SERVICE PROJECTS

KMG runs comprehensive initiatives aimed at developing infrastructure, enhancing the performance of oilfield services, and modernising assets. The key strategic priorities include ensuring sustainable water supply, restructuring oilfield service assets, increasing their profitability, renewing the vehicle fleet, and modernising production assets.

The infrastructure of KMG's oilfield service projects covers key production facilities, including equipment repair and maintenance sites, logistics hubs, and specialised machinery and transport. We pay close attention to automating business processes, implementing international certification standards (API Specification Q2 – American Petroleum Institute's quality management standard of for oilfield service companies), and upgrading existing facilities.

1 Desalination plant construction

The purpose of the project is to supply drinking water to the city of Zhanaozen and reduce the load on the Astrakhan–Mangyshlak water pipeline.

- Design capacity: 50 thous. m^3 per day
- Status: EPC contracts concluded, construction and installation works completed.
- The plant is expected to become operational at the design capacity in 1H 2025.

2 Building oilfield services portfolio and asset restructuring

- In 2024, a pilot project was launched to transfer oilfield service subsidiaries and associates to Ozenmunaigas and Mangistaumunaigaz, to be implemented in two phases (transfer of KMG's share and transfer of personnel).
- Plans for 2025: completion of activities to transfer assets in Zhanaozen and Aktau.

3 Bringing oilfield service assets to a break-even point

- Initiatives include: automation of business processes, implementation of segregated accounting, and API Specification Q2 certification.
- Status: in 2024, MEM (MangistauEnergoMunay, an oilfield services division) received the first API Spec Q2 certificate in Kazakhstan. Applications for certification of other assets are scheduled for 2025.

4 Renewal of vehicle and equipment fleets

- 2024 results: a total of 95 vehicles delivered. Leasing agreements with suppliers concluded.
- Plans for 2024–2026: renewal of 408 vehicles at Kalamkas and Zhetybai fields.

5 Construction and modernisation of production assets

- Zhetybai field: Design documents for the construction of a new production facility developed and approved.
  - Status: Tender and the launch of construction and installation works are slated for 1Q 2025.
- Production site of OzenMunayService:
  - Completion of concrete and installation works is expected by the end of January 2025.
  - Landscaping and site improvement will be completed in 1Q 2025.

Fleet renewal of KMG's subsidiaries and associates

Company	2024	2025	2026
	Actual	Target	Target
Oil Transport Corporation, units	186	155	96
Oil Services Company, units	0	10	25
OzenMunayService, units	0	0	5

INNOVATIVE TECHNOLOGY DEVELOPMENT

Exploration

Introduction of wireless sensors

Wireless sensors for seismic surveys helped bring down survey times and increase coverage, leading to faster data acquisition and improved data quality. Pilot seismic surveys employing a unique equipment configuration successfully investigated depths of up to 20 km in the Caspian sedimentary basin, opening up new hydrocarbon exploration opportunities.

Investment in innovation

Between 2020 and 2024, KMG invested KZT 250.8 bln, including KZT 98.2 bln allocated to high-technology projects, thus strengthening the Company's competitive edge. In 2024, increases in oil reserves were achieved through a comprehensive approach integrating 3D seismic surveys, laboratory analysis of core samples, and re-interpretation of well logging data, highlighting the importance of integrating diverse research methods.

New technologies and partnerships

In 2024, collaboration with international companies flourished. At the Berezovsky block, bids from Sinopec, LUKOIL, and Chevron are being reviewed to leverage advanced exploration technologies and incorporate best global practices. At the Mugodzhar block, our partnership with Shell and Chevron will allow for the testing of deep drilling technologies that offer substantial expansion potential. As part of the Zhylyoi project, KMG agreed key terms with CNOOC for the joint implementation of digital twins to enhance production planning and monitoring.

Implementation of new technologies and process optimisation

2024 trials confirmed the effectiveness of wireless sensors. Their planned deployment across other sites will improve data acquisition efficiency. Artificial intelligence and machine learning in seismic data processing helped enhance interpretation accuracy and speed, enabling proactive planning. R&D activities include testing technologies at the Gran field to optimise survey times and cover larger areas, reducing costs and improving efficiency.

Comparative study of STRYDE cable-free nodal seismic acquisition against conventional cable systems

Results from the CDPM[1]-3D project utilising STRYDE technology demonstrate:

- cost reduction: total project cost went down by 20% to USD 6.5 mln (from a planned USD 8.2 mln);
- time savings: work completed in 58 days instead of 75 days (a 33% reduction);
- personnel optimisation: field crew size decreased fourfold (from 15 to 4 people), with overall headcount reduced by 60% (from 77 to 32);
- efficiency gains: seismic crew productivity increased by 35% (1,278 operations vs 828), and the amount of data acquired rose by 20% (1,278 vs 1,026);
- environmental benefits: reduced equipment and transportation led to a 44% decrease in vehicle mileage (531 km vs 945 km), bringing down emissions.

The project confirmed that modern technology and process optimisation deliver significant improvements with reduced costs and environmental impact.

