INVESTMENT PROJECT
CONSTRUCTION OF ENTERPRISE
FOR REFINED METAL ANTIMONY MANUFACTURING

State Atomic Energy Corporation
‘ROSATOM’

Referred by:
Nikolay Petrovich Agarkov

Basic Features of the Project

Project Description

Formation of a new hydrometallurgical enterprise for antimony flotation concentrate processing with refined metal antimony grade Su0 output on the basis of the existing shop.

Project Objectives

- Satisfy the metallic antimony demand of Russian consumers; replace enriched raw materials exported with high-quality Russian state standard product.
- Counteract the dependence of Russian economy (especially the military-industrial complex) on foreign supplies of antimony concentrate.
- Expand the sphere of employment of the population of the city of Krasnokamensk (Zabaikalsky Krai) from the uranium production.
- Perspective of Russian position strengthening in the world antimony industry due to Chinese mineral base deplete.

The project implementation will coincide the Russian strategy on non-ferrous metallurgy development in 2014-2020 and up to 2030 (Order of the Ministry on Industry and Trade of the Russian Federation No. 839 of May 5, 2014).
Project participants

Uranium Holding ARMZ
Mining Division of State-owned Company Rosatom. It performs the fifth place in the world in terms of uranium mining volume and the second place in terms of uranium reserves in the bowels.

PJSC “PPGHO”
(a subsidiary of the ARMZ group)
City-forming enterprise of Krasnokamsk and the largest mining facility in Russia as well as one of the largest uranium mining entities in the world. It is the largest diversified mining company in the Trans-Baikal Territory. It conducts uranium mining by a conventional method at 16 uranium and molybdenumuranium spots of the Streltsov ore field.

Krasnokamenskiy antimony combine enterprise, LLC
The history of the Voyager Group of Companies began in 1994. Since its foundation, the Voyager Group is primarily involved with manufacturing facilities purveyance with antimony, lead, lead-antimony alloys, ligatures and chemical compounds. In 1997 company “Voyager” serves more than 50% of the Russian market consumption in antimony and antimony trioxide raw staff. The deliveris is currently spreading into the CIS, Europe and the USA markets.
As of 2017, Voyager Group owns 3 antimony ore deposits and Nerchinsk Polymetallic Combine Enterprise.

JSC “RUSBURMASH”
(a subsidiary of the ARMZ group)
Is the largest dynamically developing geological exploration company capable of carrying out the entire range of drilling operations on solid minerals ore deposits.

Science and Research Institution on Production Technology Developing
Science and Research Institution on Production Technology Developing
## Project Name

<table>
<thead>
<tr>
<th>Place of implementation</th>
<th>Refined Metal Antimony Manufacturing (Zabaykalsky Krai, Krasnokamenskiy district, the City of Krasnokamensk)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Cost of the Investment Project (including Value Added Tax – VAT)</td>
<td>958.5 million RUB (at productivity of 5000 tons per year) 4 billion RUB (at productivity of 20000 tons per year)</td>
</tr>
<tr>
<td>Net Present Value (NPV)</td>
<td>816.8 million RUB</td>
</tr>
<tr>
<td>Discounted Payback Period</td>
<td>5.3 years</td>
</tr>
<tr>
<td>Internal Rate of Return (IRR)</td>
<td>41.6%</td>
</tr>
<tr>
<td>Annual Power Estimate</td>
<td>25 000 MW per year</td>
</tr>
<tr>
<td>Number of jobs created</td>
<td>107 persons (the Project First Stage) 420 persons (since the Project Second Stage)</td>
</tr>
</tbody>
</table>
### Project Economic Outlines

#### Cost of production for 1 ton of metal antimony in Krasnokamensk

<table>
<thead>
<tr>
<th>Component</th>
<th>Cost (RUB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemicals and Materials</td>
<td>2% 6000</td>
</tr>
<tr>
<td>Power</td>
<td>3% 9000</td>
</tr>
<tr>
<td>Basic raw materials</td>
<td>95% 287000</td>
</tr>
</tbody>
</table>

