

# **Electricity Sector Reform in Central Asia: Observations on the Diverse Experiences of some Formerly Soviet Republics and Mongolia**

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For consideration towards a special issue of the Journal of Cleaner Production  
Addressing 'Social, economic and environmental sustainability of domestic energy sector  
reforms in less developed countries'

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## **Acknowledgements:**

Much of the information included in this paper was collected by an ADB study team comprising Aashish Mehta and David Butcher (consultant). A much more detailed report from this study [1] was published by ADB in November 2005. The authors gratefully acknowledge valuable discussions with David Butcher, Peter Choynowski, Sohail Hasnie, Natsuko Toba, Xavier Humbert, Bo Q. Lin, Sujata Gupta and Merlita Pajarillo. The Public Private Infrastructure Advisory Facility supported the study tour and conference through which much information was accrued. The assistance of multiple translators, ADB support staff in our country missions and headquarters, and staff from our partner development agencies is gratefully acknowledged. All remaining errors are our own.

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## **I. Introduction**

In this paper we review the experiences of five former Soviet Central Asian Republics (Azerbaijan, Kazakhstan, Kyrgyz Republic, Tajikistan and Uzbekistan), as well as a former Soviet satellite - Mongolia, with power sector reforms. Each country's power sector consisted of a vertically integrated public sector monopoly immediately following the breakup of the Soviet Union. Since then, each country has adopted a different strategy with respect to industry structure. These strategies included different approaches to vertical unbundling, separation of policy and regulation, privatization and tariff determination. While it must be borne in mind that countries' strategies were endogenously chosen in response to national sector conditions, the common structural starting point and the variations in structural reform paths permit an instructive comparative analysis. The analysis informs the debate on the design of economically sustainable reforms.

The style of this paper is, of necessity, quite different to most presented in the canon on power sector economics. This is because many institutional features of power sectors, taken for granted in the canon (the existence of binding prices and profit maximizing firms<sup>2</sup>, for example) are conspicuously missing in most Central Asian power sectors. The key issues in most of these power sectors relate to activities that are not fully reflected in official statistics. Indeed, as we will show, a key issue is the incentives underlying the compilation of official statistics themselves. Nor are these issues given to standard theoretical economic analysis. The issues relate more to governance, information flows, politics, and some very simple economic

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<sup>1</sup> The views contained in this paper are those of the authors. They do not reflect the views of the Asian Development Bank, its board, or its member countries.

<sup>2</sup> Even as it recognizes the perverse incentives introduced by regulation (e.g. the Averch Johnson effect), the canon almost always assumes that firms seek to maximize profits subject to regulatory and other constraints.

incentives. Therefore, our approach is to present and analyze the facts, without alluding extensively to theory. The sources of information include official government and company reports where we judge them to be reliable, and documents prepared by and for development agencies offering technical assistance. However, the most incisive information comes from discussions with officials from the power sectors, governments, aid agencies, regulatory authorities, and consumers. While much of this information is extremely interesting, we only discuss the observations which are corroborated by more than one source or are reflected in data we consider reliable.

There were several key problems in these power sectors under the vertically integrated public sector monopoly model inherited from the Soviet era in the early 1990s. First, the power utilities were charged with a wide variety of objectives. The official objectives included providing cheap power to industries, demographic and political groups deemed strategically important or vulnerable; providing revenues to the state; and achieving energy self-sufficiency. One unofficial but ubiquitous objective has been to generate a parallel stream of unreported income to power sector officials. Minimizing the costs of meeting power demand, and making normal operating profits are also goals that have been stated by governments often in the past. However unlike the case of privatized utilities, profit maximization - and therefore revenue collection and cost minimization - have been compromised often in favor of the above objectives. These diverse and conflicting demands on power utilities were also reflected in the objectives of policy makers and regulators, whose tasks and responsibilities have only recently been separated, and only in some countries.

The second key problem with this model was the lack of accountability and the poor collection and dissemination of disaggregated sector data. This lack of transparency permitted significant levels of corruption and commercial losses, which were in turn aggravated by a high prevalence of barter and the inadequacy of metering, monitoring, billing, bill collection, allowances for the disconnection of non-paying customers, and financial reporting. Economically, this laxity meant that electricity tariffs lost much of their relevance and traction on the sector, and energy and power demand<sup>3</sup> and supply could not be controlled through price incentives. This, in turn has led to massive overuse of energy, poor timing of energy demand, and sourcing of energy needs in the region that does not reflect minimum economic production costs.

The third key problem was that tariffs were set below financial cost recovery levels to fulfill planning, social protection, and other objectives. Coupled with the very poor performance of the utilities in ensuring that power use was measured and paid for, these problems reduced the financial viability of the sector. The consequent postponement of critical infrastructure rehabilitation, coupled with poor demand management, has resulted in high unmet demand for power, unreliable power supplies and high technical losses. Given the lack of transparency, consumer protection has been weak, and the burden of power unreliability falls disproportionately on poor and rural consumers.

The fourth key problem is that vertically integrated utilities were free to utilize market power in naturally monopolistic functions of power supply, and the opacity afforded by vertical integration, to pursue the unofficial objectives noted above. Because domestic fuel sources are not priced appropriately the utilization of domestic generators created economic rents. Control

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<sup>3</sup> The distinction between energy and power demand is that energy demand is integrated over time and is measured in kilowatt hours (kWh), while power demand is instantaneous and measured in kilowatts (kW). Energy supplied (in kWh) and power capacity (in kW) are the supply side counterparts to energy and power demand respectively.

of transmission lines has been used frequently to ensure that power is sourced from domestic generators, even when imported power would be cheaper, thereby generating larger domestic rents. The opacity afforded by vertical integration allowed these rents to be seized by sector officials with impunity.<sup>4</sup>

These problems set the stage for serious difficulties following the break-up of the Soviet Union. The various distortions described above were maintained during the Soviet era with the help of large financial inflows from the Central government. These inflows were used to cover the costs of infrastructure expansion and rehabilitation, and, to a lesser extent, to provide direct social assistance to consumers. These inflows ceased following independence creating huge financial strain on the sectors. Salaries of utility employees remain low in comparison to the sums of money which they handle, with obvious implications for corruption.<sup>5</sup>

Further, under the Soviet Union, the Republics were connected by gas and electricity transmission infrastructure, and the sourcing of energy was directed from Moscow in an attempt to minimize the cost of supply to the Union as a whole. Upon achieving independence, the goal of energy self-sufficiency, and the market power enjoyed by public utilities were used to limit cross border flows of energy, and much of this transmission capacity is underutilized. As a result, domestic bottlenecks have appeared, and investments that would otherwise be unnecessary are being prioritized by governments.<sup>6</sup>

Finally, independence resulted in a significant shift in the structure of energy demand, away from larger industrial consumers, and towards smaller and more residential consumers. This was because independence was accompanied by economic contractions, especially in the tradable goods sectors, as well as significant human displacement and migration due to economic changes and war in Azerbaijan and Tajikistan. These shifts in demand meant that more numerous and elusive residential consumers, whose utilization of energy is difficult to monitor, control and charge for, became more important. This significantly shifted the composition of the problems with financial discipline in the sector. While commercial losses resulting from power being illegally commandeered by large enterprises are certainly critical (probably even dominant), and are only possible with complicity of sector officials, unreported power consumption at lower voltages by small consumers is more difficult to curtail, even for a well-intentioned distribution company. The demand shifts also meant that the location of demand in the power grid shifted, implying new system constraints.

Our paper examines the paths to structural reform taken by these six countries; presents data on progress towards solving the problems listed above; and presents economic hypotheses linking the structural changes with progress identified. This analysis is used to derive suggestions for the further structural reforms of the sectors. The experiences documented make a strong case for (i) improving the transparency of operations of Central Asia's power utilities, beginning with illuminating the transactions between subsidiaries; and (ii) improving incentives for distribution companies to perform their billing and cash collection responsibilities, both through improved accountability, and, in the countries studied, some privatization of these commercial services. They also highlight the critical role of governmental commitment to restoring discipline, and the importance of setting limited and consistent objectives for regulators.

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<sup>4</sup> For more on the linkage between vertical integration and rent seeking, see the section on Uzbekistan.

<sup>5</sup> For example, controllers at Tajikistan's power utilities were paid no more than 60 Somoni per month (approximately \$20) until 2003. An incentive scheme introduced in 2003 encouraged controllers to earn an additional 100 Somoni per month by collecting more cash. See ADB et. al. [8].

<sup>6</sup> This is a conclusion of World Bank [22].

In section II we describe briefly the primary energy endowments of the countries involved, and their energy infrastructure. In section III, we review the experiences of each country, and their reform paths, comparing the outcomes across countries to develop key findings. Section V elaborates these findings and concludes.

