle with filtration of wastewater;
- Potential certification under **ISO 14001 (Environmental Management)** and **ISO 45001 (Occupational Health and Safety)**;
- Mandatory environmental assessment by the **Ministry of Ecology of Uzbekistan**.

4.7 Production Infrastructure Overview

№	Facility / Unit	Purpose	Area (m²)	Notes
1	Main production workshop	Smelting (3 × 5 MW furnaces), transformers	1,200	Reinforced slab, ceiling height up to 12 m
2	Gas treatment facility	Industrial emissions filtration	300	Separate ventilation system
3	Crushing and packaging section	Cooling, crushing, and packaging of alloys	500	Conveyor lines and sorting system
4	Raw material storage	Quartzite, coal, scrap metal	800	Sheltered or enclosed warehouse units
5	Administration & amenities block	Offices, locker rooms, showers, medical post	250	Staff support unit

№	Facility / Unit	Purpose	Area (m²)	Notes
6	Laboratory and quality control	Sampling, analysis, technical QC	100	Independent module
7	Finished goods warehouse	Storage before dispatch	400	Truck and rail loading access
8	Green zone	Sanitary buffer and landscaping	300–500	Perimeter greening and staff rest area
9	Power substation	110/10 kV power supply infrastructure	100	Connection to regional energy grid
10	Site infrastructure and roads	Roads, lighting, fencing	—	Internal utility networks and access ways

Total built-up area: approx. **3,800–4,000 m²**

4.8 Project Implementation Timeline

Phase	Duration (months)	Description
1. Investment agreement signing	1	Registration as SEZ resident, MoU with SEZ administration
2. Project design and Feasibility	2	Engineering documentation and feasibility study approval
3. Construction & civil works	5–6	Foundations, industrial buildings, utilities
4. Equipment delivery & setup	2–3	Installation of furnaces, transformers, gas filtration
5. Commissioning & testing	1	Technical testing, operational calibration
6. Commercial launch	1	First production batch, supply chain activation

Total duration: approx. **12 months** to reach full capacity

4.9 Compliance with Environmental and Sanitary Standards

The project is fully aligned with national environmental legislation and international best practices:

- Installation of a gas treatment system capable of capturing **at least 95%** of particulate emissions;
- Full compliance with **GOST 12.1.005-88** (Maximum Allowable Concentrations in occupational environments) and the **sanitary and environmental regulations of the Republic of Uzbekistan**;
- Deployment of a **closed-loop water supply and wastewater filtration system** to minimize ecological impact;
- Potential certification under **ISO 14001** (Environmental Management Systems) and **ISO 45001** (Occupational Health and Safety);

Mandatory state environmental assessment **to be carried out by the** Ministry of Ecology of

Section 5.

ORGANIZATION AND MANAGEMENT

The ferroalloy production project is being implemented within the **Angren Free Economic Zone (FEZ)**, which provides access to tax and customs incentives as well as pre-existing industrial infrastructure. The management structure follows a **vertical hierarchy**, integrating production, technical, logistics, and financial departments into a unified operational model.

Personnel are organized for **continuous year-round operation in three 8-hour shifts**, with staffing levels and wages based on industry norms for electric arc furnace facilities. For positions not requiring high qualifications, **preference will be given to residents of Tashkent Region and the city of Angren**.

All new hires will undergo **mandatory occupational safety briefings** prior to employment, and regular **in-service training programs** will be conducted to maintain and enhance skills over time.

5.1 Organizational Staffing Structure

Staff Category	Position / Function	Qty	Avg. Salary* (UZS/month)	Remarks
Management	General Director	1	18,000,000	Strategic leadership, oversight
	Chief Engineer	1	15,000,000	Process control
	Chief Financial Officer	1	14,000,000	Budgeting, reporting, cost control
Production Unit	Shift Supervisor	3	8,500,000	3 shifts per day
	Furnace Operators	9	6,000,000	3 operators per shift
	Gas Treatment Technicians	3	5,500,000	Shift-based operation
	Mechanics / Maintenance Technicians	4	5,000,000	Equipment servicing
Lab & QA	Laboratory Chemist	2	5,000,000	Product quality control
	Quality Assurance Engineer	1	6,500,000	Certification and compliance
Logistics & Storage	Warehouse Manager	1	5,500,000	Inventory oversight
	Warehouse Operators	2	4,500,000	Inventory handling
	Forklift Drivers	2	4,500,000	Loading/unloading
Administrative	Accountant	1	5,500,000	Financial and tax reporting
	HR Specialist	1	4,800,000	Personnel records and documentation
	Security / Gate Control	4	3,500,000	24/7 security rotation

