

SECTOR ASSESSMENT (SUMMARY): ENERGY¹

Sector Road Map

1. Sector Performance, Problems, and Opportunities

1. **Overview.** Oil accounts for about a quarter of Kazakhstan's gross domestic product and about 60% of its total exports. Natural gas production volumes have been increasing and Kazakhstan became a net gas exporter in 2003. Kazakhstan also has the largest recoverable coal reserves in Central Asia, and is the second largest coal producer in the region (after the Russian Federation). Coal, produced in the northern regions, is used to power most of the country's electricity generation. Kazakhstan is also the world's largest exporter of uranium ore. There is no domestic nuclear generation.

2. Kazakhstan's economy is highly energy-intensive, and uses two to three times more energy than the average for the Organisation for Economic Co-operation and Development countries. With coal dominating its energy sector, Kazakhstan is also the largest emitter of greenhouse gases (GHGs) in Central Asia (Table 1), and its GHG emissions per capita are among the highest in the world. Its industry sector's carbon intensity is five times the European Union average. Kazakhstan has set voluntary targets for GHG emissions reductions of 15% by 2020 and 25% by 2050 compared to 1992 levels.

Table 1: 2009 Energy Consumption by Fuel and 2007 Greenhouse Gas Emissions by Sector

| Fuel | Amount (mtoe) | Sector | Emissions (mtCO ₂ e) |
|------------------|------------------|-------------|------------------------------------|
| Oil | 12.0 | Energy | 208.6 |
| Natural gas | 17.7 | Industrial | 18.5 |
| Coal | 33.0 | Agriculture | 14.4 |
| Hydroelectricity | 1.7 | Waste | 4.6 |
| Total | 64.4 | | 246.1 |

mtoe = million tons of oil equivalent, mtCO₂e = million tons of carbon dioxide equivalent.

Sources: British Petroleum. 2010. *BP Statistical Review of World Energy*. London (June); and Republic of Kazakhstan. 2010. *Climate Investment Funds: Clean Technology Fund Investment Plan for Kazakhstan*. Astana (2 November).

3. **Fossil fuels.** Kazakhstan is expected to double production and become one of the world's leading oil exporters as the giant oil fields in the Caspian Sea region are developed.² Its oil industry has historically been considered one of the most open in the region to foreign investment, and most of its major fields are being developed in partnership with international companies.

4. The lack of access to a seaport makes the country dependent on pipelines to transport its hydrocarbons to world markets. It is also a transit state for pipeline exports of natural gas from Turkmenistan and Uzbekistan to the Russian Federation and the People's Republic of China. The state company KazMunaiGaz owns KazTransGaz and KazRosGaz—the two principal natural gas transportation companies. Historically, natural gas development in Kazakhstan has lagged behind oil because of the lack of domestic gas pipeline infrastructure (Table 2). KazTransOil,

¹ This summary is based on the Asian Development Bank sector knowledge and the Government of Kazakhstan. 2010. *Government Program on the Accelerated Industrial-Innovative Development of the Republic of Kazakhstan, 2010–2014*. Astana. Available on request.

² US Energy Information Administration. November 2010. *Country Analysis Briefs – Kazakhstan*. <http://www.eia.gov/countries/cab.cfm?fips=KZ>.

owned 100% by KazMunaiGaz, operates the oil pipeline system, much of which is in poor condition.

Table 2: 2009 Fossil Fuel Production and Reserve Data

| Item | Unit | World Total (%) |
|--|------|-----------------|
| Annual oil production (mtoe) | 78.0 | 2.0 |
| Annual oil consumption (mtoe) | 12.0 | 0.3 |
| Oil reserves (billion tons) | 5.3 | 3.0 |
| Annual natural gas production (mtoe) | 29.0 | 1.1 |
| Annual natural gas consumption (mtoe) | 17.7 | 0.7 |
| Natural gas reserves (trillion cubic meters) | 1.8 | 1.0 |
| Annual coal production (mtoe) | 51.8 | 1.5 |
| Annual coal consumption (mtoe) | 33.0 | 1.0 |
| Coal reserves (billion tons) | 31.3 | 3.8 |

mtoe = million tons of oil equivalent.

Source: British Petroleum. 2010. *BP Statistical Review of World Energy*. London (June).

5. **Renewable energy.** Kazakhstan has renewable energy resources, but only a fraction is utilized. Five large hydro projects on the Irtys River generate about 8 terawatt-hours per year—only 30% of the country's economically viable potential. The economic potential of small hydros is 7.5–11.0 terawatt-hours per year, of which only 5% is produced.³ The country has exceptional wind potential estimated at 1,820 million kilowatt-hours (kWh) per year.⁴ Some 255 megawatts (MW) of wind power, 92 MW of small hydro, and 6 MW of solar capacities are expected to be added to help achieve the 1.5% alternative and renewable energy target in the energy mix by 2015. Up to 450 MW of large hydropower capacity will be added by 2015.⁵ In July 2009, a law on the use of renewable energy sources was enacted.