## II. Setting

Figure 1 is a map of the five former-Soviet Central Asian Republics. While Kazakhstan, The Kyrgyz Republic, Tajikistan and Uzbekistan share large and important borders Azerbaijan is separated from these countries by the Caspian Sea. Mongolia (not shown) also does not have a common border with any of the countries shown.

Kazakhstan, Kyrgyz Republic, Tajikistan and Uzbekistan, which from here on we will refer to as the four Central Asian Republics (CARS), possess significant complementarities in their energy resource endowments. Table 1 presents data on the primary energy resource endowments of these countries. This table shows that Kazakhstan's fossil fuel resources are substantial. Uzbekistan possesses natural gas reserves, estimated at 1.8 trillion cubic meters. In contrast to these large deposits, annual gas extraction rates in Uzbekistan have recently averaged around 56 million cubic meters annually.<sup>7</sup>

In contrast to Uzbekistan and Kazakhstan, The Kyrgyz Republic and Tajikistan possess few viable fossil fuel deposits. However, being primarily mountainous countries, they are extremely rich in hydropower potential. Several large dams in The Kyrgyz Republic and Tajikistan built during Soviet times provide a current installed hydroelectric capacity of 2950 megawatts (MW) in Kyrgyz Republic and 3,218 MW in Tajikistan. Given excellent topographical and hydrological conditions, Tajik and Kyrgyz generation from existing dams provide a very cheap source of hydropower. While these countries' governments argue that further hydropower development provides easily the most cost-effective means of increasing electricity supply in the region, it is commonly argued by international development agencies that summer demand in the region may be more cheaply met by curbing energy losses, improving pricing and promoting demand side management, while winter demand is best handled using gas fired thermal plants.<sup>8</sup> This is because energy intensities in the region are extremely high (Table 2), and the fixed costs of hydropower development are too high to be supported for winter generation only.

Seasonality plays a significant role in the region's power sectors. Winters are extremely cold, especially at higher elevations in The Kyrgyz Republic and Tajikistan, and in Mongolia and Northern Kazakhstan. Demand for energy, especially amongst residential consumers, is therefore significantly higher in winter than in summer. The shift in demand from large industrial to residential consumers has aggravated this imbalance. Further, hydropower is costly to generate in the winter, because reservoir levels are low, and released water runs out of control over the frozen landscape. Such water spillage contributes to diminished or zero flows into the Aral Sea, which is rapidly shrinking. Much standing water is also left on Uzbek flatland.<sup>9</sup>

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<sup>7</sup> Source: MVV [16].

<sup>8</sup> This is a key message of World Bank [22].

<sup>9</sup> For more on the environmental impact of winter hydropower generation, the reader is referred to World Bank [24], or several reports by environmental agencies on the disappearing Aral Sea.

There is therefore significant potential for energy trade in the four CARS. Soviet industrial and energy transmission infrastructure was built with precisely these complementarities in mind. The electricity grids of these four countries and Turkmenistan are all interconnected by a 500 kilovolt (KV) transmission ring, with a Unified Dispatch Center (UDC) operating from Tashkent. A large aluminum smelter was built in Tajikistan in order to utilize widely available hydropower to supply aluminum to Soviet industries in other republics. Uzbekistan was endowed with gas refining and thermal power generation capacity in excess of its own demand. Pipelines to carry Uzbek gas to Bishkek (The Kyrgyz Republic), Almaty (Kazakhstan) and Dushanbe (Tajikistan) were also built to meet winter heat demand. Cotton farming on the plains, especially in Uzbekistan, was developed assuming certain arrangements for water releases by the upstream states (The Kyrgyz Republic and Tajikistan)

Following the disintegration of the Soviet system, much of this infrastructure has been underutilized. Political disputes, and limited access to hard cash in the Kyrgyz Republic and Tajikistan have resulted in significantly reduced gas exports from Uzbekistan to its neighbors. Disagreements between the upstream (Kyrgyz Republic and Tajikistan) and downstream countries (Kazakhstan and Uzbekistan) regarding water management have deepened the rift. Meanwhile, Uzbekistan, which controls most of the valleys, and therefore most of the vital transmission lines, utilizes grid access and pricing to seek a significant share of hydropower resource rents, thereby reducing the volume of electricity exported to countries within and outside the region. For example, Tajikistan does not have its own transmission lines connecting its Northern and Southern grids. Therefore, it sells surplus power from the Southern grid to Uzbekistan, and imports Uzbek power into the Northern grid for almost twice the price.

Fuel prices in the region are low. Because Uzbekistan is a double land-locked country, and the number of gas export routes are limited, the prices received by Uzbekistan for its gas exports have ranged from \$42 to \$48 per thousand cubic meters (KCM)<sup>10</sup>, although some recent deals to export gas to Russia and Ukraine have reportedly brought prices as high as \$57/KCM.<sup>11</sup> This compares to current world prices of approximately \$108/KCM for gas of equivalent heat content on the European markets.<sup>12</sup> These low market prices of gas resources are echoed in the prices of other fuels throughout the region. It is important to note that domestic prices for fuel are often even lower than these border prices. For example, Uzbekistan used to supply its power utility with gas at \$8/KCM in 2002.<sup>13</sup>

These low fuel prices have three important environmental consequences. First, as shown in table 2, they promote excessive energy intensity. Second, they make imported hydropower look relatively expensive in fuel producing countries. Third, as mentioned, this means that reservoirs are discharged in upstream countries to meet domestic winter demand, rather than foreign summer demand, causing significant spillage of water. The region is therefore consuming fossil fuels at an unnecessarily high rate given the needs of its economies, while water is discharged inappropriately. This is particularly costly in economic terms, because the value of fuel resources is likely to rise in the future, while hydropower discharged from existing dams according to sensible schedules should be considered to be relatively clean.

Azerbaijan<sup>14</sup> is an energy rich country and has signed large deals<sup>15</sup> to exploit its oil and gas deposits in the Caspian Sea. However, under the Soviet Union, it balanced its energy

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<sup>10</sup> Source: ADB [4].

<sup>11</sup> Source: Industry personnel and development agencies.

<sup>12</sup> Figures converted to international prices using data on heat content from MVV [16].

<sup>13</sup> Source: ADB [7].

<sup>14</sup> The information in this paragraph is drawn from ADB [3].

sector needs through trade with its neighbors. Azerbaijan has an extensive power transmission and distribution network with power transmission interconnections with Armenia, Georgia, Iran, Russia and Turkey. Following independence from the Soviet Union, Azerbaijan was engaged for much of the early 1990s in a border conflict with Armenia, resulting in the displacement of an estimated 700,000 people. Simultaneously, its industrial sector collapsed. This has shifted electricity demand from industry towards small, often illegally connected, residential users. The cost of the conflict to the public purse was also substantial, while hard economic times meant that the extremely low inherited tariff levels could not be adjusted. These factors sharply limited the funding available for investments in infrastructure rehabilitation or adjustments, and Azerbaijan's already old energy infrastructure deteriorated further. Distribution and transmission faults became more frequent, and outage rates of generators are very high. Poorly treated gas has compromised the condition of the gas transmission system, further hampering the delivery of heat to households and fuel to power plants. It has also prompted some consumers to switch to electrical heating. Azerbaijan can no longer meet peak electricity demand, and outages are frequent, particularly in rural areas, where power is only available for 8-12 hours daily.<sup>16</sup>

Mongolia<sup>17</sup> is an expansive, sparsely populated country with extremely cold winters. Most of the population outside the main cities is serviced by small off-grid generators. These local power arrangements are outside the scope of this paper. Instead, we focus on the Central Grid, which serves the capital – Ulaanbaatar, and its surrounding areas. This grid consists of five coal-fired combined heat and power plants (CHPs) with a total installed capacity of 710 MW, of which an estimated 464 MW is available. Peak demand in the system is around 500 MW, and this difference is imported from Russia, mostly during winter. The coal comes from domestic mines. Given the earlier parlous state of its energy infrastructure following the Soviet collapse, Mongolia has made substantial rehabilitation of its energy infrastructure during the past decade, which have involved the energy sector taking on considerable debt.<sup>18</sup>

### III. Country Experiences

We now present an overview of the energy sector reforms undertaken by each of the six countries to see what lessons can be drawn from this. For expositional ease, we move roughly from the least reformed sectors, to the most reformed sectors, although rankings are not always possible. In order to facilitate this discussion, we include tables comparing sector ownership, losses, tariffs and institutional frameworks for governing the sectors.

