

# Diesel Fuel Production from Raw Coal

**CTL Technology — Coal-to-Liquids  
Strategic Analytical Paper**

*Dushanbe — 2026*

# A 21st-Century Strategic Opportunity

- Tajikistan can convert domestic coal into modern diesel fuel and achieve energy independence.

**4.3**

billion tonnes

total coal reserves

**100%**

imported

dependence on  
foreign fuel

**\$483**

million/year

fuel import bill

**90+**

million tonnes

coking coal — Ziddi  
deposit

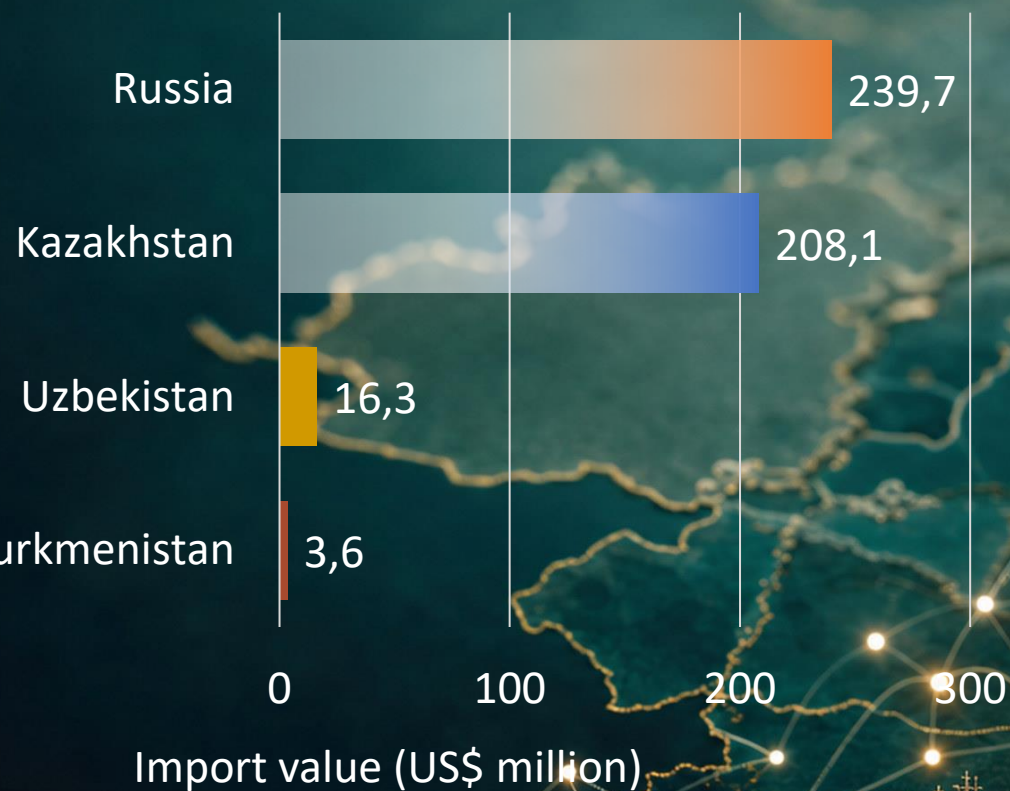
## Strategic context

CTL technology has been deployed at industrial scale in China and South Africa, and its commercial viability is fully proven.

**The Ziddi deposit — with over 90 million tonnes of coking coal and only 72 km from Dushanbe — is the optimal resource base for the project.**

# Complete Dependence on Imports

Fuel imports: \$483 million per year



100% of domestic demand is met through imports. Domestic production covers only 2% of demand.

Liquefied gas (LPG) 39.1%

Diesel fuel 27.7%

Gasoline 21.7%

Bitumen and other 10.7%

**Diesel:** over 297 kt/year · current price 0.90–1.05 USD/L

# Key Deposits for the CTL Project

**331 million tonnes**

confirmed recoverable reserves · 36+ deposits

## Ziddi deposit — the optimal base

- Carbon 68–72%
- Calorific value 5400–5800 kcal/kg
- Sulfur 0.4–0.8%.