- **303 thousand RUB per ton**

- **Considering the benefits provided within the territory of the Krasnokamensk Advanced Social and Economic Development Area (TOSER)**

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#### The selling price for 1 ton of metal antimony

- **Average surplus**: 60%

<table>
<thead>
<tr>
<th>Description</th>
<th>Price (RUB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of production</td>
<td>303 thousand RUB per ton</td>
</tr>
<tr>
<td>World market sales price</td>
<td>522 thousand RUB per ton</td>
</tr>
<tr>
<td>Sales price in Russia</td>
<td>966 thousand RUB per ton</td>
</tr>
</tbody>
</table>

- **The average producers’ surplus on antimony at sale**: 60%

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#### Production Output Chart

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>Annual Production Volume, Tons</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>1500 (30%)</td>
</tr>
<tr>
<td>2018</td>
<td>4500 (90%)</td>
</tr>
<tr>
<td>2019</td>
<td>5000 (100%)</td>
</tr>
<tr>
<td>2020</td>
<td>5000 (100%)</td>
</tr>
<tr>
<td>2021</td>
<td>5000 (100%)</td>
</tr>
<tr>
<td>2022</td>
<td>5000 (100%)</td>
</tr>
<tr>
<td>2023</td>
<td>5000 (100%)</td>
</tr>
<tr>
<td>2024</td>
<td>5000 (100%)</td>
</tr>
<tr>
<td>2025</td>
<td>5000 (100%)</td>
</tr>
</tbody>
</table>
# Antimony: Global Distribution and Consumption Placement

## Major Consuming Countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Thousand tons</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. China</td>
<td>107.8</td>
</tr>
<tr>
<td>2. United States</td>
<td>40.2</td>
</tr>
<tr>
<td>3. Germany</td>
<td>21.1</td>
</tr>
<tr>
<td>4. France</td>
<td>7.9</td>
</tr>
<tr>
<td>5. Russia</td>
<td>2.5</td>
</tr>
</tbody>
</table>

## Application of metal antimony

- I: Fire retardant production
- II: Microelectronics
- III: Special alloys production
- IV: Manufacture of batteries
- V: Pharmacy
- VI: Arms and ammunition
World Structure of Antimony Consumption by Areas of Application

- Fire retardant (antimony trioxide): 48%
- Batteries (antimony metal): 28%
- Lead alloys (antimony metal): 13%
- Catalyst for plastics (antimony trioxide): 8%
- Other spheres: 3%
- Other countries: 7.1%

China 79.8%
South Africa 2.6%
Tajikistan 2.9%
Bolivia 3.7%
Russia 4.0%

230 Thousand tons per year

the world market of metal antimony due to 2016 results

Table 1. Metal Antimony: Dynamic Price Forecast

<table>
<thead>
<tr>
<th>Years</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>2026</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antimony Price, $US</td>
<td>8700</td>
<td>9000</td>
<td>9400</td>
<td>9800</td>
<td>10200</td>
<td>10600</td>
<td>11000</td>
<td>11400</td>
<td>11900</td>
<td>12400</td>
</tr>
</tbody>
</table>
The Main Antimony Projects in the Russian Federation

- **Zabaikalskiy Mining and Concentrating Combine Enterprise**
  - Date Started: 2014
  - Status: Intra-corporate war stopped production

- **National Antimony Company**
  - Date Started: 2013
  - Status: Environmentalists and public organizations hamper construction

- **Krasnokamensky Antimony Plant**
  - Date Started: 2015
  - Status: The project is adopted at Krasnokamensk Territory of Advanced Social and Economic Development, environmentalists' approval, the technology is fully developed

The Main Factors for Antimony World Intake Growth

- Paintwork materials
- Sodium-ion batteries
- Bearings in mechanical engineering
- Construction materials
- Cosmetology
- Sodium-ion batteries
- Construction materials

Exhausting reserves of antimony in China

The ban of Chinese authorities on "dirty" ways of antimony producing

Antimony Market (2/2)
• Proximity of the largest market: Krasnokamensk is located at 50 km far from the China border
• The possibility of expanding the Intake Roe Fields: the exploration potential of PJSC “PGGHO” and JSC “Rusburmash” allows conducting low cost geological search