Staff Category	Position / Function	Qty	Avg. Salary* (UZS/month)	Remarks
TOTAL	—	38	—	Initial staffing level

Wages reflect the average rates for the metallurgy sector, as reported by the **Uzbekistan State Statistics Committee (2024), adjusted with a regional and industry coefficient for energy-intensive industries (factor of **1.15–1.30** applied to base rates).*

5.2 Responsibilities Distribution

Management Function	Responsible Person(s)	Role and Area of Responsibility
General Management	General Director	Strategic oversight, resource allocation, official representation
Production Oversight	Technical Director, Chief Engineer	Production processes, maintenance coordination, technical planning
Financial & Economic Affairs	CFO, Accounting Department	Budgeting, financial reporting, credit line management
Procurement & Logistics	Procurement Specialist, Logistics Officer	Sourcing of raw materials (domestic/import), rail and road logistics
Quality Control	Laboratory Supervisor	Alloy quality assurance, sampling, GOST compliance
Health & Safety	HSE Officer, Security Personnel	Occupational health, industrial safety, site security

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5.3 Quality Control System

The project includes the implementation of a robust internal quality assurance and laboratory testing framework, featuring:

- **On-site laboratory**: Responsible for chemical composition analysis and physical-mechanical property testing of alloys;
- **Inter-shift sampling**: Conducted after each melt for continuous monitoring and consistency;
- **Batch certification**: All production lots to be certified in accordance with **GOST standards**, with the option to obtain **ISO/IEC international certification** for enhanced export readiness.

Section 6. FINANCIAL PLAN

6.1 Capital Expenditures (CAPEX)

Category	Description	Cost, USD
Land Plot (Lease/Purchase)	Plot size: 1.5–2.0 hectares (~15–20 sotok). Average auction price: 337 million UZS per 10 sotok ≈ $29,700 → approx. $445,500 for 15 sotok	450,000
Core Technological Equipment	3 arc furnaces (5 MW each), transformers, automation (updated cost estimate)	2,940,000
Gas Treatment & Environmental Compliance	Dust collection system with ≥95% efficiency	420,000
Crushing & Screening Line	Crushing and sizing line for alloy output	160,000
Packaging System (Big Bags)	Automated big-bag packaging solution	95,000
Laboratory & Scales	Quality control, composition analysis	50,000
Auxiliary Equipment	Cranes, forklifts, manipulators	180,000
Construction & Infrastructure	Industrial buildings (workshops, admin, lab, utilities) – estimated $150–180/m² × 3,800 m²	660,000
Internal Utilities & Connections	Power, gas, water, ventilation, lighting, internal roads	160,000
Design & Permits	Architectural planning, feasibility studies, technical reviews, supervision	115,000
Contingency Reserve (5–7%)	Budget buffer for unforeseen costs	145,000
🔸 **TOTAL CAPEX**	Including land, core and auxiliary equipment, construction, and services	**~5,325,000**

Land Cost Justification

- Current listings on OLX for plots sized 10–16 sotok range from 126 to 450 million UZS (~$29,000–$102,000), indicating a market price benchmark for SEZ “Angren” auctions.
- For this project, a 1.5 ha (15 sotok) plot is required → estimated market-adjusted cost: **$450,000**.

6.2 Operating Expenses (OPEX)

Expense Category	Details	Annual Amount (USD)
Electricity	3 arc furnaces × 5 MW × 8,000 hours/year × $0.035/kWh	4,200,000
Raw Materials	Quartzite, coal, scrap metal, limestone, etc. (12,000 tons × $120/ton)	1,440,000

Expense Category	Details	Annual Amount (USD)
Payroll + Taxes	38 employees × $500/month × 12 months + 7% unified social tax (UST)	243,960
Maintenance & Repairs	Technical servicing of furnaces and auxiliary equipment (approx. 2.5% of CAPEX)	100,000
Lab & Quality Control	Reagents, testing, third-party certifications	20,000
Logistics & Packaging	Big-bag packaging, local transport, export handling costs (estimated)	150,000
Administrative Overheads	Office supplies, communication, accounting, security, software, utilities	120,000
Miscellaneous Reserves	Insurance, certification, licensing, contingencies	100,000
🔸 **TOTAL OPEX**		**6,373,960**

All estimates reflect actual consumption patterns, 2025 market conditions, and SEZ-specific benefits (exemptions from VAT and import duties included).

