

Russian and Caspian Energy

Energy Efficiency in Kazakhstan

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Key points

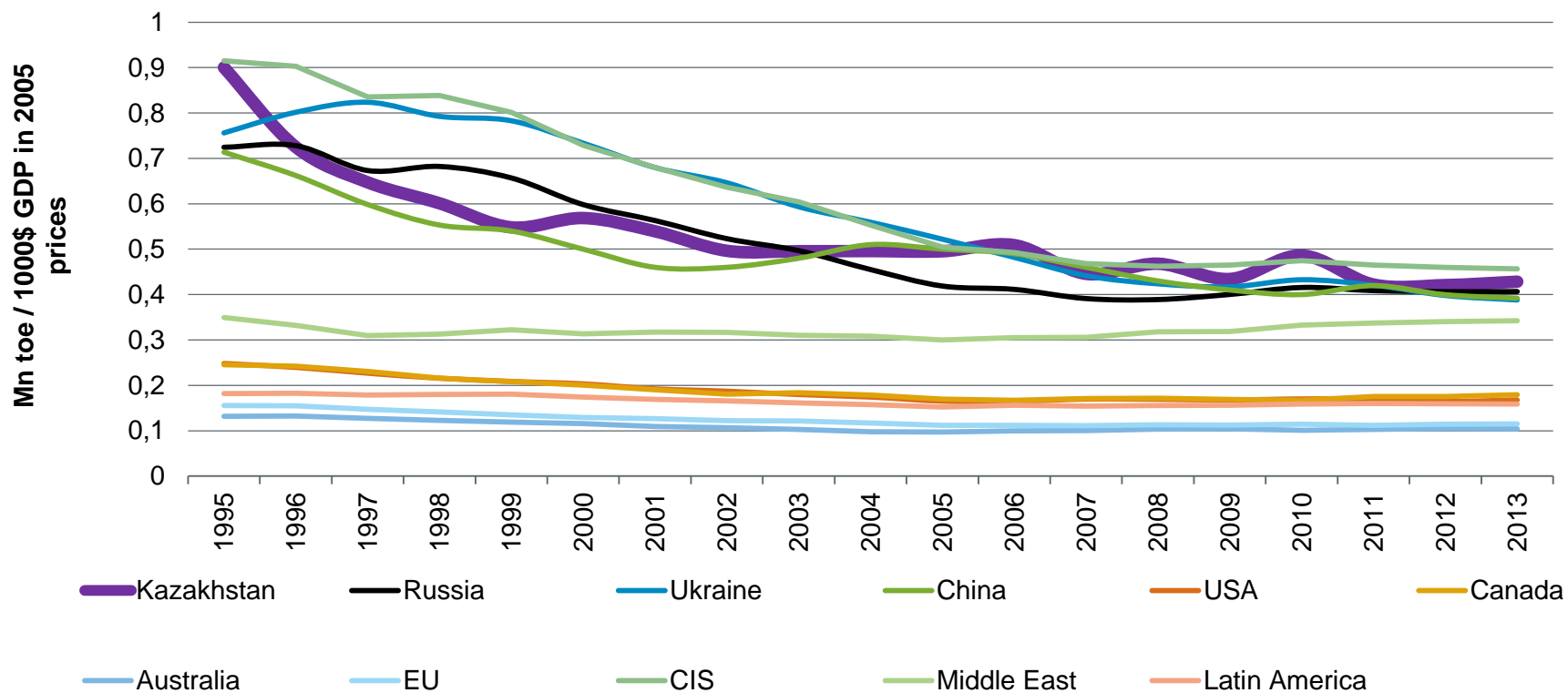
- Kazakhstan's energy efficiency has decreased substantially, in line with its peers in CIS and China, over the past 20 years
- It does remain relatively energy inefficient compared to developed economies with similar industrial/economic structure (i.e. Australia and Canada)
- There are objective reasons for the relative inefficiency (overall GDP reliance on heavy industry and resource extraction, as well as large distances)
- But sectoral analysis shows some worrying trends (i.e. serious inefficiencies in the power and metals sectors compared to peers)
- One of the key reasons for this has been domestic energy policy, especially electricity pricing (although the government is moving to gradually change this)
- International experience shows that a combination of energy price reform and targeted energy efficiency programs can help change this situation (e.g. Ukraine and China)