#### *Tajikistan:*

The power sector in Tajikistan consists of three separate grids. As indicated in Table 5, the Northern and Southern grids are still owned by the public vertically integrated company – Barki Tajik (BT), while the small Eastern grid has been turned over to a community based management scheme implemented by the Aga Khan Foundation and the Swiss government. This system is facing difficulties in raising tariffs to permit the recovery of its financial costs. However, it is reported to have fared significantly better than the state owned distribution

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<sup>15</sup> At the end of 2004, deals already totaled \$11 billion, and the estimates of expected oil and gas export revenues between 2004 and 2024 range from \$70 billion to \$210 billion. The lower figure, while still very large in relation to Azerbaijan's GDP, appears more reliable.

<sup>16</sup> Source: Discussions with consumers, corroborated by development agency personnel.

<sup>17</sup> Information from this section is drawn from ADB [1].

<sup>18</sup> According to Mongolia's Energy Regulatory Authority [12], the revenues of the central grid in 2003 were \$71 million. Indicative figures, not officially confirmed, put the annual cost of international debt service obligations by the grid at \$20 million.

companies (DISCOs) in terms of discipline. Table 4 shows that in 2002, out of all electricity supplied by Barki Tajik's generators, 22% was not reflected in bills, 54% did not result in a payment, and only 21% resulted in a cash payment.<sup>19</sup> Bills not paid in cash are paid in barter and offsets on government books. Accurate information regarding the prevalence of barter and offsets, and the arrangements by which non-cash assets are valued to write off electricity bills, has proven impossible to obtain in all the countries under consideration in this paper. The reasons for this relate to the sensitivity and illegality of such transactions.

There have been peculiar structural changes in Tajikistan's power sector. In 2001 the power sector was removed from the Ministry of Energy's direct control and Barki Tajik was created as a corporate entity. This was done in order to facilitate further structural changes and improve the commercial performance of the sector. In January 2004 the general manager of BT was appointed as the Minister of Energy, following which BT was effectively remerged with the Ministry of Energy. Ostensibly this reversal has been undertaken to give the Minister a free hand in expediting reforms.

One apparently positive change has been the formation of a series of electricity sales companies, which took over meter reading, billing and collection from the distribution departments. According to the government, these subsidiaries of Barki Tajik have succeeded in improving the collection rate from 70% of billings to 86%. The measures to achieve this in Dushanbe involve the computerization of the customer billing and collections database. However, in contrast to the picture painted by these statistics, we have been shown evidence that the billing systems are still not always correctly applied, and may be ignored in favor of bills calculated by consumers themselves. Aside from this, no actual vertical unbundling has been undertaken in Tajikistan, although the government is formulating a restructuring plan.

Tariffs in Tajikistan are very low, as indicated in Table 5. The highest tariff paid by any class, 1.6 US cents/kWh, is far below more usual international rates of 5-9 cents/kWh, and significantly below the rate of 2.10 cents/kWh deemed necessary for financial cost recovery by the World Bank<sup>20</sup>. The State Agency on Antimonopoly Policy and Entrepreneurship (AAMP) has recently introduced seasonal tariffs in an attempt to flatten the seasonal load curve. Unfortunately, this was done by offering summer discounts from these already low tariff levels, rather than by raising the winter tariff to reflect costs of unmet demand. There are also large cross subsidies which basically support residential consumers, the aluminum smelter, municipal agencies and agricultural pumping. Some consumers pay as little as 0.28 cents/kWh for summer power in Tajikistan. These pricing failures result in large unmet demand, which is handled by frequent load shedding which falls disproportionately upon the poor in Dushanbe and in rural areas.<sup>21</sup>

Affordability of electricity is the key reason that tariff reforms have proven difficult in Tajikistan. According to data collected by the State Statistical Agency of Tajikistan, 83% of the Tajik population was below the poverty line in 2000, with families with elderly members and young children being especially vulnerable, following the loss of many breadwinners in Tajikistan's civil war. In order to balance the need for financial viability in the power sector with affordability concerns, the government has introduced two policies. First, while committing the

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<sup>19</sup> According to these figures 89% of generated power was sold, 88% of that was billed, 70% of that was collected and 40% of this was cash. Therefore, we have  $0.89 \times 0.88 \times 0.7 \times 0.4 = 0.22$  collected in cash.

<sup>20</sup> World Bank [22], p. 12.

<sup>21</sup> Electricity service outside of the large cities in Tajikistan between October and April is limited to four hours daily: 6–8 am, and 5–7 pm., and load ceilings are even applied during these times, leading to load shedding (see ADB [2], volume 1, chapter 11, page 4).

country to 6% tariff increases every quarter for the next five years, it has also introduced a lifeline tariff scheme. Under this scheme, households are permitted up to 250 kWh of electricity per month at a reduced rate of 0.53 cents/kWh (0.26 in the summer), and pay 0.9 cents/kWh for higher levels of consumption. While the scheme is certainly a reasonable approach to balancing these needs, the lifeline level was extended to 250 kWh from its original level of 150 kWh. The reasons for doing this are not clear. The decision reduces conservation incentives for households with monthly consumption in the range of 150-250 kWh/month, and constitutes a significant financial transfer from the already strapped utility to middle income consumers.<sup>22</sup> The second measure undertaken by the government, is the institution of an income support scheme that provides budgetary support to consumers when utility bills consume a sizable portion of their income. However, we are unable to confirm that vulnerable households have begun to receive these payments yet. In any case, the tariff levels are extremely low, and the implementation of the phased tariff increases may be politically infeasible.

Tajikistan has long had difficulties with end user electricity metering. The AAMP raised the electricity connection fees charged to unmetered customers, in an effort to provide incentives for them to install meters. While this has worked, there is a lack of clarity regarding who actually pays for the installation of meters. BT claims that consumers are not charged for meter installation, while some consumers claim that officials require payments.

As figure 6 shows, the AAMP's regulatory decisions are subject to presidential approval, which in practice politicizes tariff decisions. Tajik regulators are also burdened with more intractable objectives to pursue when setting tariffs, than regulators in any other country in the region. In particular, they are asked simultaneously to maintain a profitable environment for BT, and to maintain low prices to support consumers and the economy. While the tension between these objectives is typical of the regulatory dilemma in most environments, given Tajikistan's tariff levels of less than half a cent per kWh (Table 5), the conflict has no conceivable resolution. The objectives cease to provide meaningful guidance to regulators, who consistently opt to maintain low prices to the detriment of the sector's financial health. This is apparent both from the decision to achieve seasonal variation in tariffs through summer price reductions, and from the decision to "help the poor" by extending the lifeline tariff allowance rather than dropping the lifeline tariff and means-testing the entitlement.

### *Uzbekistan*

Uzbekistan's power sector remains almost entirely state-owned, within the Joint Stock Company Uzbekenergo (UE). Officially, each of the companies of UE are separate legal entities. However, each subsidiary reports directly to the Company Council. Tariffs are not unbundled, separate account books for the subsidiaries are not available, and neither are measurements of the bulk power passing between companies. All communications to the regulator are forwarded by the Company Council. In essence, then, there are no publicly observable boundaries between the companies, and they are effectively completely vertically integrated.

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<sup>22</sup> While we do not have the data to measure the income elasticity of demand in Tajikistan, electricity is widely reported to be a normal good (one that consumers increase their consumption of as they become richer). It must follow that as the lifeline allowance is increased, the poor (who consume less than the allowance) cease to benefit from the subsidy. A better way to target the poor, is to means-test entitlement to the lifeline (as the Mongolian regulator has directed, see [12]), and/or to reduce the tariff paid on the lifeline allotment.

This gives rise to some awkward disputes. For example, multiple sources in the Uzbek government have claimed that power flows from the high voltage transmission lines into the low voltage distribution system are carefully misreported. These figures are allegedly used to claim that electricity that is actually lost from the distribution lines due to theft, managerial negligence or bribery, has been lost from the high voltage transmission lines. It would be in the utility's interest to make such claims, because while high distribution losses are incriminating, high transmission losses signal technical failings which would require large investments to rectify. Due to the poor state of bulk metering, and the complete lack of real time system control, it is impossible to confirm or reject these allegations.

This opaqueness sharply limits private sector interest in investing in the Uzbek power sector. While the government has officially sanctioned the sale of up to 49% stakes in UE subsidiaries, investor interest has been lacking. Investors may be put off by the lack of managerial oversight that they could exercise. They might also be unwilling to invest because the flows of cash and electricity in the sector are invisible to outsiders, and may mask grim results. This latter point is clear from table 4. These figures show that out of all electricity generated in 2002, only 82.8% of generated electricity results in a billing, 61.2% results in a payment, and only 33.7% results in a payment in cash. The Uzbekistan government asserts that improvements in these figures have been achieved, although no new figures were offered to our study team. In order to improve bill payment, consumers are now permitted to pay their electricity bills at savings banks or post offices.