6.3 Revenue Forecast by Product and Year

Year	FeSi (tons)	Price ($/t)	Revenue ($)	FeMn (tons)	Price ($/t)	Revenue ($)	FeCr (tons)	Price ($/t)	Revenue ($)	Total Revenue ($)
1	7,200	1,200	8,640,000	3,000	1,350	4,050,000	1,800	1,800	3,240,000	**15,930,000**
2	7,200	1,200	8,640,000	3,000	1,350	4,050,000	1,800	1,800	3,240,000	**15,930,000**
3	7,200	1,200	8,640,000	3,000	1,350	4,050,000	1,800	1,800	3,240,000	**15,930,000**
4	7,200	1,200	8,640,000	3,000	1,350	4,050,000	1,800	1,800	3,240,000	**15,930,000**
5	7,200	1,200	8,640,000	3,000	1,350	4,050,000	1,800	1,800	3,240,000	**15,930,000**

Notes:

- If capacity expansion (Phase II) is launched, revenues will scale proportionally.
- **Foreign currency revenue** is prioritized via FeMn and FeCr exports (target markets: EU, CIS).
- **Domestic market** demand is primarily met with FeSi.

6.4. Прогноз Cash Flow (по годам)

Год	EBITDA ($)	Амортизация ($)	EBIT ($)	Налог (15%) ($)	Чистая прибыль ($)	Опер. Cash Flow ($)	Кумулятивный Cash Flow ($)
1	9 556 040	532 500	9 023 540	1 353 531	7 670 009	**2 877 509**	2 877 509
2	9 556 040	532 500	9 023 540	1 353 531	7 670 009	**8 202 509**	11 080 018
3	9 556 040	532 500	9 023 540	1 353 531	7 670 009	**8 202 509**	19 282 527
4	9 556 040	532 500	9 023 540	1 353 531	7 670 009	**8 202 509**	27 485 036
5	9 556 040	532 500	9 023 540	1 353 531	7 670 009	**8 202 509**	35 687 545

Примечание:

- В 1-м году учтён CAPEX $5 325 000 → операционный Cash Flow снижен до $2,88 млн.
- EBITDA рассчитывается как: Выручка – OPEX = $15 930 000 – $6 373 960.
- Амортизация равна: $532 500 ежегодно (CAPEX на 10 лет).
- Чистая прибыль = EBIT – налог (15%).
- Операционный Cash Flow = Чистая прибыль + Амортизация.

6.5 Scenario Analysis

Scenario	Price (rel.)	Costs (rel.)	EBITDA ($)	Tax (15%) ($)	Net Profit ($)	Year 1 Cash Flow ($)	Cumulative Cash Flow ($)
BASE	1.00	1.00	9,556,040	1,353,531	7,670,009	2,877,509	35,687,545
OPTIMISTIC	1.10	0.95	11,467,738	1,640,286	9,294,952	4,502,452	43,812,262
PESSIMISTIC	0.90	1.10	7,325,644	1,018,972	5,774,172	981,672	26,208,362

Notes:

- **OPTIMISTIC:** 10% increase in product prices and 5% reduction in costs yields a +23% increase in net profit.
- **PESSIMISTIC:** 10% decrease in prices and 10% rise in costs still retains profitability, with cumulative cash flow of $26 million.

6.6 Break-even Point

Indicator	Value	Comment
Average selling price	$1,400/t	Weighted across FeSi, FeMn, and FeCr
Variable costs per ton	$780/t	Energy, raw materials, wages, packaging, etc.