Energy intensity of Kazakhstan's economy declined 50% compared to the mid-1990s, but still room for improvement



Kazakhstan's aggregate energy intensity still relatively high by global standards: partly due to (1) economic structure (resource-intensive, mining and metals economy; and (2) actual inefficiencies in energy consumption

GDP energy intensity comparison



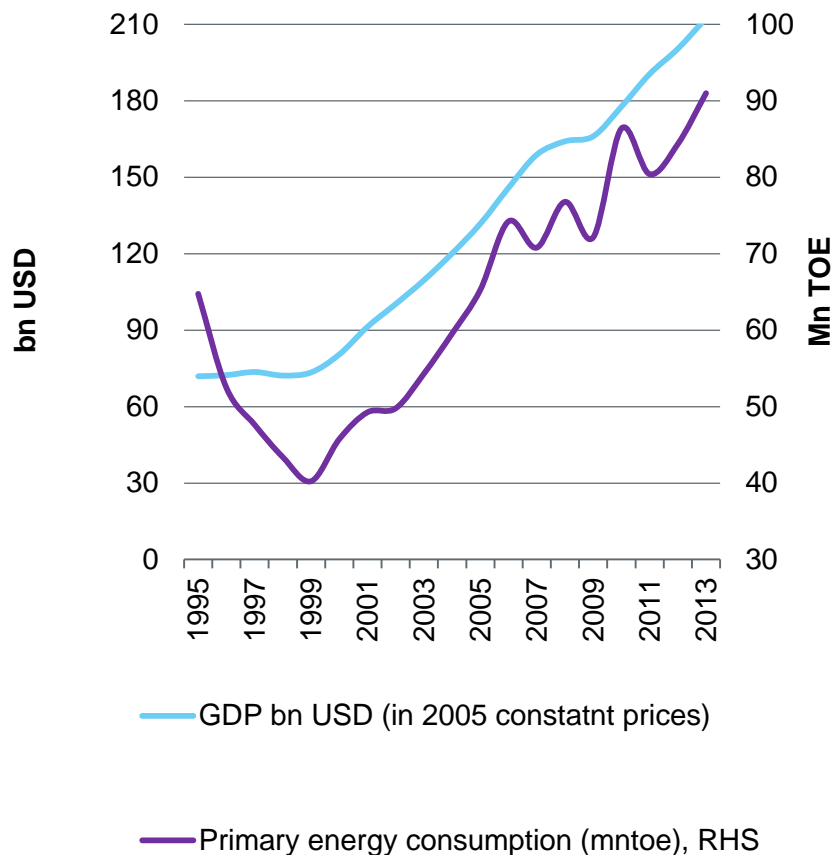
Source: IHS

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Primary energy consumption in Kazakhstan still growing at nearly same pace as economy itself



