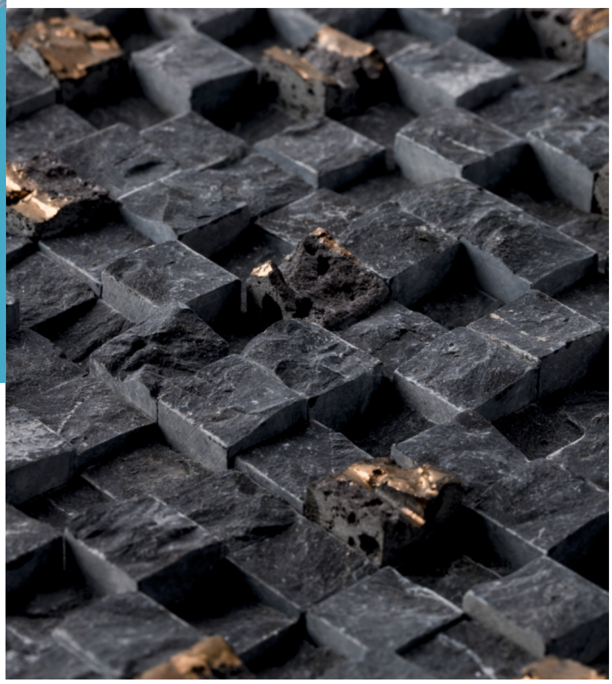
"UZBEKISTAN TECHNOLOGICAL METALS COMPLEX" JSC

# MOLYBDENUM AND TUNGSTEN



## THE FOUNDATION OF GREEN AND HIGH-TECH INDUSTRIES

“UZBEKISTAN TECHNOLOGICAL METALS COMPLEX” JSC

# JSC “UzTMK”

implements projects for deep processing of strategic raw materials with the production of high value-added products for the energy sector, mechanical engineering, and advanced technologies. The development of production sites in Akhangaran and the Samarkand region forms a modern, environmentally sustainable, and logistically efficient model of metallurgical production.

# MOLYBDENUM

The project involves the development of a modern production facility in Akhangaran (Kelajak Metallari Technopark) with deep processing of molybdenum raw materials.The process flow is focused on producing high-value products, improving resource efficiency, and reducing environmental impact.

**10,000 t/year**
MOLYBDENUM RAW MATERIAL PROCESSING

**4,800 t/year**
**$MoO_3$**
(hydrometallurgy)

**3,175 t/year**
Molybdenum Powder

**up to 95%**
Water Recycling

**24**
thousand t $CO_2$/year

**Applications:billets, rods, bars, fine wire.**

# TUNGSTEN

The project is aimed at establishing a modern production facility in the Samarkand region.Production chain: concentrate → $WO_3$ / APT → powder / carbide → finished products.The technology is focused on deep processing of raw materials, improving resource efficiency, and reducing carbon footprint through energy-efficient technologies and optimized logistics.