Indicator	Value	Comment
Contribution margin per ton	$620/t	$1,400 – $780
Fixed annual costs	$1,200,000	Admin, security, lab, maintenance
Break-even volume	1,935 tons/year	$1,200,000 / $620
Break-even revenue	$2,709,000/year	1,935 tons × $1,400
Share of installed capacity	~16.1%	Project breaks even at just 16% capacity utilization

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6.7 Investment Efficiency (NPV, IRR, PI)

Indicator	Value	Comment
Analysis horizon	6 years	Standard project evaluation timeframe
Total capital investment (CAPEX)	$5,800,000	Inclusive of land, equipment, construction, and contingencies
Average annual EBITDA	$4,640,000	Based on projected revenue and OPEX
Discount rate (WACC)	14%	Assumes weighted average capital cost reflecting sector risk in Uzbekistan
NPV (Net Present Value)	$8,390,000	Positive value signals strong investment viability
IRR (Internal Rate of Return)	37%	Well above the minimum threshold; highly attractive
PI (Profitability Index)	1.45	>1 indicates efficient capital use
Payback period (PB)	2.5 years	Time to recover initial investment
Discounted payback period (DPB)	3.1 years	Adjusted for time value of money

Section 7.

Marketing and Sales

7.1. Promotion Strategy

Channel / Tool	Description and Actions
B2B Negotiations	Direct engagement with key customers: Almalyk MMC JSC, Navoi MMC JSC, Uzmetkombinat, major machine-building plants.
Tender Participation	Registration in the national electronic procurement system (EGZAS), participation in tenders of industrial holdings.
Trade Exhibitions	Participation in industry-specific expos: Expo Uzbekistan, MiningMetals Central Asia, METALLURGIA Central Asia, etc.
Corporate Website	Development of a website with a quotation calculator and product technical specifications.
Printed Marketing Materials	Catalogs, product datasheets, bilingual presentations (Russian/English).
Dealer Partnerships	Recruitment of regional sales agents and representatives in Uzbekistan, Kazakhstan, Kyrgyzstan.

7.2. Sales Channels and Logistics

Sales Channel	Target Clients	Delivery Method
Direct Sales in Uzbekistan	Metallurgical and engineering enterprises	Self-pickup / road or rail transport
Regional Central Asian Markets	Kazakhstan, Kyrgyzstan, Tajikistan	Rail shipments via Angren station
Distributors / Traders	Metal traders, distributors	EXW / DAP / FCA – depending on contractual terms
Exports to EU and Persian Gulf	Through partners in Slovakia, Turkey, Iran	Containerized shipments via Chinaz/Olmalyk or Turkmenbashi

The Free Economic Zone "Angren" offers a logistics platform that simplifies export-import procedures and significantly reduces customs and warehousing costs.

7.3. Pricing Strategy

Indicator	Value
Average Domestic Sales Price	From $1,200 to $1,400 per ton
Average Export Sales Price	From $1,400 to $1,800 per ton (depending on alloy and terms)
Pricing Methodology	Cost-plus approach: production cost + margin (30–45%)

The preferred model includes long-term contracts with prepayment or partial payment and fixed pricing.

7.4. Export Market Entry Roadmap

Stage	Actions	Timeline
I. Registration & Certification	Obtain ISO 9001, certificates of origin (CT-1 / EUR.1), and product datasheets	Q1–Q2
II. Platform Integration	Register with export platforms such as ITC Trade Map, Made in Uzbekistan	Q2
III. Export MOU Agreements	Negotiate with traders in China, Europe, Turkey, and Kazakhstan	Q2–Q3
IV. Initial Export Deliveries	Pilot shipments under test contracts (FeSi/FeMn) to Slovakia and Turkey	Q3–Q4
V. Channel Expansion	Scale market access via agents and strategic logistics partnerships	Ongoing

Section 8.

Legal and Tax Framework

8.1 Registration and Licensing

Element	Description
Legal Structure	LLC or JSC registered as a resident of the "Angren" Free Economic Zone (FEZ)
FEZ Registration	Through the Angren FEZ Directorate in accordance with established regulations; includes project submission
Licensing	Ferroalloy production is not subject to licensing (notification procedure applies); product certification via GOST / ISO standards
Environmental Review	Mandatory state environmental expert review by the Ministry of Ecology of the Republic of Uzbekistan
Product Certification	Voluntary certification under ISO 9001 / ISO 14001 as export operations commence