Legend:

- **Krasnokamenskiy Antimony Plant**
- **Antimony Concentrate Logistics Chain**

- Proximity of the largest market: Krasnokamensk is located at 50 km far from the China border
- The possibility of expanding the Intake Roe Fields: the exploration potential of PJSC “PGGHO” and JSC “Rusburmash” allows conducting low cost geological search
### Project participants and Product Sales Scheme

<table>
<thead>
<tr>
<th>ARMZ Group</th>
<th>Voyager Group</th>
<th>State Company Rostech Global Resources Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>русбурмаш</td>
<td>Voyager Group</td>
<td>Ростех</td>
</tr>
<tr>
<td>ППГХО</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ВНИИП ПРОМТЕХНОЛОГИИ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Production funds</td>
<td>• Basic raw materials (antimony concentrate)</td>
<td>• Investments</td>
</tr>
<tr>
<td>• Design and survey work</td>
<td>• Technologies</td>
<td>• Equipment manufactured at Rostekh Group</td>
</tr>
<tr>
<td>• Geological exploration work</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Staff</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Infrastructural and logistics support</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(thermal power station, railway junction,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>special equipment)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SPV-company Project Operator**

**Company-trader "Krasnokamenskaya antimony"**

Product Line:
- Antimony metal
- Antimony trioxide
- Antimony trisulphide

### Project Participants
- **Domestic consumers**
- **Divisions United Instrument Manufacturing Corporation**
- **Foreign Consumers**
Electricity and thermal energy (heat) generating

- The average annual power output: 1.7 million kW/h
- The average annual heat output: 1.5 million Gcal.

- The installed power capacity is 410 MW, current capacity is 210 MW
- Reserved Capacity

1 kWh - 1.54 rubles
1 Gcal - 646 rubles
Artesian water 1 m³ - 10.68 rubles
Fixed tariffs estimate term for 10-15 years

- Raw materials railway transportation from Krasnokamensk to the industrial facilities (approx. 100 km);
- Annual cargo transportation volume is 3.6 million tons.
- Cargo flow increase potential

PJSC “PPGHO” includes 34 production associations, including hydrometallurgical plant, sulfuric acid plant, mechanical renewing plant.
Mechanical renewing plant is one of the largest industrial enterprises in the southeast of the Trans-Baikal Territory.

The permanent customers of the plant are mining, energy and chemical companies. The products line includes 2526 items.

Total area for production expansion is 5147 m²

Plant Facilities:
- Foundry
- Metal structures and non-standard equipment workshop
- Digital program control mechanical assembly shop
- Mining equipment production and repair workshop
- Technical gases production shop
- Forging and thermal facility
- Electrical repair shop
- Nondestructive testing laboratory
Project Implementation Schedule

- TOSER Krasnokamensk Residential Status Obtaining
- Project Investors and Financial Sources Search
- Long-Term Facility Agreement Signing and Registration
- Construction Project Documentation Accomplishing; State Expertize Report
- Contractors selected confirmation
- Public hearings on Production Environment Influence
- Production area reconstruction due to Construction Project
- Technology complex machinery production
- Equipment installation
- Staff recruiting and training
- Raw materials and subsidiaries delivery for complex equipment testing
- Product test release
- Test result analysis and technology adjusting
- Order placing for transportation and stock equipment delivery

Investment Stage Chart Sketch
**Project Business Advantages**

- Proximity to the mineral resource base
- Proximity to the major market
- Tax privilege territory (TOSER)
- Environmentalists’ reconcilability due to lack of specific demands
- Local municipal and regional authorities support
- Fixed tariffs for power and infrastructure service costs for 10 years
- Developed transport system
- Developed industrial infrastructure
- Termination or freezing of many antimony plants on the territory of the Russian Federation
- Sharp depletion of ore deposit on antimony in China
Addendum № 1.