A third potential reason for the lack of investor interest in the sector has to do with the rules for electricity dispatch. UE owns the transmission company, DISCOs and generators. It is difficult to see how potential investors in generation could be convinced that their generation capacity would be dispatched by UE on a purely economic basis. This industry structure is therefore likely to require significant alteration if new generation investment is to be attracted without the government resorting to providing unnecessarily expensive guarantees, such as overly generous take-or-pay clauses in power contracts<sup>23</sup>. Independent management of the transmission company, and adequate transparency in its decision-making, cash-flows and power flows, will be helpful in reducing the scope and cost of attracting private investment in generation.<sup>24</sup>

Uzbekistan has made significant progress on electricity pricing. As demonstrated by Table 3 and by Figure 2, which documents electricity tariff changes in Uzbekistan, real electricity prices have been increased significantly since 2002, while cross subsidies have been eliminated. Electricity tariffs now average 2.85 cents/kWh. The World Bank suggests an average economically efficient tariff level of 3.5 cents/kWh in Uzbekistan.<sup>25</sup>

Power tariff increases are unlikely to continue due to affordability constraints. The Ministry of Finance (MoF), which regulates electricity tariffs is also unconvinced of the merit of UE's arguments that cost recovery requires tariff increases. It has stated<sup>26</sup> that further tariff increases are difficult to consider until UE shows significant improvements in metering, billing

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<sup>23</sup> A take or pay clause requires the buyer (usually the government or transmission company) to commit to paying for a particular amount of power capacity whether it is utilized or not. Generosity of such clauses has resulted in significant disputes and fiscal strain in countries affected by the East Asian Crisis.

<sup>24</sup> We emphasize that this is not a suggestion for privatization of the transmission company. The issue here is the independent accountability of the transmission company, not who owns it.

<sup>25</sup> World Bank [22], appendix 5.1.

<sup>26</sup> Statement included in a speech prepared by the MoF for the CAREC Members' Electricity Regulators Forum 2005 meeting.

and collection efficiency. The government is not publicly entertaining the possibility of using lifeline tariffs to smooth the path to economically efficient tariff levels, because it feels that further complications in tariff structures should wait until after the serious problems with commercial laxity are addressed.

Uzbekistan is undertaking a campaign to ensure universal end-user metering. This is being initiated in response to concerns regarding the very poor energy efficiency of the economy. However, consumers are required to pay for their own meters. This has had the effect of dissuading consumers from having meters installed, and there is rumored to be a black market for stolen electricity meters. The combination of increases in most public utility tariffs and new metering charges has caused many consumers to refuse to pay their bills, resulting in a proliferation of court cases.

The regulatory mandate given to the MoF is quite simple, as shown in table 6. Because it is only required to work towards financial cost recovery, it has been able to raise tariffs substantially while reducing cross subsidies. However, as it is not obliged to consider the long-term optimal utilization of primary energy resources, the MoF does not question the assertion that Uzbek thermal power is cheaper in economic terms than imported hydropower. As explained earlier, this assertion is false, because the financial costs of Uzbek thermal generation benefit from a serious undervaluation of the gas feedstock,<sup>27</sup> and is resulting in premature extraction of gas resources.

#### *Kyrgyz Republic:*

The Kyrgyz Republic's state-owned electricity sector was corporatized as Kyrgyzenergo in 1997, in much the same way as was done in Uzbekistan and Tajikistan. As in Uzbekistan and Tajikistan, it is not clear that any direct benefits accrued from this move alone. However, in 2001, the company was vertically unbundled into four DISCOs, a transmission company and several power plants. The power plants are held under a Joint Stock Company (JSC). Each of these companies is publicly owned. Each company has its own account books, managerial autonomy, and reports separately to the regulator.

The vertical unbundling of the sector has revealed the extremely poor financial state of the sector, and in particular, the miserable performance of Kyrgyzstan's DISCOs. As is clear from table 4, commercial losses are high, and billing and collections are extremely weak. The reason that these previously unobservable weaknesses have become visible is important. When the system was vertically integrated, cash transfers between distribution and other departments were an internal matter. Shortfalls in cash could be handled discreetly through compromises, and creative accounting. However, since the companies have been separated, transmission and generation companies expect to be paid in full, and have weaker incentives to be discreet about managerial shortcomings at the DISCOs. Because the DISCOs do not collect sufficient cash, clashes over the distribution of cash have become public.

This publicity brought transparency in its wake. It has become very clear that the extent of corruption and fraud in the vertically integrated company was substantial. The exact vehicles for such malfeasance are fascinating, but unfortunately, the details of each device cannot be independently verified and will not be discussed here. What matters is that following the

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<sup>27</sup> Despite our requests from various agencies, we were not able to learn the price paid by UE for its gas feedstock since 2002, at which time it was only 20% of the border price.

unbundling of KyrgyzEnergo, estimates of the distribution losses went up from 15% to 38%, and this does not even include the 50-81%<sup>28</sup> of billings that are not collected in cash.

Concerned with the large number of unmetered customers, a large end-user metering drive is being undertaken. However, customers installing meters are required to pay for them. This is causing resistance to metering, and spawning a black market for stolen electricity meters. This black market in turn brings customers into conflict with meter readers. While meters should be left outside apartments to be easily read, customers are reluctant to place them outside for fear that they will be stolen.

Now that DISCO performance has been highlighted as a problem, there is growing momentum to fix the problem. Despite the transparency, the performance of these companies has remained stubbornly poor. At least one DISCO manager has stated publicly that his company is unable to improve its performance due to political interference which prevents punitive actions against powerful non-paying customers, and has called for the DISCOs to be privatized. Privatization plans have been actively developed, but political support for their implementation has so far been lacking.

Given the inadequacy of cash collections in the Kyrgyz Republic, the regulatory body – the State Energy Agency (SEA), has been called upon to allocate scarce cash. Bills may now be paid at a savings bank or post office. The State Energy Agency is then called upon to adjudicate on how the cash will be split between the companies in the sector. Unfortunately, these splits are subject to negotiation, and are not determined by a pre-existing formula. As a result, they do not engender any strong incentives for DISCOs to collect more cash. In this regard, the contrast with the example of Azerbaijan (see below) is extremely useful.

One crucial point to note is that once the distribution becomes subjective and delinked from the amounts owed to companies at calculated tariffs, they render tariffs irrelevant. Firms who do not expect to see the cash they are owed given tariff levels, cease to be concerned with tariffs. Thus, the cash distribution system usurps the role of tariffs in directing the allocation of resources and investment in the sector. It is therefore vital that cash collection rules not only provide adequate incentives to improve billing and collections, but also that they provide appropriate inducements to invest in the sector. However, when the cash flow is anemic, these investment incentives and collection incentives become impossible to satisfy simultaneously from the limited cash collections of the sector.

In order to solve these problems – investment incentives can be provided by two mechanisms. First, investors can be asked to put up with anemic flows of funds now in exchange for future flows of cash. Second, the shortfall in collections may be made up or financed from the fiscal budget. When fiscal inputs are provided, it is vital that a credible schedule for phasing them out is indicated as well. These two mechanisms are well utilized in the Azeri cash distribution scheme, and have already proven conspicuously absent in the Kyrgyz Republic. To wit: the State Energy Agency actually tried briefly to implement a proper incentive based formula for allocating cash. However, despite improving collections, the system was scrapped because the transmission and generation companies could not sustain the low initial cash receipts that it entailed for them. Budgetary support would be necessary for such a scheme to work in the future.

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<sup>28</sup> Collection rates vary significantly across distribution companies.

While DISCOs continue to perform poorly, official figures show the Kyrgyz transmission company performing quite well, with total transmission losses of 6.3%.

Tariff reforms in the Kyrgyz Republic have been slow. Cross subsidies are still substantial. Lifeline tariffs are provided to all residential consumers, as indicated in Table 5. Marginal tariff levels vary from 1.15 to 1.8 cents/kWh, against World Bank estimates of efficient tariff levels of around 2.3 cents/kWh.<sup>29</sup> Table 6 shows the two reported goals of the State Energy Agency – cross subsidy reduction and movement from variable cost recovery to economic cost recovery. These are quite simple and mutually compatible. They have not been achievable despite the flexibility permitted by a lifeline tariff policy. This is due in part to the fact that the SEA is sidetracked by its role as the arbitrator in the cash disputes, and the fact that tariff reforms are quite irrelevant until tariffs are given traction on the sector by forcing consumers to acknowledge them.

### *Mongolia:*

Mongolia has proceeded with unbundling of its Central Electricity grid much as the Kyrgyz Republic has. In 2001, eighteen independent publicly owned distribution, transmission and generation companies were formed, each with a separate legal, financial and managerial basis. In practice, the boards of each of these companies have too many personnel in common to be considered truly autonomous. In hindsight, given that Mongolia is unlikely to have enough of or the right type of generators to sustain competition in the near future, it is not clear that eighteen separate companies were required. However, unbundling has served a useful purpose.