Reserves sufficient for over 70 years of operation.

| Deposit           | Reserves | Coal type  | Distance from Dushanbe | CTL rating |
|-------------------|----------|------------|------------------------|------------|
| Ziddi (Karategin) | 90+ Mt   | Coking     | 72 km                  | ★★★        |
| Nazar-Ailok       | 212 Mt   | Anthracite | 280 km                 | ★★         |
| Fan-Yagnob        | 166 Mt   | Coking     | 149 km                 | ★★         |
| Shurob            | 144.6 Mt | Brown coal | Isfara                 | ★          |

# Two Pathways from Coal to Liquid Fuel

## DCL — Direct Coal Liquefaction

### Principle

Coal + hydrogen + catalyst

### Temperature / Pressure

450–470°C · 150–300 atm

### Efficiency

55–65%

### Products

Diesel (60%+), naphtha

### Reference

Shenhua Group (China)

## ICL / FT — Fischer-Tropsch

### Principle

Coal → Syngas → FT synthesis

### Temperature / Pressure

900–1500°C → 20–30 bar

### Efficiency

45–55%

### Products

Diesel, gasoline, synthetic wax

### Reference

Sasol (South Africa)

Recommendation: **ICL route (Fischer-Tropsch) with Lurgi/Shell gasification**

# From Raw Coal to Diesel: 8 Process Stages

## Preparation

- Crushing to -50 mm

## Beneficiation

- HMC cyclone, ash ↓

## Pyrolysis

- 300–900°C, without air

## Gasification

- Syngas ( $\text{CO} + \text{H}_2$ )

## Gas cleanup

- Rectisol, Claus, WGS

## FT synthesis

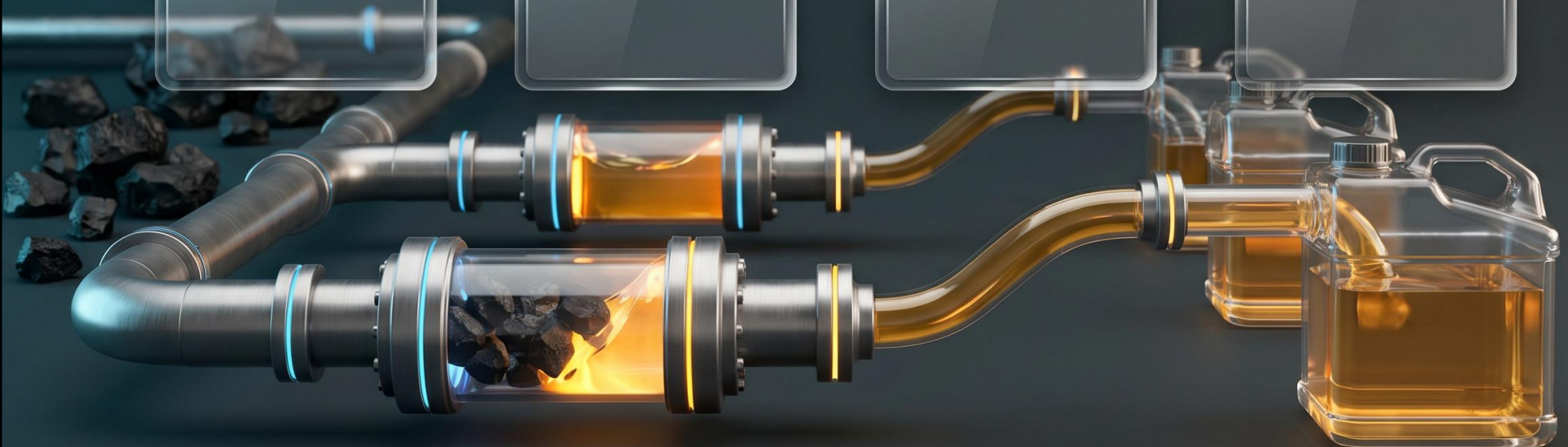
- 200–350°C, catalyst

## Hydrocracking

- Wax → diesel, naphtha

## Fractionation

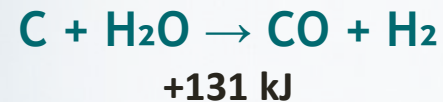
- Product separation



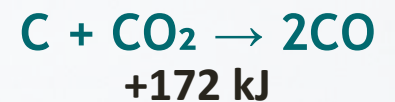
# Converting Coal to Syngas

Key gasification reactions:

Water–gas reaction



Boudouard reaction



Water–gas shift (WGS)



–41 kJ

**Recommended gasifier: Lurgi BGL**

20–30 bar · 700–1000°C · 100–500 t/d — suited to Tajikistan's mountainous conditions. Shell SCGP for larger scale.