6. **Institutional structure.** The Ministry of Industry and New Technologies oversees national energy development, including electricity and renewable energy. Transmission, distribution, and heat tariffs are regulated by the Agency for Regulation of Natural Monopolies. The wholesale and capacity market Kazakh Operator of Electric Energy and Power Market (KOREM) operates the centralized electricity trading market. The Ministry of Oil and Gas regulates the oil and gas sector.

7. **Power sector structure.** Kazakhstan has unbundled its generation, transmission, and distribution functions. About 87% of electric power generation is in the private sector. Of the 21 electricity distribution companies, only two remain state-owned. The national transmission and dispatch system is operated by the Kazakhstan Electricity Grid Operating Company (KEGOC), which is owned by the Kazakhstan National Welfare Fund Samruk-Kazyna.

8. **Power generation.** About 70% of electricity is generated from coal, with oil, natural gas, and hydropower each accounting for about 10% of total generated electricity. Almost half of the generating infrastructure is older than 30 years and needs upgrading and modernization. According to the Ministry of Industry and New Technologies' strategic plan for 2020, electricity generation in 2015 will amount to 103.5 billion kWh and consumption to 100.5 billion kWh.

³ Republic of Kazakhstan Climate Investment Fund. 2010. *Clean Technology Fund Investment Plan for Kazakhstan*. Astana.

⁴ United Nations Development Programme and Global Environment Fund. 2006. *Report: Prospective of Wind Power Development in Kazakhstan*. Almaty.

⁵ Government of Kazakhstan, Ministry of Environmental Protection. 2009. *Kazakhstan's Second National Communication to the Conference of the Parties of the United Nations Framework Convention on Climate Change*. Astana.

9. **Transmission and distribution.** KEGOC owns 24,500 kilometers of transmission lines, which operate at 110 kilovolts (kV), 220 kV, and 500 kV, and interact with neighboring countries through interregional networks. KEGOC has undertaken several projects to modernize the aging and obsolete system, including linking the coal-rich north with load centers in the south. A development program up to 2025 has 16 major projects to eliminate outages. Nearly half of the distribution system is over 35 years old. Electricity distribution losses are estimated at 13%.

10. **Heating.** With its extreme winter climate, heating for much of the country comes from centralized district heating systems run on combined heat and power plants. Combined heat and power plants are usually coal-fired and often create pollution problems. They cover about 40% of heat production in Kazakhstan, with the remaining heat being produced by heat-only boilers, often with low efficiencies. Inefficiency is exacerbated by supply–demand mismatches caused by poor planning and forecasting, and lack of demand-side energy management. Large investments are needed to upgrade heating systems. However, most district heating systems are owned by local public sector entities with regulatory frameworks and tariffs that are inadequate to attract private investment.

11. **Energy efficiency.** The potential for energy saving in Kazakhstan’s industrial sector is high, from 10%–30%, as a result of old production technologies and utility equipment. Old buildings’ energy usage can also be reduced by 20%–25%. Efficient design and construction, submetering, improved controls, and energy management systems offer cost-effective means for increasing efficiency. On the supply side, the average electrical efficiency of existing power plants is only 32% and has potential for increasing to best-practice efficiency of 42%–53% for coal-fired plants. In January 2012, a Law on Energy Savings and Energy Efficiency was passed along with a comprehensive action plan that targets a 10% reduction in energy intensity by 2015 compared with 2008, and a 25% reduction by 2020.

12. **Summarized sector challenges.** It is clear from the above that a key challenge for Kazakhstan’s energy sector is to upgrade the country’s aging infrastructure. A linked challenge is that power and heating tariffs are still too low to incentivize private investors to finance infrastructure upgrading of the sector. The problem is particularly acute for heating systems, which need substantial resources for their rehabilitation and capital requirements. Reducing energy intensity is another key challenge. Insufficient transmission between producing and demand regions also needs to be addressed.

13. There are competing visions in Kazakhstan regarding the best solution to meet its growing power demand. On the one hand, it is thought that coal-fired generation offers the best solution for energy security. On the other hand is the view that renewable energy, energy efficiency, and greater use of natural gas should be encouraged for diversification and cost-effective mitigation of climate change impacts. Developing an effective strategy to address the growing power demand in the country will be a key challenge for the Government of Kazakhstan.