As happened in the Kyrgyz Republic, the vertical unbundling highlighted the poor performance of the DISCOs. One DISCO, in Darkhan, was privatized, and is reputed to be performing quite well, although official figures have not been made available to us. In contrast, the state owned DISCOs are performing very poorly. For example, the Ulaanbaatar DISCO has reported approximately 30% electricity losses for several years now.<sup>30</sup> In contrast to these high losses, the company reports that collections as a percentage of billed amounts average 96%. This high collection rate can be attributed to Mongolia's system for managing cash in the sector as explained below.

Despite the contrasting experiences with private and public DISCOs in Mongolia, there is significant resistance to the privatization of additional DISCOs.

Mongolia's Energy Regulatory Agency (ERA) has complete flexibility in setting electricity tariffs. Its objectives include financial cost recovery, a variety of social goals, and economic efficiency. In order to pursue these goals simultaneously, it makes use of a lifeline tariff, wherein the first 75 kWh of electricity used by residential consumers in a month is provided for free. For additional units 4.1 cents/kWh is charged. All other classes of consumers are charged 4.1 cents/kWh as well, so cross-subsidies are limited.<sup>31</sup> Wholesale tariffs at 2.82 cents/kWh do not yet cover financial costs, and certainly do not suffice to begin paying off the sector's accumulated debt.

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<sup>29</sup> World Bank [22], appendix 5.1.

<sup>30</sup> Source: Ulaanbaatar Distribution Company [19].

<sup>31</sup> Even when all consumers are charged the same tariff, a cross-subsidy can exist, if some consumers – those who are supplied at higher voltages, for instance - are cheaper to supply than others.

Mongolia's experience with transmission companies post unbundling has been quite good. Because power flows into and out of the transmission systems are now readily observable, the ERA has been able to implement a performance based regulation system for transmission. Under this system, transmission companies may only claim a specified level of transmission losses, and must shoulder the costs of the remaining losses themselves. The ERA has simply reduced the level of permissible losses over time, and the Central Regional Electricity Transmission Company (CRETC) has so far always met this ceiling. Last year, the ceiling was 4%, and the ERA has just lowered it to 3.5%.<sup>32</sup> These levels are technically difficult to achieve.

In order to improve and cope with the cash flow situation created by the high commercial losses, the ERA established a single buyer market (SBM). This is a "market" in name only, as all prices are dictated by the Electricity Regulatory Authority (ERA). Unlike most SBMs there is also currently no scope for economic dispatch. Dispatch is based principally on availability, location and the demand for cogenerated steam for heating and industrial use.

In practice, the Mongolian system is probably better described<sup>33</sup> as a financial management system based on prearranged cash splits rather than a SBM. Cash flows from consumers to a special zero balance account. Everyday, all received revenue is transferred from this account into the General Revenue Account. Payments from the General Revenue Account are made, in the following order of priority to Expenses, Imports, Generation, Transmission and Distribution. No person is authorized to tamper with the stated cash-flow shares, virtually eliminating any prospect of fraud or theft. The ERA reports<sup>34</sup> that since the SBM was introduced revenue to power plants as a percentage of what is owed to them has increased from 75% to 80% and the percentage of delayed inter-company payments has decreased from 40% to 15%.

This cash-flow scheme effectively eliminates short-run incentives to not collect cash, as well as any possibility of diverting cash paid by consumers. This explains the high collections rate in Mongolia. However, because the cash splits are frequently renegotiated, the amount of cash DISCOs expect to keep does not change in any robust predictable fashion when long term efforts to reduce distribution losses are implemented. This might help to explain why distribution losses have remained stagnant at 30% for some years now.

#### *Azerbaijan:*

Azerbaijan's key restructuring initiative was to separate electricity distribution from generation and transmission, and to auction concessions to the private sector for the management of its four DISCOs. The auction did not proceed smoothly. The lowest bidder (a foreign company) was disqualified because the government claimed that its bid required commercial guarantees outside the scope of the auction rules. The aggrieved party has disputed this interpretation. Concessions for two out of the four companies were eventually won by Barmek – a Turkish company, while the other two were won by Bayva – a local firm.

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<sup>32</sup> Source: CRETC officials.

<sup>33</sup> This description is drawn from ADB [1].

<sup>34</sup> Ulaanbaatar Distribution Company [19].

Transmission and generation assets are held by Azerenergy, a vertically integrated state-owned enterprise. Further vertical unbundling of Azerenergy is unlikely to proceed until a proper electricity regulator is established, and the flows of cash from the DISCOs are raised to adequate levels.

Consistent estimates of transmission losses in Azerbaijan are not available, although we include data on distribution losses in table 4. Reliable estimates of the collection rates before the privatization of management are elusive. However, the collection rates have shown marked improvement since the concessions were given. Tables 7 and 8 show the recent collection rates and distribution loss rates, both of which register robust and rapid improvements. For reference, the residential collection rates prior to the management concessions were reportedly only 12%.<sup>35</sup> Despite the initial difficulties, the management concessions have clearly brought about improvements in billing and collections.

The incentive structure driving the improvements in commercial performance is worth understanding. As we have argued in the case of the Kyrgyz Republic, when cash is in short supply, the rules for distributing this cash generally override any incentives created by the tariff structure. It is therefore important to ensure that this system leaves all parties with the right incentives. We have also argued in this case that when collections are weak, implementing a system that provides incentives to DISCOs to improve commercial performance, while still allowing reasonable cash flows to other investors, will require additional cash flows in the sector to come from the government. In Azerbaijan, each of these insights is addressed.

In Azerbaijan, recognizing that the bill paying culture and management infrastructure would not permit rapid progress in bill collection, the concession agreements specify percentages of the amount of money owed by the DISCOs (DISCOs) to Azerenergy that must be paid in each year. The remainder of what is owed can be deferred interest free until specified dates. This shortfall is made up directly from the government budget. The amounts total around \$350 million annually.<sup>36</sup> As the DISCOs are in theory only deferring these amounts, the government will be paid back in the future, and only the interest on these shortfalls should be considered to be a subsidy to the DISCOs.<sup>37</sup> This budget support makes this scheme acceptable to Azerenergy. The percentage of new payables from each DISCO to Azerenergy that must be paid is scheduled to increase towards 100% in 2010.

The scheme also provides incentives for the DISCOs to collect cash. For example, in 2005, Barmek is obliged to make timely payments on 70% of what it owes Azerenergy. As long as it fulfills this obligation, it may collect as much as much of its billings as it can. It may keep every Azerbaijan Manat it collects over that payment obligation for the time being. This is a generous incentive to collect, as the deferred interest on the balance of collections is a pure profit increase to the DISCO, and, in contrast to the situation in Kyrgyz Republic and Mongolia, it keeps all the fruits of its additional collection efforts in cash.

Unfortunately, disputes have arisen regarding the private DISCOs' failure to pay Azerenergy even the required shares.<sup>38</sup> Barmek has argued that because several publicly

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<sup>35</sup> Source: Azerenergy officials.

<sup>36</sup> For example, for 2003, a total subsidy of 1850 in Azerbaijan Manat (roughly \$370 million) is quoted by UNDP [20] page 86.

<sup>37</sup> According to Azerenergy, improvements in collections have been dramatic, and such large subsidies are not required. However, it is important to note that if improving collections were to result in reduced subsidies, this would act as a disincentive to improve collections.

<sup>38</sup> The Baku-based TURAN news agency ran a series of articles on these disputes between 4-7 July 2005.

owned utilities are in arrears on their power bills, it is not obliged to make its contractually mandated payments to Azerenergy. Regardless of the legal merit of this argument, the lesson is that when a government does not require publicly owned companies to pay their bills, or fund their short-fall, this can compromise the usefulness of private management concessions in solving sectoral cash-flow problems.

Unlike Uzbekistan, progress towards removing cross subsidies in Azerbaijan has been very limited. This is having an adverse impact on collections. Tables 3 and 7 are consistent with the view that collecting bills from residential consumer groups carries high average fixed costs, but low margins for the DISCOs, which results in relatively greater effort being expended to collect bills from commercial enterprises.

The second most difficult consumer group to charge for electricity is the category defined as 'others'. This includes large public services such as municipal transport, hospitals and water supply companies.<sup>39</sup> This highlights the vital role of government commitment to solving commercial problems at distribution companies, even once they have been privatized.