HEIGHT : 22.0 m  
PRESSURE : 40 bar  
TEMPERATURE : 1,400 °C

# Production Scenario: 250,000 t Diesel/Year



**250,000**  
tonnes of diesel/year  
Option A target

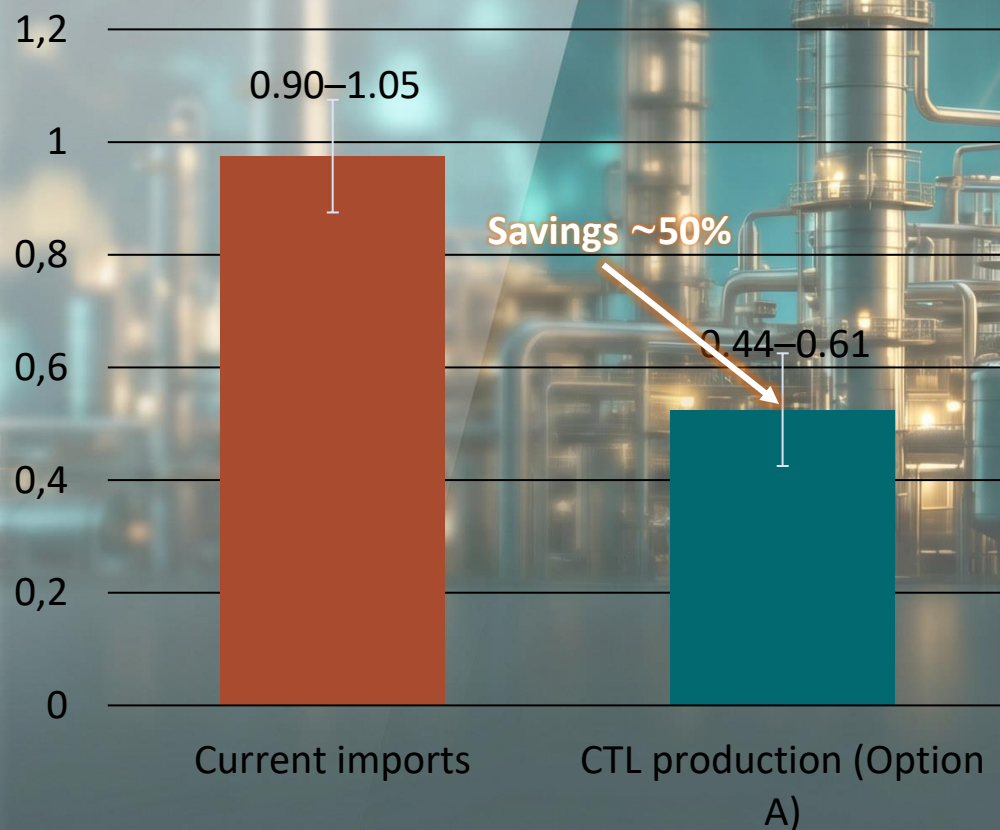
**~1.25**  
million t/year  
Demand (~3,788 t/day)

**48–52%**  
efficiency  
Coal → diesel (ICL)

**5.2–5.8**  
tonnes : 1  
Coal-to-diesel ratio

| Products                  | Tonnes/year | Price, USD/t | Revenue, USD M         |
|---------------------------|-------------|--------------|------------------------|
| Synthetic diesel (Euro 5) | 250,000     | 700–820      | ~188                   |
| Gasoline (RON 92)         | 60,000      | 600–750      | ~42                    |
| Synthetic wax             | 20,000      | 1200–2500    | ~35                    |
| Jet fuel / Kerosene       | 27,000      | 750–1100     | ~24                    |
| LPG + other products      | —           | —            | ~36                    |
| <b>TOTAL REVENUE</b>      |             |              | <b>~USD 325 M/year</b> |