**15,000 t/year**
CONCENTRATE PROCESSING

**up to 7 920 t/year**
APT

**up to 6 200 t/year**
powder / carbide

**up to 95%**
WATER RECYCLING

**≈ 36**
thousand t $CO_2$/year

**Applications:billets, rods, bars, fine wire,drills and milling cutters (carbide), inserts and cutting teet.**

TMK
"UZBEKISTAN TECHNOLOGICAL METALS COMPLEX" JSC

## Key Performance Indicators — Existing and New Hydrometallurgical Tungsten Production Plant

| Existing plant for the production of rare metals and hard alloys | New Plant (target) |
|---|---|
| Commissioning Period1950s | Phase 1: planned for 2027 |
| Core TechnologyIon Exchange (IX) | Modern hydrometallurgy |
| Concentrate Processing 2,500 t concentrate/year | 15,000 t concentrate /year(Phase 3) |
| Scaling Factor Baseline level (1×) | 6× increase |
| W Recovery87–94% (depends on concentrate composition) | ~96%(design target) |
| W Losses in Tailings 6–13% of incoming W | ~4% of incoming W |
| $H_2$ Production Method Electrolysis (alkaline) | Electrolysis (modern, specialized) |
| Electrolyzer Load Factor <25%(chronic underutilization) | 90–95% (nominal operation) |
| Specific Energy Consumption ($H_2$)~65–70 kWh/kg $H_2$(partial load) | ~50 kWh/kg $H_2$ (optimal load) |
| Electricity Source for $H_2$Grid electricity(~0.50 kg $CO_2$/kWh) | Solar RES (~0.03 kg $CO_2$/kWh, target) |
| Specific Energy Consumption (per t W)Baseline level (index 1.00) | ~0.60 (−40%) |
| Water Recirculation ~20% (partial recycling) | 90% (closed-loop system, design) |
| Automation & Control Conventional instrumentation (I&C) | Industry 4.0 (from Phase 1) |
| Environmental Certification Not implemented | ISO 14001 + EPD (target) |
| Reduction of W Losses in Tailings— | ~60% reduction* |

АО "УЗБЕКСКИЙ КОМБИНАТ ТЕХНОЛОГИЧЕСКИХ МЕТАЛЛОВ»

# ESTIMATED CARBON FOOTPRINT

## PER TON OF W PRODUCTION

## HYDROGEN STRATEGY

| CURRENT PLANT | NEW — GRID | NEW SOLAR $H_2$ |
|---|---|---|
| **~68**<br>~68 kWh/kg $H_2$<br>(<25% load) | **4-6**<br>(90–95% load) | **1,5–2,5**<br>(solar power) |
| Specific emissions<br>**34**<br>kg $CO_2$/kg $H_2$ | Specific emissions<br>**25**<br>$CO_2$/kg $H_2$ | Specific emissions<br>**1,5**<br>1.5 kg $CO_2$/kg $H_2$ |
| **~2,0**<br>t $CO_2$/t W | **4–6**<br>**~1,5**<br>t $CO_2$/t W | **1,5-2,5**<br>**~0,09**<br>T $CO_2$/T W |
| Baseline | ▼ **40 - 40%** | ▼ **75 - 85%** |

07

"UZBEKISTAN TECHNOLOGICAL METALS COMPLEX" JSC

# GREEN HYDROGEN

## LOW-CARBON TRANSFORMATION OF METALLURGY

The green hydrogen project is considered one of the key directions in the technological modernization and decarbonization of JSC "UzKTMC".

A phased implementation of an electrolyzer system for hydrogen production is planned, with subsequent integration into the company's metallurgical processes. At the first stage, the development of a technical concept, selection of a technology partner, assessment of the infrastructure readiness of the site, and preparation of the project financial model are envisaged. The next stage involves the implementation of a pilot project to test operating regimes, confirm efficiency, and prepare for further scaling.

In the long term, the project will enable a reduction in the carbon footprint of products, decrease the consumption of traditional energy carriers, enhance the environmental sustainability of production, and establish a foundation for the transition to modern low-carbon technologies.

## VALIDATED PATH FOR $CO_2$ REDUCTION

<table>
<tr><th>SCENARIO</th><th colspan="2">$CO_2$ REDUCTION INDICATORS</th></tr>
<tr><td rowspan="2">Baseline scenario<br>(conventional technology)</td><td colspan="2">≈ 3,3–3,6 thousand t $CO_2$/year<br>(gas component of reduction processes)</td></tr>
<tr><td>↓20–30% $Co_2$</td><td>↓700–1 100 t $CO_2$/year</td></tr>
<tr><td>$H_2$ implementation (pilot stage)</td><td>↓700–1 100 t $CO_2$/year</td><td rowspan="2">↓ up to 40–50% $Co_2$<br>with integration of RES and expansion of $H_2$ infrastructure</td></tr>
<tr><td>Full-scale implementation</td><td></td></tr>
</table>

## EMISSION REDUCTION DRIVERS

-replacement of natural gas with hydrogen
-improved process energy efficiency
-improved process energy efficiency
-transition to low-carbon energy

## KEY PARAMETERS

- capacity: **up to 20 MW**
- hydrogen production: **up to ~4,000 $Nm^3/h$ $H_2$**
- operation mode: **24/7**
- storage: **up to 20 bar**

## IMPACT

**up to 100 t $CO_2$/year** — confirmed pilot-stage effect
→ scalable emission reduction
→ compliance with international ESG standards
→ increased investment attractiveness