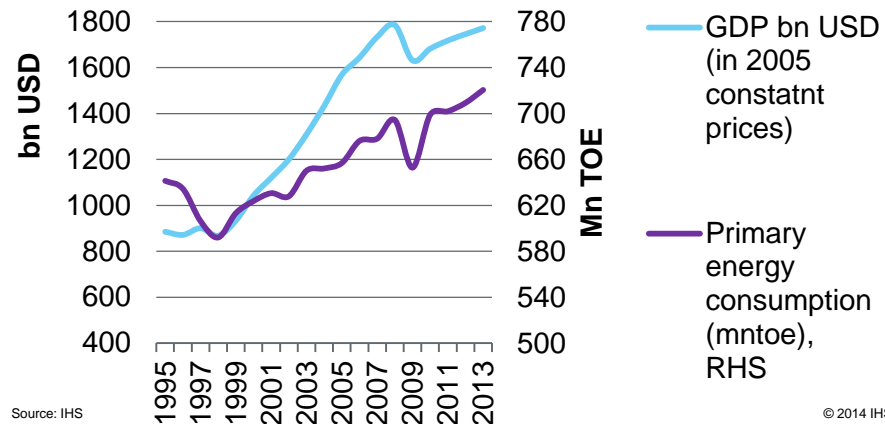
Kazakhstan: energy consumption vs GDP



Source: IHS

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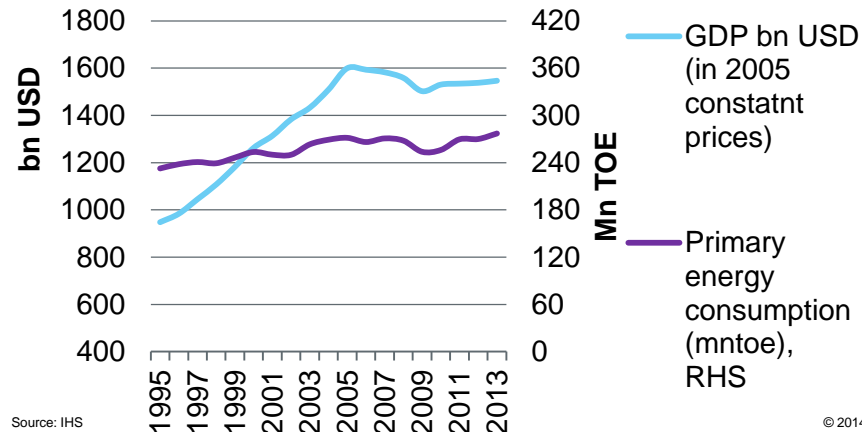
Russia: energy consumption vs GDP



Source: IHS

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Canada: energy consumption vs GDP



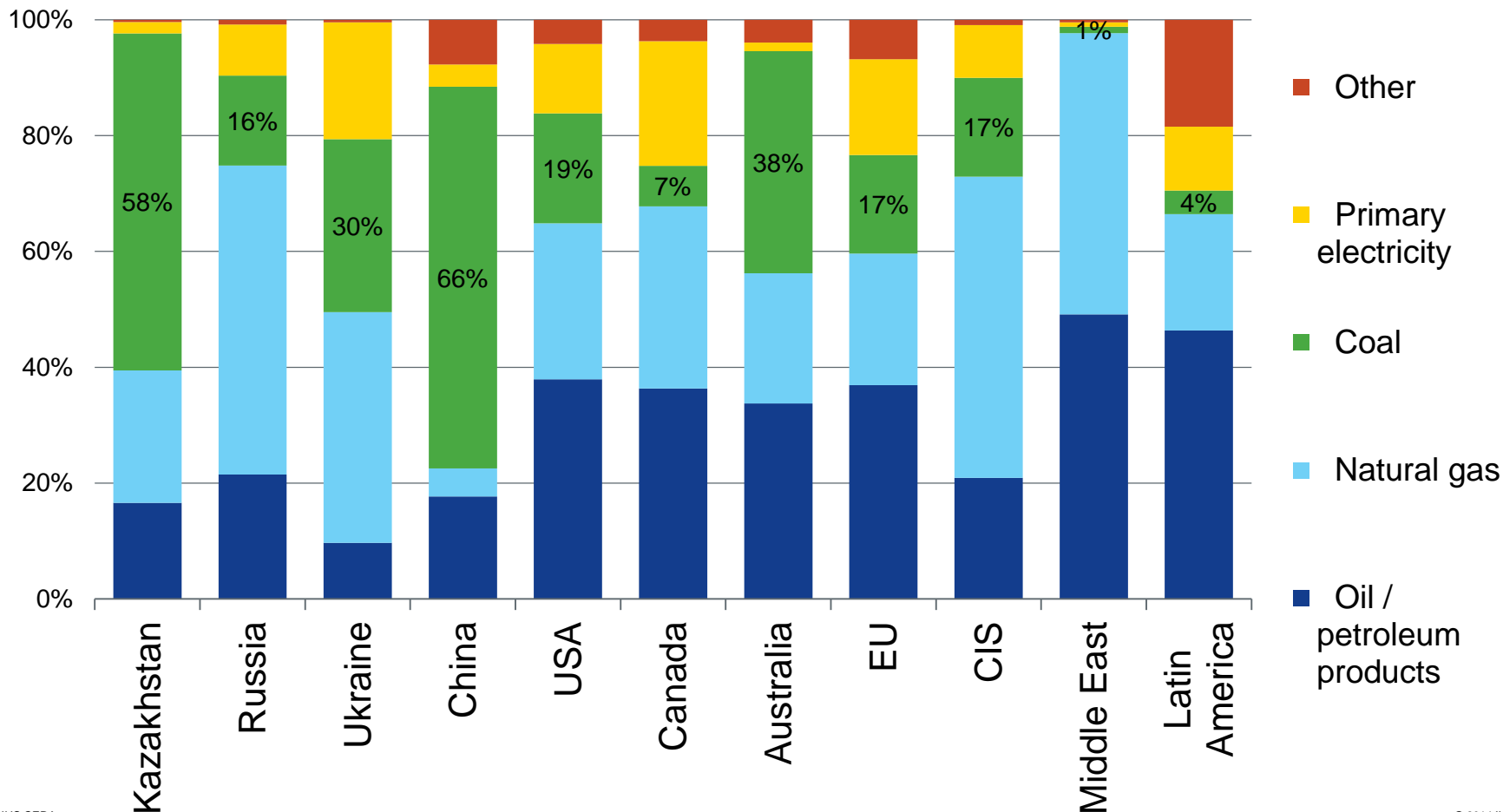
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Unlike most other countries, Kazakhstan Is a predominantly coal-based economy (like China)