2. Government’s Sector Strategy

14. The government’s energy sector strategy is largely embodied in its 5-year plan, which provides for the government’s overall economic plan (footnote 1). The government also has longer-term plans that drive its strategy.⁶ Key aspects of the energy sector strategy include the following:

⁶ Key among them are Government Strategy 2030: Prosperity, Safety and Well-being of Kazakhstani People, and Government Strategy 2020: New Decade—New Economic Growth— New Opportunities for Kazakhstan.

- (i) increase oil and gas extraction, but also diversify the Kazakhstan economy to increase non-oil and gas exports;
- (ii) develop a competitive and open power market and improve sector performance by commercializing utility operations;
- (iii) achieve self-sufficiency on electricity generation, build new generation to replace imported power, and develop renewable energy generation;
- (iv) reduce energy intensity and promote energy efficiency;
- (v) augment the national power grid and improve interconnections with regional grids; and
- (vi) reconstruct and modernize heating systems.

15. The government encourages state-owned entities in the energy sector to borrow on a nonsovereign basis from international development partners for development projects. This is consistent with the government's efforts to develop the private sector's role in energy. It is clear that rehabilitation or replacement of existing thermal power and heat generation facilities will require significant capital on an ongoing basis.

16. Kazakhstan is an active participant of the Central Asia Regional Economic Cooperation (CAREC). In 2008, CAREC countries defined their long-term strategy for developing the region's energy sector to ensure energy security, integration of the region's energy markets, and energy trade.⁷ In October 2009, CAREC countries agreed to a framework to strengthen and expand the regional power transmission network collectively to allow for increased regional power trade.⁸ The Asian Development Bank (ADB) and other multilateral institutions participating in CAREC agreed to support diagnostics studies, capacity development, and investments in the energy sector.

3. ADB Sector Experience and Assistance Program

17. ADB has yet to finance an energy sector loan in Kazakhstan. This is due in part to high oil prices, which have reduced the country's need for foreign borrowings. However, ADB has been in recent discussions with the government about financing possible projects in the sector, including those for energy efficiency, transmission, and new technologies. In this context, extending and augmenting the country's transmission grid to link demand and supply centers and improve energy security is a government objective that ADB can support through project investments. The government is also evaluating renewable energy power generation projects, which may require financing from ADB and other development partners.

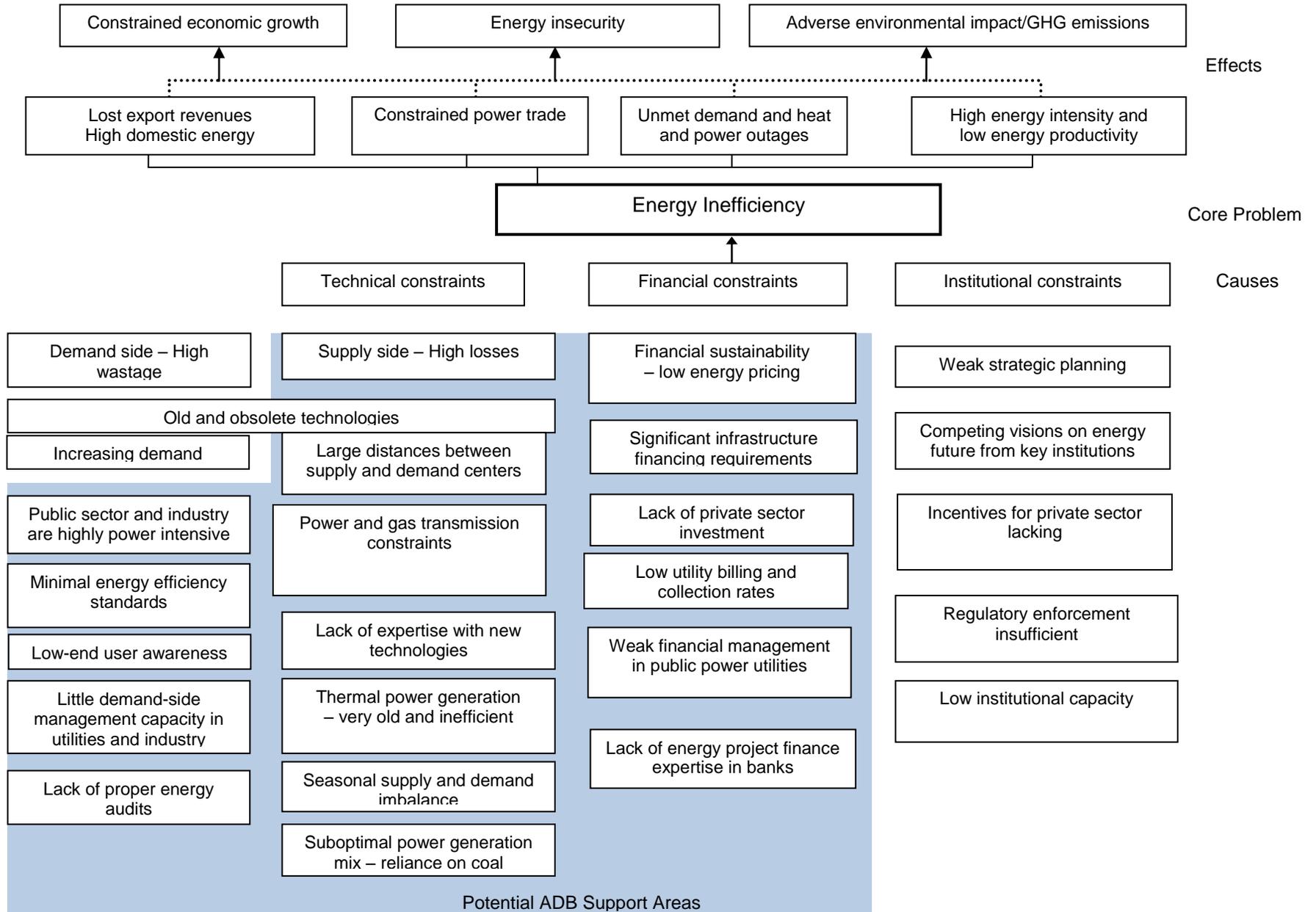
18. Improved energy efficiency is an important priority, and provides an opportunity for ADB to help the government assess energy efficiency options, and provide support for ensuing supply- and demand-side projects. ADB has completed a diagnostic study to assess energy efficiency in Kazakhstan and is identifying potential projects for investment.