Status of The Mineral and Raw Materials Data Base for Antimony in the Russia

The State Register Data, as follow:

- The Russian Data Base performs data on 13 antimony deposits with the total balance amount at about 315 thousand tons of metal.
- Off-balance reserve amount is up to 57 thousand tons.
- The reserves are concentrated in 2 federal districts: Far Eastern (62%) and Siberian (38%).
- The extraction is currently carried out in Yakutia, the Krasnoyarsk and Zabaikalskiy regions.
- Antimony total output amount in concentrates is 10-13 thousand tons. A project is being implemented to increase the processing of antimony ores of the Zhypkoshinskiy deposit.
Antimony Consumers in the territory of the Russian Federation
(1/2)

MAJOR ANTIMONY CONSUMERS IN RUSSIA

BATTERIES MANUFACTURERS

*Used antimony metal Su0, Su2*

- **Vologda Battery Plant**, Limited Liability Company
  Main production: lead and various types of its alloys

- **Plant of Autonomous Power Sources (AIT)**, Public Joint-Stock Company
  Main production: industrial alkaline nickel-cadmium accumulators and batteries

- **Velikie Luki Plant of Alkaline Batteries**, Joint-Stock Company
  Main production: industrial batteries

- **Accumulator Technologies (AkTeh)**, Limited Liability Company
  Main production: engine start batteries

- **Kursk Battery Plant (Accumulator)**, Limited Liability Company
  Main production: batteries

- **Leningrad Battery Plant (ELECTROTIAGA)**, Joint-Stock Company
  Main production: batteries

- **Saratov Battery Plant (Electrostochnik)**, Joint-Stock Company
  Main production: batteries

- **Tyumen Battery Plant (TAZ)**, Limited Liability Company
  Main production: batteries of various types
Antimony Consumers in the territory of the Russian Federation (2/2)

MAJOR ANTIMONY CONSUMERS IN RUSSIA

**Antimony production ‘2017**

**SEMICONDUCTORS PRODUCTION PLANTS**
- **Tsifron**, Moscow
  Main production: electronic components, specific electronic manufacturing
- **Plant Exiton**, Moscow region
  Main production: integrated circuits and semiconductor devices

**PLANTS ON CHEMICAL FIBER, PAINT AND LACK, PLASTIC PRODUCT**
- **Used antimony trioxide**

**BABBITE AND ALLOYS PRODUCTION PLANTS**
- **Used antimony metal** Su₀, Su₂

**PLANTS ON CHEMICAL, FIBER, PAINT AND LACK**
- **PLANTS ON CHEMICAL, FIBER, PAINT AND LACK**
  - **Trade House ‘Sverdlovsk Metallurgical Plant’**, Ekaterinburg, LLC
    Main production: bearings and special alloys
  - **Plant of Metals and Alloys**, Ryazan, Joint-Stock Company
    Main production: cast alloys and blanks from non-ferrous metals
  - **Solders Plant**, Novosibirsk, Joint-Stock Company
    Main production: solders and rolled products from non-ferrous metals

**MAJOR ANTIMONY CONSUMERS IN RUSSIA**
- **Babbit**
  Trade House ‘Sverdlovsk Metallurgical Plant’, Ekaterinburg, LLC
  Main production: bearings and special alloys
- **Plant of Metals and Alloys**, Ryazan, Joint-Stock Company
  Main production: cast alloys and blanks from non-ferrous metals
- **Solders Plant**, Novosibirsk, Joint-Stock Company
  Main production: solders and rolled products from non-ferrous metals

**PLANTS ON CHEMICAL, FIBER, PAINT AND LACK**
- **Used antimony trioxide**

**MAJOR ANTIMONY CONSUMERS IN RUSSIA**
- **Ruspolimer**, Limited Liability Company
  Main production: sale of polymer raw materials
- **Caustic**, Volgograd, Joint-Stock Company
  Main production: sale of chemical and polymer raw materials
- **Roskomposit**, the city of Bronnitsy, Joint-Stock Company
  Main production: sale of chemical and polymer raw materials

**MAJOR ANTIMONY CONSUMERS IN RUSSIA**
- **Tsifron**, Moscow
  Main production: electronic components, specific electronic manufacturing
- **Plant Exiton**, Moscow region
  Main production: integrated circuits and semiconductor devices