Share of fuels in final primary energy consumption in different countries



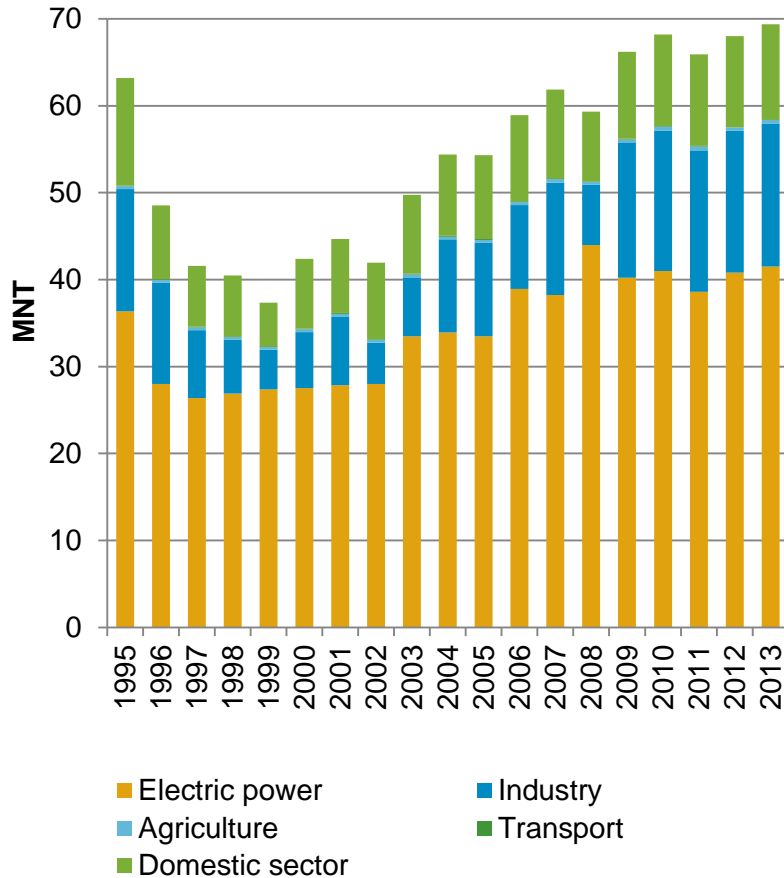
Source: IHS CERA

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Coal remains main fuel supporting broader economy, while main area of gas consumption growth has been in domestic sector (households/communal/commercial consumers)