19. ADB can play an active role in encouraging regional cooperation in the energy sector for the mutual benefit of Kazakhstan and CAREC countries. ADB also has a role to play in promoting international best practices. Capacity building in the areas of new energy technologies can be also supported.

⁷ Seventh Ministerial Conference of CAREC. 2008. Strategy for Regional Cooperation in the Energy Sector of CAREC Countries. Baku, Azerbaijan (November).

⁸ Eighth Ministerial Conference of CAREC. 2009. Energy Action Plan Framework. Ulaanbaatar, Mongolia (October).

Problem Tree for Energy



ADB = Asian Development Bank; GHG = greenhouse gas
 Source: Asian Development Bank.

Sector Results Framework (Energy, 2012–2016)

| Country Sector Outcomes | | Country Sector Outputs | | ADB Sector Operations | |
|--|--|---|---|--|--|
| Sector Outcomes with ADB Contribution | Indicators with Targets and Baselines | Sector Outputs with ADB Contribution | Indicators with Incremental Targets | Planned and Ongoing ADB Interventions | Main Outputs Expected from ADB Interventions |
| Efficient use of energy and reduced energy intensity | <p>Energy content of GDP decreased by at least 10% by 2016 to 0.50 terawatt-hour per \$1 billion GDP on a purchasing power parity basis (2008 baseline: 0.56 terawatt-hour per \$1 billion GDP)</p> <p>Average thermal power generation efficiency improved to 34% in 2016 (2009 baseline: 31%)</p> <p>Alternative and renewable generation increased to 1.5% of national capacity by 2015 (2010 baseline: 0.4%)</p> | Energy infrastructure expanded, improved, diversified, and well managed | <p>Electric power supply increased to 103.5 billion kWh by 2015 (2010 baseline: 82.3 billion kWh)</p> <p>825 megawatts of thermal power generation upgraded by 2016</p> <p>2,445 kilometers of transmission network constructed or rehabilitated by 2016</p> <p>1.6 billion kWh of new alternative and renewable generation installed by 2015</p> <p>340 megawatts of heat generation capacity upgraded by 2015</p> | <p>Planned and Ongoing ADB Interventions</p> <p>Planned key activity areas Energy efficiency (60% of funds) Electrical power transmission (40% of funds)</p> <p>Pipeline projects with estimated amounts Energy Efficiency Project (\$110 million); project preparatory TA (\$600,000) Power Transmission (subsovereign) (\$100 million) Second Energy Efficiency or Renewable Energy Project preparatory TA (\$1.5 million)</p> <p>Ongoing projects with approved amounts Expanding the Implementation of the Energy Efficiency Initiative in Developing Member Countries (\$3 million) (TA 6501-REG)</p> | <p>Planned key activity areas/pipeline projects</p> <p>Energy audits of government buildings (number to be determined during forthcoming project preparatory TA)</p> <p>700 kilometers of transmission lines rehabilitated</p> <p>Technical and corporate management capacity of energy agencies improved</p> |

ADB = Asian Development Bank, GDP = gross domestic product, kWh = kilowatt-hour, TA = technical assistance.

Source: Asian Development Bank.