Trials of the impulse sources have commenced in environmentally sensitive areas of the Caspian Sea.

Seismic survey digitalisation

Field seismic surveying of 2,669 and 613 linear km was completed at Mugodzhary and Bolashak, respectively. The use of machine learning techniques in data processing speeds up interpretation of results and increases the precision of prospective target identification. KMG Barlau and Sinopec have partnered on an agreement for using geological data on the Berezovsky block, with the integration of blockchain technologies for data protection, ensuring the security and transparency of information sharing.

[1] Common Depth Point (CDP) Method.

Plans for 2025

Wider use of innovative technology

3D seismic surveys are planned for the eastern flank of the Tsentralnoye field (220 km²), utilising wireless sensors to significantly expand coverage while mitigating the environmental impact. Completion of drilling and well testing at the Turgai Paleozoic and Karaton Subsalt blocks, coupled with the integration of AI-driven real-time data analysis solutions, will facilitate rapid decision-making regarding further development. Five exploration wells are also slated for the Taisoygan-1 and Taisoygan-2 blocks, employing carbon footprint reduction technologies.

New exploration projects

Licences are to be sought for three promising blocks, with planned 2D and 3D seismic surveys followed by data processing using supercomputers to generate more accurate models and enhance exploration efficiency.

Drilling

Field development: current status and outlook

KMG's operating assets primarily consist of depleted fields with diverse reservoir characteristics and crude oil properties. Remaining recoverable oil reserves are estimated at approximately 440 mln tonnes, of which 248 mln tonnes are classified as hard-to-recover, necessitating innovative approaches for efficient development.

In 2023, KMG held a strategic session addressing technological bottlenecks, which resulted in the drafting of roadmaps of technological bottlenecks for seven subsidiaries and associates. These roadmaps address the challenges of developing hard-to-recover reserves, including recommended technologies and measures, risk assessments, phased implementation from 2024 to 2029, and the integration of advanced methods throughout all stages, from lab and pilot testing to commercial use.

In 2024, the Company approved new standards for the feasibility study of technologies, introducing uniform approaches to selecting and adopting EOR methods. This is a crucial step in managing KMG's complex assets, enabling the deployment of modern solutions to enhance the efficiency of developing high-risk and high-cost fields.

Technological approaches by reservoir type

Technologies employed across fields can be broadly categorised into three groups based on the complexity of oil recovery.

- **Low-permeability reservoirs:**
  - hydraulic fracturing;
  - horizontal drilling with multi-stage hydraulic fracturing;
  - radial fracturing;
  - gas dynamic fracturing;
  - water shut-off.
- **High-viscosity oil:**
  - horizontal drilling;
  - steam injection;
  - hot water injection;
  - polymer flooding;
  - conformance control.
- **Carbonate reservoirs:**
  - acid fracturing;
  - horizontal drilling with acid fracturing;
  - Water Alternating Gas injection;
  - cyclic flooding;
  - conformance control.

2024 results

During the year, KMG implemented 502 technology-focused initiatives across its fields, which yielded an additional 390 thous. tonnes of oil. Some of these technologies were deployed for the first time.

- **Carbonate reservoir innovations.** In 2024, lab research on chemical compositions for conformance control were conducted for the first time at the Alibekmola field. Previously unused in KMG's carbonate fields, the technology demonstrated promising results. By December 2024, six injection wells had been treated, resulting in an additional 390 tonnes of oil.
- **Radial fracturing.** The Uzen and Karamandybas field reclamation project pioneered radial fracturing on six production wells, boosting output by over 5 tonnes per day for each well. This solution was successfully adapted for bottom water-drive reservoirs where hydraulic fracturing presents significant challenges.

Plans and outlook to 2029

Wider use of new technologies:

- slim hole drilling;
- ASP flooding;
- treating reservoirs with CO_2 injections;
- foam acidising;
- dual steam injection;
- in-situ combustion.

Digitalisation of technology implementation

The Testing Centre online portal operating on a one-stop shop principle will continue to be upgraded, including the implementation of new tools for application monitoring, improved document templates, and integrated data analysis algorithms. This will increase efficiency and reduce time costs.

Upstream

Production efficiency measures

Launched in 2023, the Testing Centre online portal accelerates the adoption of innovative technologies by streamlining application processing and pilot testing. These efforts contribute to both maintaining stable production and driving innovation, ultimately strengthening the Company's long-term sustainability and competitiveness.

Developing depleting fields

At mature fields, such as S. Balgimbaev, Botakhan, Koshkar, etc., where the watercut is high and reserves are depleted, production optimisation is underway. This includes shutting in wells with low flow rates and transferring them to servicing, and other innovative methods. These efforts aim to extend field life and enhance recovery through modern technologies such as polymer flooding and hydraulic fracturing.

Technological bottlenecks and plans to 2050

To improve the oil recovery factor, advanced technologies are being actively researched and implemented, including:

- polymer flooding;
- multi-stage hydraulic fracturing;
- radial fracturing;
- dual injection and production;
- slim hole drilling;
- Water Alternating Gas injection, etc.