Responsibilities for policy and regulation have not yet been segregated from each other, and four bodies are involved. The Ministry of Industry and Energy (MIE), which succeeded the Ministry of Fuel and Energy in 2004, provides overall policy direction to the sector. The Ministry of Economic Development (MOED) oversees privatization and de-monopolization, while the MoF assists with financial planning and coordination. Tariff regulation is handled by an interim body called the Tariff Council, with membership from all three Ministries. Tariff Council proposals must be cleared by the president. As can be seen in Table 6, this compromise institutional framework operates with a mandate that is similar to the mandate in Uzbekistan – to recover a portion of costs. This commits the Tariff Council to strive for greater financial cost recovery, which it is doing. Natural gas tariffs were increased 650% in the past two years, and electricity tariff reforms are likely to proceed soon. For the time being DISCOs are charged only 1.7 cents/kWh for the power they purchase, while residential consumers pay only 2 cents.

Plans to establish an independent regulator have been developed with the help of international donors, but have yet to be implemented.

### *Kazakhstan*

Kazakhstan has gone much further than any other country in the region in terms of power sector reform. It has taken the functions of sector regulation and utility business management out of the hands of policy makers. It has vertically unbundled the sector into generation, transmission and distribution. It is currently working out how to split the distribution business into the monopolistic wires business and its potentially competitive retail services component. Kazakhstan would like to introduce competitive electricity retailing.

Kazakhstan has multiple generators that sell bulk power at unregulated prices (barring a few enclaves that lack the transmission lines connecting them to enough generators for pricing to be competitive). Wholesale prices are negotiated directly with buyers, who may choose which generators to contract with. The contracts are standardized by KOREM (the Kazakhstan Electricity Wholesale Market), which also facilitates contracting and handles dispatch in

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<sup>39</sup> Source: Discussions with distribution company officials.

conjunction with KEGOC (The Kazakhstan Electricity Grid Operating Company). In addition to facilitating such medium and long-term contracting, KOREM has been charged with running a day-ahead market, and is planning to institute a spot market.

While there is not yet a working spot market, then, prices are bilaterally determined not regulated, and transactions are voluntary. Another key effect of market pricing is also discernable, which is that disinvestments and investments are being scheduled according to the positioning of supply and demand. To wit: as prices fell during the post-independence years of excess capacity (currently drawing to a close), investments in generation capacity froze. With the recent squeeze in excess capacity due to resumed growth, and the strengthening of the North-South transmission line (which connects the Southern grid to the North, and from there to Russia), private investment plans, are being discussed again.

Data on distribution losses and collections rates at the privatized DISCOs were not made available to us.<sup>40</sup> However, sector officials (private and public) all report significant improvements. The regulator, transmission company, and even a private broker that lubricates power sales to DISCOs have each indicated that the DISCOs' arrears to their suppliers were eliminated shortly after they were privatized. External reports indicate a bumpier transition, but also confirm a significant improvement in billing and collection efficiency.

There are several useful lessons to be gleaned from the Kazakh example. First, Kazakhstan privatized most of its distribution assets. This appears to have led to substantial and rapid improvements in commercial and collection efficiency. This indicates that with the right commercial incentives in place, significant and rapid improvements in DISCO performance are possible.

Second, privatization will only work if the government is seriously committed to allowing private participants an opportunity to remain financially healthy by tackling tariff reform. One early foreign private entrant, bought the Almaty DISCO but left Kazakhstan over a dispute regarding tariffs and support from the government for disciplining non-paying customers. Subsequent entrants do complain about tariffs, but there have been no further high-profile disinvestments from distribution companies.

Third, when possible governments should be willing to remove all cross ownership between potentially competitive and naturally monopolistic functions. Kazakhstan has enjoyed significant success in attracting foreign investors in electricity generation, unlike the other countries surveyed in this paper. Many sector experts link this to the trust that investors place in the independence of the KEGOC from the generators and distributors.

Fourth, the Kazakh experience reinforces the view that a sector regulator is far more likely to succeed if it has limited goals, a mandate to operate independently, and is not distracted by non-core responsibilities (like resolving cash flow disputes). Kazakhstan's Agency for the Regulation of Natural Monopolies (AREM) has been entrusted with a single regulatory goal— to enhance competition. Given that it has real regulatory independence, and is permitted to let private firms succeed or fail based on their own competitive merits, it has been able to work unimpeded on the development of the wholesale market.

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<sup>40</sup> The reason offered to us by private DISCO management for keeping these data confidential, was that higher documented efficiencies would induce regulators to reduce permissible distribution tariffs.

## IV. Discussion

The paper has eight key findings of relevance to power sectors in transitional economies. First, effective vertical unbundling of the sector is critical for revealing the location and mechanisms of commercial losses. Where this has been done (Kazakhstan, The Kyrgyz Republic, Mongolia, and, to a lesser extent, Azerbaijan), the debate over policy reforms has been clarified. In each of these countries, the poor performance of DISCOs was highlighted, and identified as a critical bottleneck for getting cash into the sector. However, as identification of this problem has not always led directly to a solution, unbundling does not carry immediate benefits.

When working in the Central Asian context, it is important to note that effective vertical unbundling requires full separation of firms' legal, financial, and regulatory reporting functions, as well as adequate real time monitoring of power flows between companies. Financial and real time monitoring of power flows provide the transparency necessary to hold managers responsible for performance of independent companies. Legal and regulatory unbundling provides the basis for providing incentives to each company to improve performance, and to not accept responsibility for the poor performance of other companies. From this perspective, the common practice of unbundling a sector into several companies managed within a Joint Stock Company framework, as is being attempted in Tajikistan and Uzbekistan, is unlikely to prove effective.

Second, the right unbundled industry structure depends critically on the underlying cost structure of the national and regional power sector, as well as the political appetite for regional competition. Vertical unbundling is potentially socially beneficial because it reveals where inefficiencies lie in the system. Where inefficiencies may be reduced by the introduction of competition, unbundling facilitates this by separating out the potentially competitive functions of the sector from the naturally monopolistic functions. In some countries, with large hydropower resources (such as Tajikistan and The Kyrgyz Republic) or very low demand (such as Mongolia), generation is not potentially competitive. Thus, these benefits of unbundling must be carefully compared with the costs of unbundling.

The costs of unbundling stem from a loss of economies of scope, as administrative and board oversight functions of the integrated utility may require replication in each newly independent subsidiary. However, it is the authors' considered opinion that in all the countries surveyed, separation of the DISCOs from the rest of the system has been, or is likely to be, extremely useful. This is because distribution reform is the key to improving sector performance, and such separation is necessary to undertake such reforms.

Whether generation and transmission need to be fully separated is likely to depend on the potential and appetite for competition at a national or regional level. For example – Uzbekistan would benefit substantially from proper vertical unbundling and a rationalization of its gas valuation. Specifically, if Uzbek gas prices reflected their true economic costs, they would rise to a level that would reveal the economic viability of summer hydropower imported from the Kyrgyz Republic and Tajikistan. However, if this is not accompanied by effective separation of generation from transmission, Uzbekenergo, which has in the past shown a strong aversion to competition, would have no incentive to allow its transmission assets to be utilized freely for imports while its generation assets remain unused. On the other hand, if vertical unbundling does take place, it is perfectly possible that such imports would still be stymied by the political objective of energy independence.

Third, adequacy of bulk metering should be prioritized over end-user metering for small consumers. While inadequate end-user metering has resulted in many consumers facing zero marginal prices for electricity consumption and therefore wasting electricity, if utility operations are too opaque to permit accountability, end user meters are unlikely to be used properly anyway. As has been demonstrated by the experiences in Kyrgyz Republic, Tajikistan and Uzbekistan, DISCOs with non-commercial objectives do not always produce the metering plans that are most likely to ensure an orderly transition to universal end-user metering. Regarding bulk metering, the lesson drawn from the positive examples of Azerbaijan, Kazakhstan, the Kyrgyz Republic, and Mongolia, is that proper delegation of responsibility for electrical energy requires that power flows between companies or departments be properly monitored. Once this is done, and this information is used to provide DISCOs with adequate incentives to improve commercial performance, it can be most efficiently left to the commercial DISCO to decide how to implement proper end-user metering.

Fourth, requiring the regulator to adjudicate on the distribution of cash has several negative effects. Cash splits replace tariffs as the primary economic signals guiding the sector. Ensuring that the methods for determining these splits are predictable, reflecting credible incentives to collect cash and invest in the sector, is challenging, and requires budgetary support if it is to be rendered sustainable. The time and political rancor involved in settling these disputes distracts the regulator from their core responsibilities. Governments, as primary shareholders must take responsibility for poor distribution company performance, rather than passing on this responsibility to regulators. Contrasting Azerbaijan's relative success with using proper incentives and fiscal support to improve cash collections, with that of the Kyrgyz Republic (and the somewhat better, but still anaemic cash-flow experience in Mongolia), yields sharp lessons for Tajikistan and Uzbekistan, should they choose to vertically unbundle their power sectors.