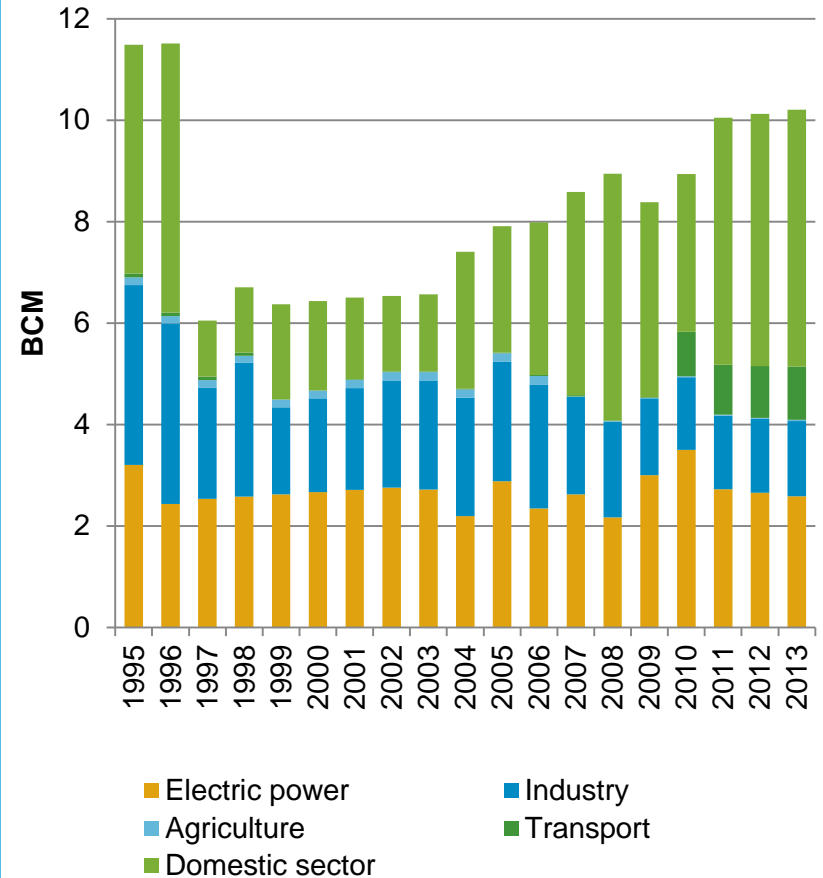
Kazakhstan coal balance



Source: IHS CER

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Kazakhstan gas balance



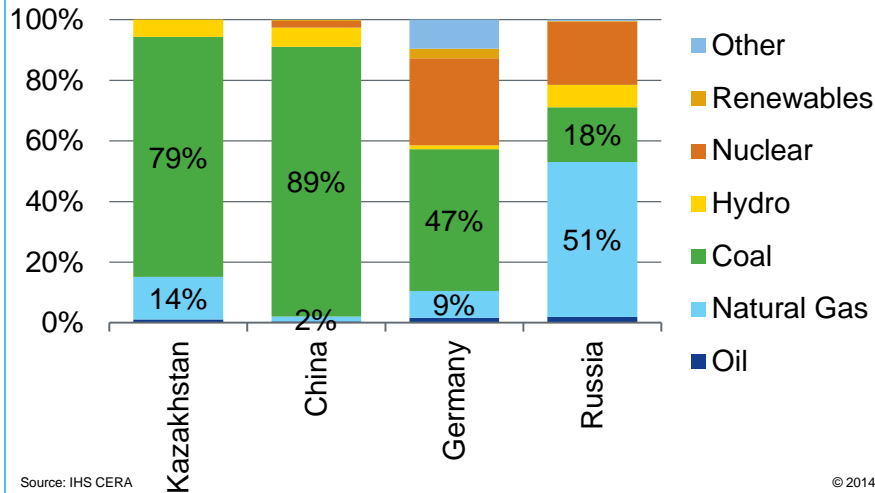
Source: IHS CER

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Age and type of equipment makes power generation in Kazakhstan very inefficient



Share of fuels in power generation



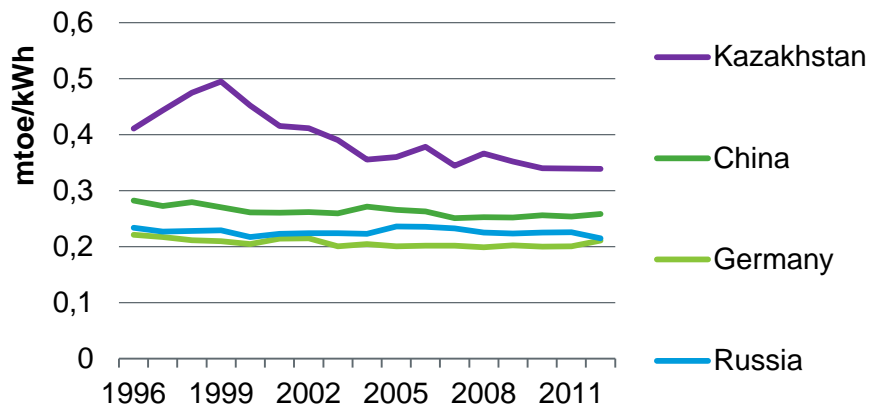
- **Kazakhstan on average consumes 36% more fossil fuels to produce 1 kWh than countries like Germany or even Russia**