These technologies are expected to unlock an additional 60 mln tonnes of oil over 25 years, significantly enhancing the economic efficiency of mature field operations.

Reclamation project at the Uzen and Karamandybas fields

2023 saw the launch of a large-scale project to reclaim the Uzen and Karamandybas fields. Key project activities include:

- drilling new production and injection wells using advanced technologies;
- implementing conformance control to improve production efficiency;
- modernising the reservoir pressure maintenance system and infrastructure;
- deploying polymer flooding and installing electric submersible pumps.

From 2025 onwards, work will continue to improve flooding systems, digitalise pipeline infrastructure, and drill horizontal wells at mature fields using cutting-edge technologies.

Plans for 2025

The focus for 2025 will be on advancing mature fields through the adoption of new solutions and the refinement of existing processes. This includes:

- drilling horizontal wells at Karsak, East Moldabek, Uzen, and others;
- introducing polymer flooding at Uzen and Kalamkas;
- using the conformance control techniques at key fields;
- using dual injection techniques at Akshabulak Central to enhance oil recovery factor and mitigate environmental risks.

These initiatives target sustainable development and the upgrade of production processes, leveraging innovative and environmentally sound technologies.

Oil refining and petrochemicals

Engineering simulation at Kazakhstan refineries

The engineering simulation system was implemented in 2020 at Atyrau and Pavlodar refineries. This software helps create a digital twin of a process unit and select an optimal operating mode. Models for both primary and key secondary refining processes are now in use at both refineries. These models simulate unit performance under varying feedstock and operational parameters.

Using these simulations, pilot tests were conducted between 2022 and 2024 to streamline equipment performance. They successfully addressed bottlenecks and improved overall unit operations.

At Atyrau Refinery, optimisation of the AVDU-3 column helped ramp up the unit's utilisation rate by 10%. The result was improved product separation, a 350–400 tonne per day increase in vacuum gas oil production, and lower fuel oil output. In 2024, vacuum gas oil production surged by 79 thous. tonnes, or 44% year-on-year, adding an estimated KZT 2.6 bln to the annual value of the product slate.

Pilot tests at Pavlodar Refinery delivered substantial fuel savings. The efficiency of the atmospheric oil distillation unit furnace improved by 6% through higher steam and lower feedstock temperatures, saving 16 tonnes of fuel per day. Increasing the bitumen production unit's pump-around reflux temperature trimmed fuel consumption by up to 20 tonnes per day. Total fuel cost savings in 2024 are estimated at KZT 170 mln.

Advanced process control system

Since 2020, KMG has been been deploying advanced process control (APC) systems across its refineries. APC acts as an automated control system, maintaining the unit's stable operation within pre-defined parameters, including feed rates, temperatures, flow qualities, etc. This results in increased oil product yields, lower energy consumption, minimised human error, and enhanced product quality.

At Atyrau Refinery, APC installed on the ADU-2 and AVDU-3 units delivered a 15 thous. tonne per year uptick in straight-run petrol fractions and an 11 thous. tonne per year increase in kerosene and gas oil fractions, generating annual cost savings of KZT 2 bln.

In 2024, the system was implemented at a petrol hydrotreating and catalytic reforming unit at Atyrau Refinery and a primary oil refining unit of Shymkent Refinery. This helped deliver more stable operations, tightening product quality consistency by 28–40% and boosting yields of naphtha and other high-margin products. At Shymkent Refinery, kerosene yields rose by up to 30 tonnes per day, translating to a potential KZT 1.5 bln uplift in the annual value of the product slate.

Transition to a unified MES system at Atyrau Refinery

In 2024, Atyrau Refinery implemented a centralised manufacturing execution system (MES). This system provides monitoring of processes and equipment, production control against plan, performance visualisation, as well as tank monitoring and tracking of oil and oil products. Key benefits of MES implementation include enhanced refinery transparency, faster decision-making, improved analytics, and streamlined reporting. The unified database enables efficient processing of large datasets and lays the foundation for introducing big data tools.

Computer simulators

A computer simulator is a digital twin of a process unit, replicating the operator's working environment with augmented reality elements. It is used for training and staff upskilling. From 2019 to 2024, computer simulators were implemented at:

- Atyrau Refinery: 9 units (primary oil refining, catalytic cracking, reforming, production of aromatic hydrocarbons, hydrotreating);
- Pavlodar Refinery: 6 units (delayed coking, petrol isomerisation, diesel fuel and kerosene hydrotreating);
- Shymkent Refinery: 10 units (catalytic cracking, isomerisation, sulphur production, etc.);
- KPI: 2 units (propane dehydrogenation, propylene polymerisation).

2024 saw an updated 2024–2031 roadmap for further computer simulation deployment. KMG has in place a robust training programme at its refineries, leveraging computer simulators for a range of activities, including annual examinations, onboarding, and emergency drills. The use of computer simulators helped reduce personnel-related incidents, improve post-incident recovery times, and enhance operator performance.