Fifth, privately managed DISCOs in the region possess much stronger commercial incentives to reduce commercial losses and non-payment than their publicly-run counterparts. This is apparent from the success of Kazakhstan and Azerbaijan in improving cash collections. However, the recent disputes in Azerbaijan also demonstrate that the payment obligations of these DISCOs to the rest of the sector must be rigidly enforced, and that this task is complicated when payment obligations to the DISCOs are not properly enforced by the government or the court system. The difficulties faced by private DISCO managers in Azerbaijan trying to collect payables from public consumers, and the difficulties faced by some in the past in Kazakhstan, demonstrate this amply.

Sixth, those governments who accept a smaller set of objectives for power sector management, regulation and policy perform consistently better. Kazakhstan, whose Agency for the Regulation of Natural Monopolies states that its only goal is the promotion of competition, has a power sector that is much more financially stable and economically efficient than any other in the region. Tajikistan, with the most tangled set of objectives, is finding it difficult to set a clear course.

Seventh, tariff reforms must be undertaken, and done so with a view to the interests of the poor. Even if commercial performance issues are resolved, with electricity tariffs as low as they are in five of the six countries surveyed (Kazakhstan being the exception), the sectors cash flow problems cannot be fixed. However, tariff reforms have not yet been completed in any of these five countries due to serious concerns regarding affordability.

The above points highlight a daunting list of challenges to returning the power sectors of the Central Asian Republics to a more economically and environmentally efficient mode of operation. Unbundling and privatization of some distribution company functions must be backed by serious governmental commitment in order to revive sector cash flows. Unless these cash flows are restored, much power trade will continue to function on an exchange and barter basis, imposing large transactions costs and distortions on domestic and international power deals. Once the cash flows are restored, incentives will have to be given to transmission companies to accept competitive electricity imports. This will involve further restructuring, the phasing out of subsidies - particularly on gas and other domestic fuel sources, and probably some fiscal support to programs of lifeline tariffs or income support. Transparency will also be important, as there are widespread allegations of unreported regional power deals. And finally, large political barriers will have to be overcome, including a recognition of the benefits of deeper power and fuel trade, and a willingness to solve riparian disputes.

The costs of failing to address these issues are high in economic, social and environmental terms. The example of Kazakhstan shows that with the exception of some of the riparian disputes, a healthy governmental commitment to transparency, restructuring, and competition can make significant progress towards these goals rather quickly.

Finally, given the lack of accountability, neither publicly nor privately held utilities in the region can demonstrate substantial improvements in the quality or reliability of service to their consumers, especially the poor and the remote. Developing measures of reliability and providing incentives to improve these measures will therefore be critical to ensuring that utilities are compelled to serve marginalized customers properly.

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## Tables:

Table 1: Primary Energy Resources in Central Asia

Fossil Fuel Reserves	Unit	Kazakhstan	Kyrgyz Republic	Tajikistan	Uzbekistan
Crude Oil	MTOE	1,100	5.5	1.7	82
Natural Gas	MTOE	1,500	5	5	1,476
Coal	MTOE	24,300	580	500	2,851
Total	MTOE	26,900	591	507	4,409
Hydropower Potential	TWh/year	27	163	317	15
	MTOE/Year	2.3	14	27.3	1.3

Source: World Bank [22], p.1

Abbreviations: MTOE = Millions of tons of oil equivalent, TWh = Terawatt-hours

Table 2: Energy intensities of select countries in 2002.

Country/ Region	Population (millions)	GDP at purchasing power parity (billions of 1995 dollars)	Total Primary Energy Supply (MTOE)	TPES / Pop (TOE/Capita)	TPES/GDP (TOE / 1,000 1995 US\$ PPP)
<b>World</b>	<b>6195.66</b>	<b>43413.48</b>	<b>10230.67</b>	<b>1.65</b>	<b>0.24</b>
<b>Asia</b>	<b>1988.11</b>	<b>5507.94</b>	<b>1183.91</b>	<b>0.6</b>	<b>0.21</b>
<b>Non-OECD Europe</b>	<b>57.82</b>	<b>1552.10</b>	<b>99.68</b>	<b>1.72</b>	<b>0.28</b>
Russia	144.07	1038.78	617.84	4.29	0.59
Canada	31.41	843.13	250.03	7.96	0.30
Azerbaijan	8.17	21.81	11.73	1.44	0.54
Kazakhstan	14.88	74.54	46.46	3.12	0.62
Kyrgyz Republic	5.00	7.06	2.54	0.51	0.36
Mongolia	--	--	--	--	--
Tajikistan	6.27	5.44	3.25	0.52	0.60
Uzbekistan	25.27	36.57	51.74	2.05	1.41

Source: International Energy Agency [13].

Abbreviations: MTOE = Millions of tons of oil equivalent; PPP = Purchasing Power Parity; TPES = Total Primary Energy Supply

**Table 3: Economic structure of Central Asian power sectors:**

Issue	Republic of Azerbaijan	Kazakhstan	Kyrgyz	Mongolia (central grid only)	Tajikistan (non-Pamir region)	Uzbekistan
Vertical unbundling:	Generation, transmission integrated. Distribution separate.	Generation, transmission, distribution separate.	Generation, transmission, distribution separate.	Generation, transmission, distribution separate.	Three fully vertically integrated systems.	In practice, fully vertically integrated.
Tariff determination:	All tariffs regulated	Wholesale tariffs market determined. Transmission and retail tariff components regulated.	All tariffs regulated	All tariffs regulated	All tariffs regulated	All tariffs regulated
How is scarce cash distributed between companies/subsidiaries?	Per shares specified in concession agreement.	N.A.	Subjective regulatory decisions.	Subjective regulatory decisions.	BT/MOE decides. Not publicly known.	Uzbekenergo decides. Not publicly known.
Generation Source (%)	Gas: 67.1 Oil: 22.5 Hydro: 10.3	Coal: 70.0 Hydro: 15.2 Gas: 10.6 Oil: 4.2	Hydro: 90.5 Coal: 4.8 Gas: 4.8	Almost exclusively coal fired CHPs.	Hydro: 97.7 Gas: 2.3	Gas: 71.8 Hydro: 12.8 Oil: 11.4 Coal: 4.0
Generation Ownership	Public. Corporatized. Azerenergy is monopolist.	Over 85% private. AES is the largest investor	Public. Corporatized. JSC Power Plants is monopolist.	Five separate major generation companies. All public and corporatized.	Public. BT is monopolist. Ostensibly corporatized, but actually under full MOE control.	Public. Is part of monopolist Uzbekenergo.
Transmission ownership	Public. Corporatized. Under Azenergy.	Public. Corporatized. Independent. KEGOC.	Public. Corporatized. Independent. JSC National Grid.	Public. Corporatized. CRETC.	Public. BT. Ostensibly corporatized, but actually under full MOE control.	Public. UzelectroSet is part of monopolist Uzbekenergo.
Distribution ownership	4 local monopoly concessions given to two private companies.	Mix of public and private local monopolies. Largely private.	Four publicly owned regional distribution monopolies.	Public, except for Darkhan, which is under private management.	Public.	Public. Fifteen DISCOs are subsidiaries of Uzbekenergo.
Retail Services Management	Bundled with distribution.	Bundled with distribution.	Bundled with distribution.	Bundled with distribution.	Publicly held ESCs, which report to BT.	Bundled with distribution.

Abbreviations: BT= Barki Tojik, CHP = combined heat and power plant, CRETC = Central Regional Electricity Transmission Company, ESC = electricity sales company, JSC = joint stock company, KEGOC = Kazakhstan Electricity Grid Operating Company, MOE = Ministry of Energy.  
Sources - Sector officials and ADB [1].

Table 4: Losses

Issue	Azerbaijan	Kazakhstan	Kyrgyz Republic	Mongolia	Tajikistan	Uzbekistan
Year of estimate	2004	2002	2004	2003	2002	2002
T & D Losses (% of net generation that is not billed)	20.9 <sup>a</sup>	19.3 <sup>b</sup>	42.0 <sup>c</sup>	21.9 <sup>d</sup>	21.7 <sup>e</sup>	17.2 <sup>f</sup>
Transmission	5.2 <sup>g</sup>	NSI	6.3 <sup>h</sup>	4.0 <sup>i</sup>	NSI	NSI
Distribution	15.7 <sup>j</sup>	NSI	38 <sup>k</sup>	National average NSI. UB distribution losses 30.64 <sup>l</sup>	NSI	NSI
Collection rate (% of billings collected)	53.3 <sup>j</sup>	92 <sup>m</sup>	86.6 <sup>k</sup>	97 <sup>m</sup>	70 <sup>m</sup>	74 <sup>m</sup>
Non-cash collection rate (% of collection not in cash)		45 <sup>m</sup>	55 <sup>m</sup> (2002 figure) 2004 figures <sup>n</sup> show 51.2-80.9% of billings not collected in cash		60 <sup>m</sup>	45 <sup>m</sup>

NSI = not separately identified, T& D= Transmission and distribution, UB = Ulaanbaatar

<sup>a</sup> State Statistical Bureau of Azerbaijan Republic. *Balance of Fuel-Energy and Material Resources*.