- Kazakhstan's high dependence on coal-fired generation (80%) makes sector less efficient (in conversion) compared to countries with sizeable share of gas, hydro, nuclear, or renewables

- **But even compared to China (itself more than 80% dependent on thermal coal-fired generation), Kazakhstan is 24% less efficient in power generation**

- Equipment aged, and worn out (over 60% officially beyond retirement), leading to widening gap between installed and actually available capacity
 - Useful life of more than 30% of all high-voltage power lines exceeds 30-40 years; level of system losses sometimes exceeds 30%

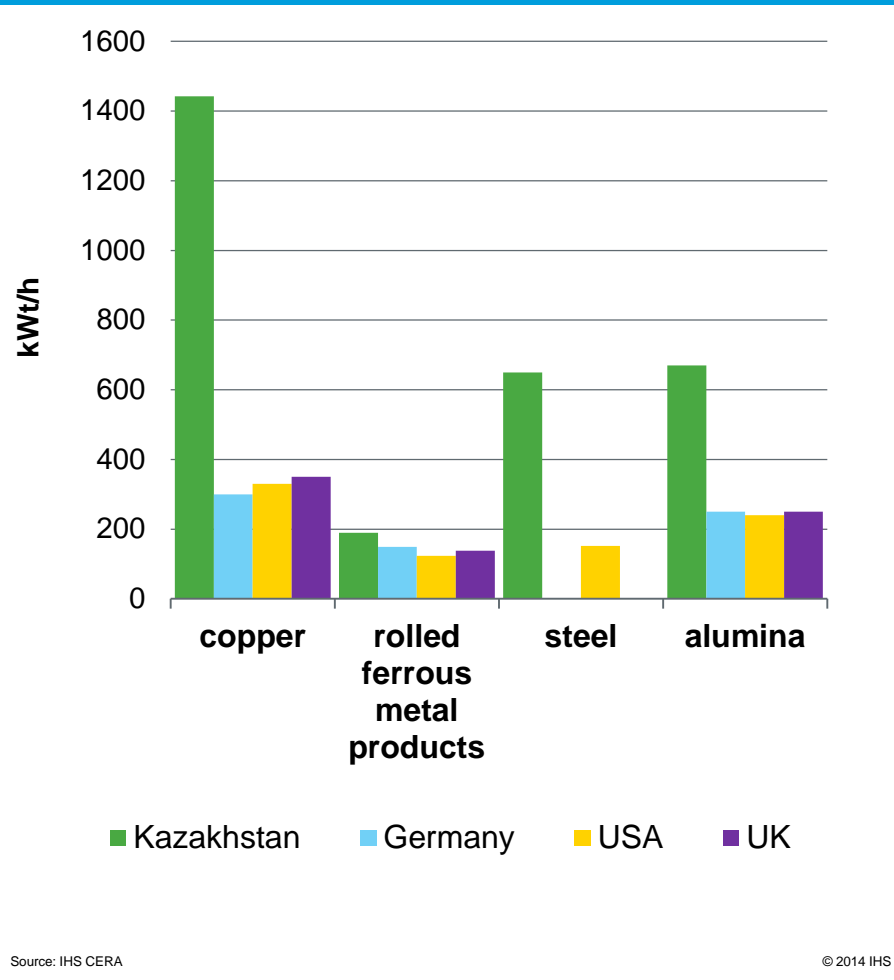
Consumption of fuel per unit of produced electricity



Metals – key industrial sector of Kazakhstan’s economy – but remains very energy inefficient