## Diesel cost: half the import price



**0.44–0.61**

USD/liter — CTL production cost

**0.90–1.05**  
**USD/L**

current import price

**OPEX:** USD 89–124 M/year for 250,000 t of diesel. Production cost: 356–496 USD/t.

# Core Equipment of the CTL Complex

## Coal beneficiation

Heavy-medium cyclone (HMC) · efficiency  $\geq 95\%$  · \$30,000–500,000

**Manufacturers:** John Finlay (Australia), Multotec

## Fractionation

Atmospheric + vacuum columns · separation of final products

**Manufacturers:** Koch-Glitsch (USA), Sulzer

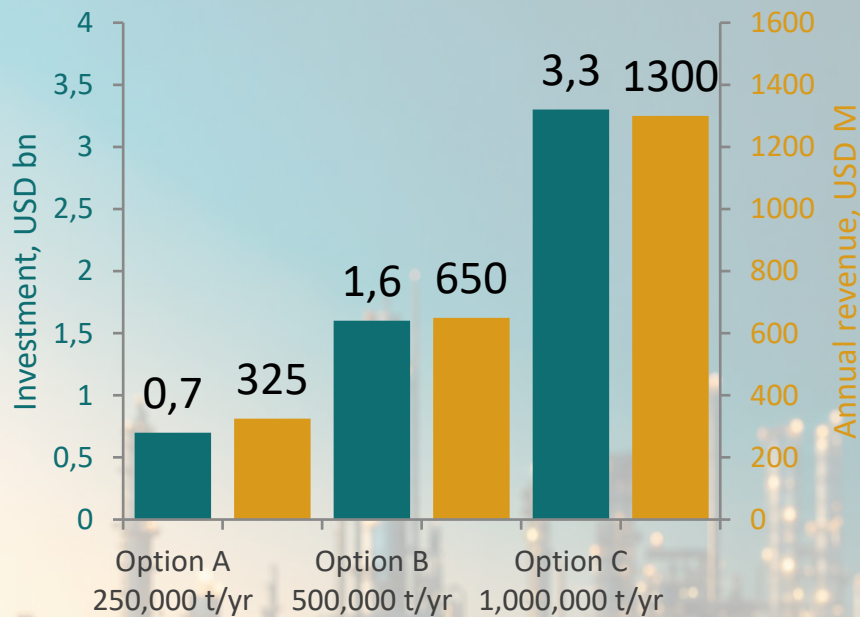


# Gasification and FT Synthesis Equipment

| Equipment                 | Operating parameters                 | Price (USD)   | Manufacturer           |
|---------------------------|--------------------------------------|---------------|------------------------|
| Lurgi BGL gasifier        | 20–30 bar · 700–1000°C               | 5–30 M        | Lurgi / Air Liquide    |
| Shell SCGP gasifier       | 30–40 bar · 1400–1600°C              | 80–250 M      | Shell Global Solutions |
| Air separation unit (ASU) | 1000 t O <sub>2</sub> /day           | 25–50 M       | Air Products, Linde    |
| Rectisol unit             | H <sub>2</sub> S removal to <0.1 ppm | 10–50 M       | Linde, Air Liquide     |
| FT slurry-phase reactor   | 200–240°C · 20–30 bar                | 30–150 M/unit | Sasol (South Africa)   |
| FT catalyst (iron-based)  | Replaced every 12–18 months          | 2–20 M        | Sasol, Haldor Topsoe   |
| Wax hydrocracking         | 380–420°C · 10–16 MPa                | 20–80 M       | Axens (France)         |

# Three Scenarios: A, B and C

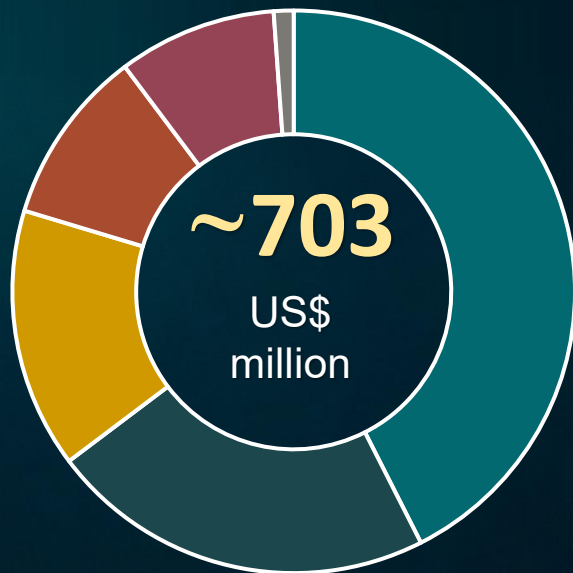
Three development scenarios:  
investment and revenue



**Ministry recommendation:** start with Option A — lower risk, then scale up.

| Indicator           | A      | B      | C      |
|---------------------|--------|--------|--------|
| Diesel, kt/year     | 250    | 500    | 1000   |
| Capex, \$ bn        | ~0.7   | 1.2–2  | 2.4–4  |
| Construction, years | 3–4    | 4–5    | 5–7    |
| Jobs                | 800+   | 1500+  | 3000+  |
| Profit, \$ M/year   | 120+   | 240+   | 480+   |
| IRR                 | 12–18% | 14–20% | 16–22% |
| Payback, years      | 8–12   | 8–12   | 8–12   |