<sup>b</sup> Calculated from World Bank figures of 15% technical losses and 5% non-billing.

<sup>c</sup> Based on calculation from transmission and distribution losses (below). Note that distribution and transmission loss numbers are from different sources.

<sup>d</sup> Energy Regulatory Authority [12].

<sup>e</sup> Calculated from WB figures of 11% technical losses and 12% non-billing.

<sup>f</sup> Calculated from WB figures of 10% technical losses and 8% non-billing.

<sup>g</sup> Imputed from total losses and distribution losses.

<sup>h</sup> Officials of Joint Stock Company National Grid

<sup>i</sup> Officials of Central Grid Company

<sup>j</sup> Ministry of Industry and Energy [15].

<sup>k</sup> Department For International Development (UK) personnel.

<sup>l</sup> Ulaanbaatar Distribution Company [19].

<sup>m</sup> World Bank [22].

<sup>n</sup> Department For International Development (UK) personnel. Note that these figures are not comparable to others in this row. Where for other countries, non-cash collection is expressed as a percentage of total collections, these figures express it as a function of total billings.

Table 5: Tariff levels

Issue	Azerbaijan	Kazakhstan	Kyrgyzstan	Mongolia	Tajikistan	Uzbekistan
<b>Unbundled or not</b>	Generation and transmission tariffs are bundled. Distribution tariffs are separate.	Situation varies with industry structure. Unbundled tariffs are preferred, but are not possible in vertically integrated service areas.	Unbundled	Unbundled	Bundled	Bundled
<b>Generation tariff , US¢ KWh</b>	1.4 (including transmission)	Set by contracts and spot market	NPI	2.82–3.66	—	—
<b>Transmission tariff;</b>	—	Varies with distance under 600 km. 0.39 ¢/kVh for over 600 km.	NPI	NI	—	—
<b>Retail tariff levels US¢ KWh</b>	Res.: 2.0 Ind.: 3.0 Comm.: 6.0	3.2–3.5 in Astana. Tariffs vary by location.	Household: 1.15 Industrial: 1.73 Commercial: 1.89 Agricultural and Government: 1.84	4.10	Regular/ Summer: Ind.: 0.89 Ag: 1.66 Pumps: 0.56/ 0.28 Comm.: 1.66 Budget 0.56/ 0.28 Municipal 0.56 Municipal transport 0.17 TADAZ: 0.94/ 0.5 10	2.85 US¢ /kWh. Higher rate residential tariffs are 2.39/kWh.
<b>Number of consumer classes for tariff purposes</b>	3	8	5	Comm. and Res. are the main classes and pay the same tariff level.		5
<b>Lowest retail tariff US US¢ KWh</b>	Res.: 2.0	2.71 Industry (Astana)	1.1 (Sever residential)	4.1 Erdenet (residential)	Pumps .56 (May-Sep: .28)	2.39
<b>Highest retail tariff, US¢ KWh</b>	Comm.: 6.0	2.84 others (Astana)	2.05 Osh Commercial	4.1 Ulaanbaatar	Agriculture and Non-Budget Organisations 1.6	Comm. 3.25.
<b>Lifeline Tariff Policy</b>	None	None. Social protection policy separately administered by local authorities.	Yes. Everybody is entitled.	Yes. Administrative decision as to who qualifies	Yes. Everybody is entitled. Separate budgetary support for utility bills of poor also exists.	None
<b>Lifeline Tariff Level</b>	None	None	1.08 <sup>41</sup> .	Free	Usually: 0.53 May to Sep.: 26	None
<b>Lifeline amount, kWh/ month</b>	None	None	150	75	250	None

— = not applicable ,Ag =agriculture, AREM = agency for the regulation of natural monopolies ,Comm = commercial establishment, GWh = gigawatt-hours, Ind = industrial, kV = kilovolt, kWh = kilowatt-hour. NI= not identified by study team, NPI = No published information, Res. = residential, Sep. = September.  
Sources: ADB records based on publicly announced tariffs.

<sup>41</sup> Department for International Development, Tariff Policy and Utility Reform Project. 2005. *Commercial Performance of Electricity Distribution Companies for 2004*. Kyrgyz Republic.

Table 6: Institutional Framework for tariff setting an policy.

Issue	Republic of Azerbaijan	Kazakhstan	Kyrgyz Republic	Mongolia	Tajikistan	Uzbekistan
<b>Agency clearing tariffs</b>	President, on advice from the Tariffs Council	AREM	Government on recommendation from the SEA	ERA	President on the recommendation of the AAMP	Pricing department of the Uzbekistan MOF (but political approval required)
<b>Objectives in setting tariffs</b>	Recovering some percentage of costs	AREM's stated objective in electricity regulation is to promote competition.	Abolish cross subsidies and approach economic cost recovery, in the meantime cover variable costs	Mixed objectives including cost recovery and political / social concerns. Aiming to reach efficient tariffs	(i) to defend consumers; (2) keep costs of production low; (3) ensuring production is profitable and encouraging investment	Recovery of a higher percentage of prod. costs (which are subsidised through lower gas prices).

AAMP = state agency on antimonopoly policy and entrepreneurship, AREM = agency for the regulation of natural monopolies, ERA = energy regulatory authority, MOF = ministry of finance, SEA = State Energy Agency.

Sources: ADB [1].

Table 7: Azerbaijan collection rates.

Distribution Company	2003				2004			
	Residential	Trade and Service	Other	Total	Residential	Trade and Service	Other	Total
Barmek	25.0	100.5 <sup>42</sup>	77.3	54.6	30.0	93.8	83.8	60.7
Bayva	18.6	83.0	80.2	35.5	24.8	89.7	86.5	43.5
Aggregate	21.4	100.1	78.1	45.8	27.2	92.9	84.6	53.3

Source: Ministry of Industry and Energy [15]

Table 8: Azerbaijan distribution loss rates

Distribution Company	Total Distribution Losses		
	2002	2003	2004
Barmek	20.1	16.7	15.3
Bayva	16.6	17.7	16.1
Aggregate	18.4	17.2	15.7

Source: Ministry of Industry and Energy [15]

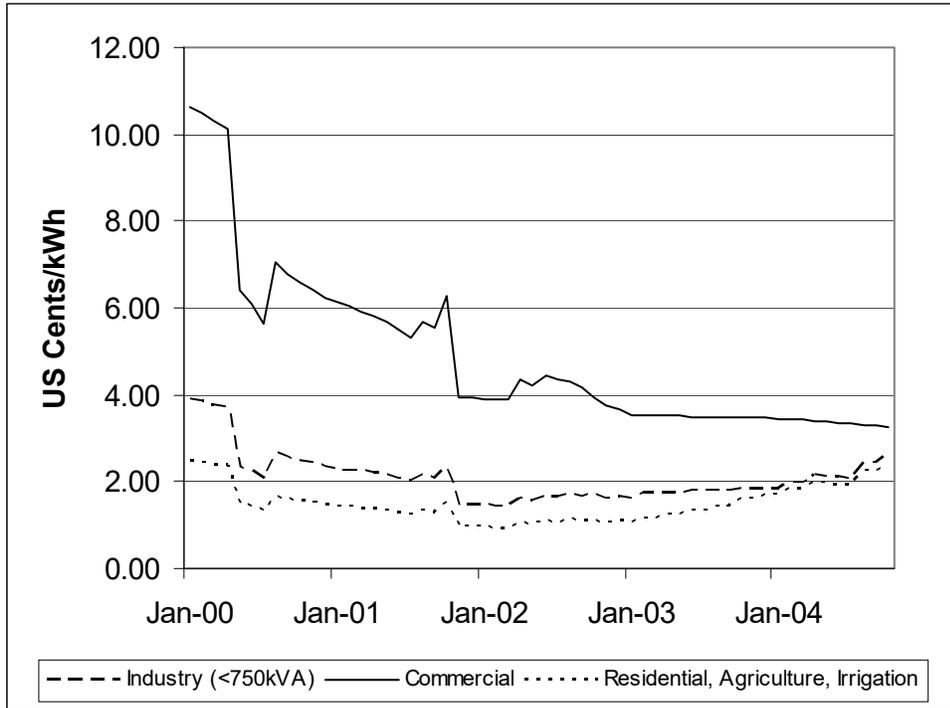
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<sup>42</sup> Collection rates in excess of 100 percent are achievable if adequate past receivables are collected.

Figure 1: Map of the Central Asian Republics



Figure 2: Uzbekistan Electricity Tariffs



Source: ADB records