Power consumption per unit of production

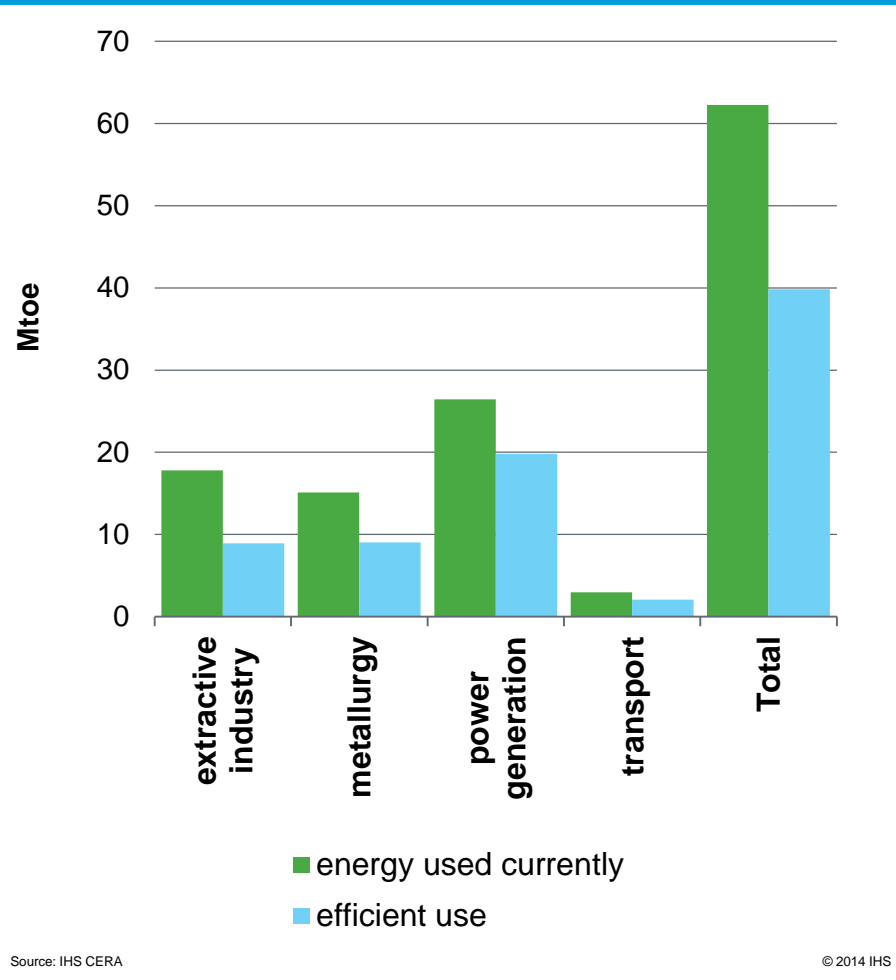


- **Metallurgy one of key pillars of Kazakhstan’s economy**
 - Accounts for 17% of total industrial production
 - Accounts for almost 20% of total exports
- **Sector relatively energy inefficient**
 - Aged and work-out equipment (over 40% in ferrous and over 50% in non-ferrous metallurgy)
 - Energy intensity of production almost twice as high as in industrial developed countries while labor productivity less than half