## Capital cost breakdown – Option A



- Process equipment – US\$299 million (43%)
- Contingencies, IDC, working capital – US\$156 million (22%)
- Installation and electrical works – US\$105 million (15%)
- Engineering and project management – US\$71 million (10%)
- Buildings and structures – US\$64 million (9%)
- Land and site – US\$8 million (1%)

~\$703

US\$ million

Total TASC (all-in)

\$142,000

per bbl/day

Within global benchmarks

~\$618

US\$ million

TOC (excl. IDC)

# Full Capital Cost Estimate – Option A

# A Multi-Product Chemical Complex

The CTL complex produces more than just diesel: its by-products generate an extra \$50–75 million in revenue.

|                     |          |                     |
|---------------------|----------|---------------------|
| Synthetic wax       | ~\$35 M  | Chemical industry   |
| Coal tar            | ~\$16 M  | BTX, naphthalene    |
| Elemental sulfur    | ~\$0.7 M | Agriculture         |
| Ammonium sulfate    | ~\$1.4 M | Mineral fertilizers |
| Surplus power (WHB) | ~\$12 M  | National grid       |





# Leading CTL Technology Companies

## Shenhua Group / CHN Energy

★★★★ #1

DCL — full CTL cycle

**China** · 4 Mt/year (2024)

## Synfuels China Technology

★★★★ #1

ICL/FT, catalysts, licensing

**China** · 50+ projects worldwide

## Sasol Technology

★★ #2

ICL/FT (Secunda)

**South Africa** · 7.5 Mt/year

## Air Products

★★

Gasification, ASU

**USA** · 100+ projects

## Shell Global Solutions

★★

SCGP gasification

**Netherlands** · Pearl GTL

## Haldor Topsoe

★

Catalysts, WGS

**Denmark** · Supplies Sasol

# Tajikistan Coal Industry Development Strategy



## Stage 1 2026–2027

### Foundation

FS & EIA for Ziddi  
Laboratory testing  
MOU with Shenhua  
Interagency commission

## Stage 2 2027–2028

### Design

Financing: Exim, AIIB,  
SCO  
FEED and infrastructure  
solutions  
Ziddi mine expansion

## Stage 3 2028–2031

### Construction

CTL plant construction  
250,000 t of diesel/year  
Training of 300–500  
specialists

## Stage 4 2031+

### Expansion

Transition to Options B  
and C  
Petrochemical cluster:  
BTX, polyolefins

# Risks and Mitigation Measures



| Risk                                             | Level       | Mitigation                                  |
|--------------------------------------------------|-------------|---------------------------------------------|
| <b>Financial</b> — need for external capital     | <b>High</b> | Agreement with Exim Bank; strategic partner |
| <b>Oil price</b> — if prices fall                | Medium      | Breakeven ~\$55/bbl; state subsidies        |
| <b>Technical</b> — mountainous conditions        | Medium      | Experienced contractor; engineering FEED    |
| <b>Environmental</b> — CO <sub>2</sub> emissions | <b>High</b> | CCS technology; Paris Agreement compliance  |
| <b>Power</b> — demand of ~80–100 MW              | Medium      | Rogun HPP; waste heat boilers (WHB)         |
| <b>Personnel</b> — shortage of specialists       | Medium      | Training programs in China and South Africa |

# Funding Sources and Incentives

## 1: Exim Bank of China

Concessional loan at 2–4%. **High**

## 2: Asian Development Bank (ADB)

Loan at 3–5%, ESG requirements. **Medium**

## 3: AIIB

Infrastructure projects. **Medium**

## 4: SCO Bank

Priority for industrial projects. **High**

## 5: JV with Shenhua/Synfuels

Technology + capital. **High**

## Statutory Incentives in Tajikistan

- Exemption from VAT and customs duties on equipment — up to 5 years
- Profit tax exemption during the payback period
- Comprehensive support from ministries
- Investment agreement with state guarantees

# Proposals



**Training program**  
300 specialists in CTL, gasification and FT synthesis (2026–2028)

**Ziddi mine expansion**  
From 244 kt to 3–5 Mt per year

**Financing negotiations**  
With Exim Bank of China and AIIB on Option A

**Feasibility Study (FS)**  
To be completed for the Ziddi deposit by the end of 2026

**Signing of an MOU**  
With Shenhua Group and Synfuels China Technology during 2026

**Legal act**  
On launching the CTL project and establishing an Interagency Commission



# A Historic Strategic Opportunity

## From Dependence to Energy Independence

Savings of up to \$300–400 million/year

- ~USD 325 million in annual revenue
- 3,000–4,000 jobs.

A country that spends half a billion dollars on imports can achieve self-sufficiency on the strength of its national coal reserves.