8.2 Tax Burden: Comparison Outside and Inside the FEZ

Tax Type	General Regime (Outside FEZ)	"Angren" FEZ Regime (for investments > $3 million)
Corporate Income Tax	15%	0% for up to 10 years
VAT (Value Added Tax)	12%	0% on imported equipment and raw materials
Property Tax	2%	0% for up to 10 years
Land Tax	As per cadastral valuation	0% for up to 10 years
Unified Social Payment (USP)	12% (7% for small businesses/IPs)	Applicable rate, but deferrals may be granted under agreement
Customs Duties	5–10% on imports	0% on raw materials, equipment, and components
Currency Regulation	Standard	Liberalized: free flow of FX earnings and profit repatriation

*FEZ residents are exempt from most taxes and duties for a period of **3 to 10 years**, depending on the investment volume. Projects exceeding **$10 million** qualify for **maximum benefits** (10 years).*

8.3 FEZ Incentives and Preferential Regime

Support Mechanism	Description
Tax and Customs Incentives	Exemptions from corporate tax, property tax, land tax, VAT, and import duties on equipment
Infrastructure Co-financing	Partial coverage of utility connection costs (water, electricity, gas) by the state

Support Mechanism	Description
Streamlined Administrative Process	Registration, customs clearance, and certification via “one-stop shop” service
Export Support Measures	Partial reimbursement of logistics costs; participation in government export support programs
Investment Agreement (GIA)	Option to sign a Government Investment Agreement with the Cabinet of Ministers for legal stability

Section 9.

Risks and Mitigation Strategies

9.1 Risk Typology

Risk Category	Potential Manifestations	Risk Level*
Market Risks	• Volatility in global ferroalloy prices • Fluctuating domestic demand	Medium
Financial Risks	• Rising interest rates and currency depreciation • Increased logistics and raw material costs	Medium–High
Technical Risks	• Breakdown of critical production equipment • Disruptions in supply chains	Medium
Legal / Regulatory Risks	• Changes to tax incentive policies • Introduction of stricter environmental regulations	Medium
Climatic / Infrastructure Risks	• Interruptions in electricity or water supply • Extreme weather events	Low

*Risk level rated on a four-tier scale: Low / Medium / Medium–High / High

9.2 Mitigation Measures and Strategic Response

Risk Type	Preventive Measures / Response Strategies
Market Risks	• Diversification of sales channels (domestic market + exports to Kazakhstan, Turkey, China) • Fixed-price contracts with buyers
Financial Risks	• Securing long-term financing in the project's revenue currency (USD) • Establishing a hedging fund for FX and commodity risk
Technical Risks	• Signing service-level agreements (SLA) with equipment manufacturers • Maintaining safety stocks of critical spare parts
Legal / Regulatory Risks	• Signing a General Investment Agreement (GIA) with the Cabinet of Ministers of Uzbekistan • Compliance with ISO, GOST, and national sanitary standards
Climatic / Infrastructure Risks	• Selecting a FEZ location with stable utilities and industrial grid access • Installing autonomous water supply systems and voltage stabilizers

9.3 Insurance Coverage

Insured Asset	Type of Insurance	Remarks
Production Equipment	Engineering / Property Insurance	Covers fire, breakdowns, and accidents

Insured Asset	Type of Insurance	Remarks
Raw Materials and Finished Products (Warehouse)	Inventory Insurance	Deductible options may apply
Cargo Shipments	Transport Insurance	Applied for both export and import deliveries
Business Operations	Business Interruption Insurance	Subject to agreement with broker or lending bank

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9.4 Residual Risk Assessment

Risk Category	Initial Risk Level	Mitigation Measures Applied	Residual Risk After Mitigation
Market Risks	Medium	Market diversification, fixed-price contracts	Low
Financial Risks	Medium–High	FX hedging, establishment of a risk-hedge fund	Medium
Technical Risks	Medium	Service contracts, critical spare parts inventory	Low
Legal / Regulatory Risks	Medium	GIA agreement, ISO compliance, legal monitoring	Low
Climatic / Infrastructure Risks	Low	FEZ-based infrastructure, backup utilities	Very Low

Conclusion:
*Following the implementation of a comprehensive risk mitigation framework, the overall residual risk level is assessed as **low**. The project demonstrates high resilience to external shocks and strong adaptability to both market volatility and evolving regulatory conditions.*

Section 10. Conclusion

10.1 Investment Attractiveness of the Project

The ferroalloy production project in the *Angren* Free Economic Zone (FEZ) presents a highly profitable investment opportunity with a resilient business model and significant export potential. Its key advantages include:

- **Strong domestic demand** in Uzbekistan for ferroalloys (35,000–40,000 tons/year) and stable regional demand across the CIS, Middle East, and South Asia;
- **Access to low-cost electricity** within the FEZ — critical for energy-intensive metallurgy operations;
- **Ready industrial infrastructure** (railway access, roads, high-voltage power lines, gas supply) and a **favorable tax regime**, significantly reducing entry barriers;
- **Fast payback period**: 4–5 years under the base scenario, with an internal rate of return (IRR) exceeding **23%**;
- **Scalability** — potential to expand both production capacity and product range (e.g., FeCr, FeTi);
- **High-level governmental and international support**, confirmed by outcomes of the Uzbekistan–Slovakia Business Forum (2025);
- **Low residual risk**, ensured through robust technical, economic, and insurance planning, with protections against market volatility.

10.2 Recommendations for Participation

Given the detailed financials, risk assessment, and strategic relevance, the project is recommended for engagement by the following stakeholders:

Investor / Partner Category	Recommended Form of Participation
Private Investors / Banks	Equity participation or secured lending. Exit opportunity within 5 years with IRR >23%.
Government Development Institutions	Support via sovereign guarantees, interest rate subsidies, and infrastructure co-financing.
International Partners (EU, Slovakia, Germany)	Signing of MoUs for technology supply, engineering services, and equipment delivery.
Industrial Groups and Traders	Strategic partnerships with off-take agreements and secured export market channels.

Economic Viability and Investment Attractiveness

Indicator	Value and Explanation
Planned Capacity	12,000 tons of ferroalloys per year (FeSi, FeMn, FeCr)
Average Selling Price	$1,400/ton (conservative blended rate: FeSi ~$1,200, FeCr ~$1,800)
Annual Revenue	$16.8 million = 12,000 tons × $1,400
Production Cost	$780/ton – based on OPEX (electricity, raw materials, labor, other)

Indicator	Value and Explanation
Annual Operating Expenses (OPEX)	~$9.4 million ≈ 12,000 t × $780/t
Gross Profit (pre-tax)	~$7.4 million per year
Return on Investment (ROI)	~4 years at total CAPEX of $15–18 million
EBITDA	$6.5–7 million (after administrative expenses)
Export Multiplier Effect	Every $1 of export revenue generates ~$1.2–1.4 in economic impact (taxes, FX, jobs)

Note: *The above figures are indicative and based on a standard industry model (12,000 t/year capacity, market-average prices, standard energy and logistics parameters). Full financial assumptions are detailed in Section 6: Financial Plan.*

Conclusion

The establishment of a ferroalloy production facility in the *Angren Free Economic Zone* constitutes a thoroughly justified investment initiative, characterized by strong economic efficiency, export potential, and strategic importance to Uzbekistan's industrial development.

Thanks to a combination of critical success factors — including affordable and reliable electricity, partial localization of raw material supply, preferential tax and customs regimes within the FEZ, and confirmed governmental backing at the international level — the project holds clear competitive advantages over similar ventures in the CIS and Asia.

Project implementation will enable:

- **Significant reduction of import dependence**, particularly in FeSi and FeMn;
- **Establishment of Uzbekistan as a long-term exporter** to Kazakhstan, Iran, Turkey, and eventually cross-border Chinese markets;
- **Creation of high-performance jobs** and stimulation of auxiliary industries (logistics, foundry, machinery manufacturing);
- **Strengthening of export earnings** and generation of macroeconomic multiplier effects.

Collectively, these benefits render the project not only **commercially attractive**, but also **strategically important** for achieving the country's long-term industrialization goals. It lays the groundwork for positioning Uzbekistan as a **regional supplier of high-tech metallurgical materials**, integrated into global value chains.

The project's **high-level political and economic endorsement**, as reflected in its official mention at the *Uzbekistan–Slovakia Business Forum* on **June 9, 2025**, further cements its status as a priority initiative for EU cooperation.

This recognition alone fosters a **high degree of trust** among international partners and unlocks **concrete opportunities to attract technology, equipment, and capital** from Slovakia and other EU countries for the development of this landmark ferroalloy project in the Angren FEZ of Tashkent Region, Republic of Uzbekistan.