Energy use in Kazakhstan's industrial sector can be at least 36% lower



Energy use in selected industrial sectors in Kazakhstan



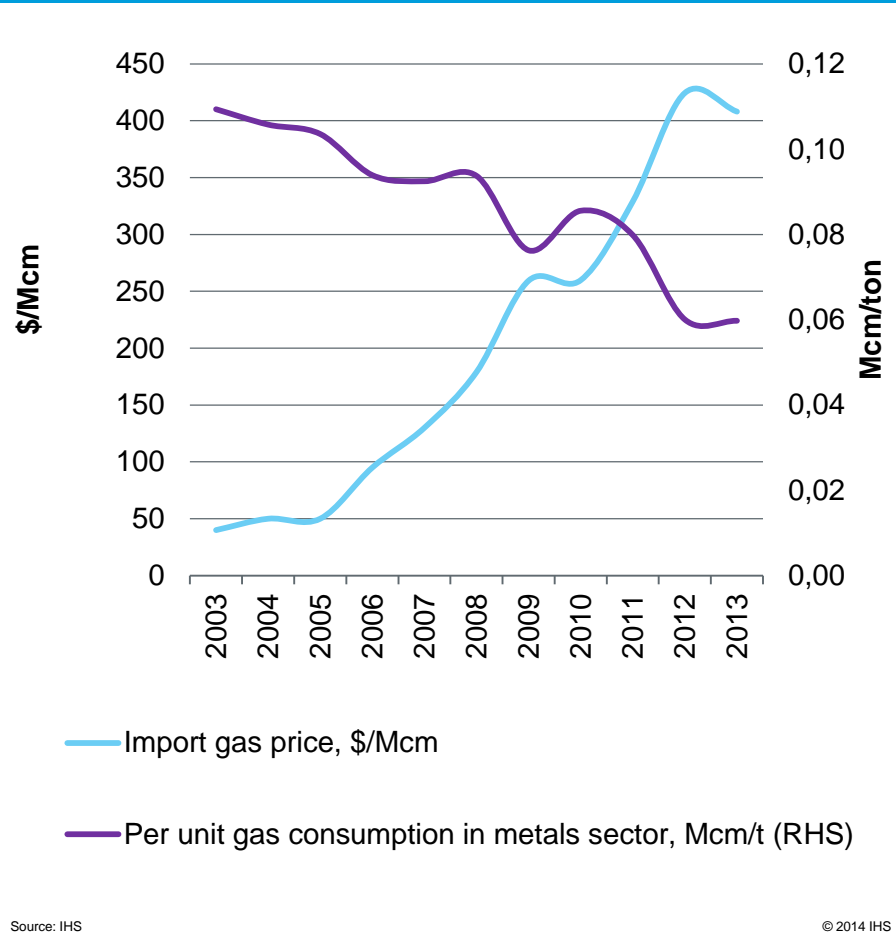
Priority measures:

- **Power generation**
 - Replacement of obsolete units and equipment
 - Construction of combined-cycle turbines
 - Introduce advanced coal-fired generation
 - Diversify generation mix (including hydro, nuclear, and renewables)
- **Metallurgy**
 - Remove energy subsidies and internalize external costs of energy (e.g. through policies such as carbon pricing)
 - Encourage investment in energy-efficient industrial equipment and processes by targeted financial incentives (e.g., tax breaks for energy-efficient investments);
 - booster private finance of energy efficiency upgrades in industry through risk-sharing or loan guarantees with private financial institutions; enabling market for energy performance contracting
- **Transport**
 - vehicle fleet modernization and renovation;
 - introduction of fuel consumption rate monitoring systems
 - optimization of cargo and passenger traffic

Case study: Ukraine's metals sector, where higher energy prices make miracles



Import gas price vs per unit gas consumption in Ukraine's metals sector



- **Ukraine's metals sector is very energy inefficient. To some extent inefficiency was "supported" by unreasonably low gas price**
- **Combination of favorable metals pricing during 2003 - 2008 and abrupt import gas price rise resulted in**
 - investments in energy efficiency during 2003-2008 - gas consumption per unit of production decreased 15.5%
 - significant achievement in 2009: gas consumption per unit of production was reduced by another 17.5%; possibly due to some closures of least-efficient plants
 - As investment activity picked up in 2010-2013 gas consumption per unit of production dropped by 20%
- **Ukrainian metal plants used several methods:**
 - Replacement of open-hearth furnaces with oxygen converters, or simply reduction of output OHF
 - Greater utilization of by-product blast furnace gas and coke-oven gas; capturing more these gases provides 30-40% of total energy use and greatly reduce gas consumption
 - Replacement of gas with coal in blast furnace production (of pig iron) through Pulverized Coal Injection (PCI)

Case study: China's Top-1000 enterprises energy-efficiency program



- In 2005, the Chinese government announced a goal of reducing energy consumption per unit of GDP by 20% between 2005 and 2010. The Top-1000 Energy-Consuming Enterprises program was key initiative
 - Top 1000 enterprises (large-scale enterprises in nine major energy-consuming industries including iron and steel, chemicals, electric power generation, non-ferrous metals, coal mining) accounted for 33% of national and 47% of industrial energy usage
 - Even though the Program was designed and implemented rapidly, it could contribute from 10% to 25% of the savings required to meet the target
- Government support is in many ways key to the final result, for example
 - Funding opportunities from Federal and Local governments
 - Tax rebates for exports of energy-intensive products
 - A differentiated electricity pricing policy: enterprises fall into one of four categories based on their level of energy efficiency - encouraged, permitted, restricted, and eliminated – and are charged increasingly higher electricity rates in order to phase out inefficient enterprises