

Electricity Sectors in CAREC Member Countries

A Diagnostic Review of Regulatory
Approaches and Challenges



Executive Summary

This study assesses the regulatory approaches and challenges in the electricity sectors of the Central Asia Regional Economic Cooperation (CAREC) Program member countries—Azerbaijan, People’s Republic of China (PRC), Kazakhstan, Kyrgyz Republic, Mongolia, Tajikistan, and Uzbekistan.

Industry Structure

A variety of industry structures of varying degrees of sophistication have developed in the energy sectors of CAREC countries (Table 1). Tajikistan’s energy sector is entirely vertically integrated and held publicly under the close supervision of the Ministry of Energy. Uzbekistan has commercialized and vertically unbundled its energy sector on paper, but in practice,

subsidiaries are supervised by UzbekEnergo—a state-owned vertically integrated monopoly. Azerbaijan maintains an integrated public generation and transmission company, but has privatized its distribution and retail functions. While retaining almost exclusive public ownership, the Kyrgyz Republic and Mongolia have both vertically unbundled their power companies. The PRC, on the other hand, has long been open to private investment in generation while retaining public ownership of transmission and distribution. It is also developing wholesale electricity markets. Finally, Kazakhstan has privatized most of its power sector with the exception of high-voltage transmission. Wholesale prices are determined by a market for tradable long-term contracts and development of retail competition is currently being pursued by the Government.

Table 1: Ownership Structure of Electricity Sectors in CAREC Countries

Item	Azerbaijan	China, Peoples Republic of	Kazakhstan	Kyrgyz Republic	Mongolia	Tajikistan	Uzbekistan
Generation	State-owned under Azerenergy	90% state-owned but there are many IPPs with diverse local and international ownership	Largely privately owned	Hydro-power is the dominant source and all major stations are government-owned.	State-owned, mostly CHPs	Mainly hydropower Owned by BT except in Pamirs. BT is a state-owned, vertically integrated company controlled by MCE.	16 state-owned JSCs under the UzbekEnergo board UzbekEnergo is publicly owned.
Transmission	Bundled with generation in publicly owned Azerenergy	Publicly owned SGC	Publicly owned KEGOC	Publicly owned JSC National Grid	Public monopolies; one for each system, Central Region is the largest.	Publicly held under BT	UzelectroSet is a subsidiary of state-owned UzbekEnergo.
Distribution	Local monopoly concessions given to two private companies—Barmek and Bayva	Subsidiaries of SGC	A mix of public and private local monopolies; largely private	Publicly owned regional distribution monopolies	Public local monopolies except for Darkhan, which is under private management	Mostly public under BT. One region (Pamir) has a vertically integrated system operated by the Aga Khan Foundation.	15 state-owned DISCOs are subsidiaries of UzbekEnergo.
Retail Services	Bundled with distribution under Barmek and Bayva	Bundled with distribution under SGC	Mostly private	Bundled with distribution under regional DISCOs	Bundled with distribution, public except for Darkhan	Publicly held ESCs under BT (except Pamir)	Underprovided by regional DISCOs under UzbekEnergo

BT = Bardi Tojik, CHP = combined heat and power plant, DISCO = distribution company, ESC = electricity sales company, IPP = independent power producer, JSC = joint stock company, KEGOC = Kazakhstan Electricity Grid Operating Company, MCE = Ministry of Energy, SGC = State Grid Company, UB = Ulaanbaatar.

Progress in eliminating regulated cross-subsidies¹ varies greatly among CAREC countries (Table 2). Kazakhstan, Mongolia, and Uzbekistan have few cross-subsidies. Azerbaijan and Tajikistan have the largest, with residential consumers being subsidized at the expense of commercial establishments, and to a lesser extent, private industry. Meanwhile, the PRC offers moderate cross-subsidies to residential and agricultural consumers. In each of these countries, however, the actual cross-subsidies differ from those mandated by the regulator because metering, billing, and collection rates vary across consumer classes.

In an attempt to deal with the social consequences of tariff reform, Kyrgyz Republic, Mongolia, and Tajikistan have implemented lifeline tariffs. Expenditure support payments to low-income consumers are also used in Kazakhstan and Tajikistan when the rising costs of utility bills become onerous. However, in Tajikistan, there are allegations that “leaky bucket” problems limit the effectiveness of this scheme.

Recognition of the importance of demand side management (DSM) has encouraged the use of sophisticated tariff structures (e.g., time-of-use tariffs, seasonal tariffs, and capacity charges), which are becoming more common in the CAREC region. Time-of-use tariffs are applied to large consumers in the PRC and are available to Mongolian consumers with appropriate meters. Seasonal tariffs are utilized extensively to deal with winter capacity constraints in Tajikistan where discounts on already low tariff levels are provided during summer. While the relative price change is helpful, its effects are undermined because summer discounts are used instead of higher winter charges, reducing the already low average tariff level. Capacity charges for large consumers are also now widely used in the region.

The institutional framework for regulatory activities varies substantially across CAREC countries, as does the range of regulatory objectives (Table 3). In general, regulators that experience the least government oversight and are responsible for meeting the clearest and smallest number of objectives have made the greatest progress toward cost-recovery tariffs. Regulated tariffs in the PRC and Kazakhstan

come closest to achieving financial cost recovery. Mongolia and Uzbekistan, which have made approaching cost recovery one goal of tariff setting, have made significant progress. However, Azerbaijan, Kyrgyz Republic, Tajikistan, and Uzbekistan also struggle to improve commercial discipline to ensure that tariff hikes do not simply lead to lower distribution, billing, and collection efficiencies.

Azerbaijan has chosen to fix the problem of commercial discipline in the sector, and is also raising prices for other public services (most notably, gas) before tackling electricity tariff reform. It is also seeking to replace the current Tariff Council—an interim body which involves multiple interested parties—with a more permanent electricity regulator. Tajikistan and Uzbekistan have attempted to raise tariffs toward cost-recovery levels, but are hindered by considerations of social affordability and the usual commercial difficulties.

Classification of tariff setting methodologies in CAREC countries is difficult. Kyrgyz Republic, Mongolia, and Tajikistan describe schemes that resemble rate-of-return (ROR) methods designed to capture reasonable costs. However, the reality is that tariffs in these countries do not adequately cover average costs or approximate the long-run marginal costs of electricity provision. The tariffs calculated in this way are therefore best viewed as inputs into the broader political process of tariff setting. Even in cases where tariffs are said to cover costs, they frequently do not include provisions for future rehabilitation requirements or debt service obligations. In Azerbaijan, Tajikistan, and Uzbekistan, the government’s recognition that tariffs are inadequate led to plans for phased tariff increases, subject to political considerations. Therefore, in all CAREC countries except the PRC and Kazakhstan, final regulated prices appear to be the result of political and social compromises rather than specific methodologies. Only transmission losses appear to be commonly subject to performance-based regulation methods, with transmission companies being encouraged to progressively lower their level of losses yearly.

Specific information on how tariffs in the PRC are calculated is not publicly available, although application of ROR principles is legally required. Tariff levels are the result of a long and unfolding process of negotiation between the National Development and Reform Commission and its provincial counterparts,

¹ The term “cross-subsidy” is used loosely because most prices are below cost. A cross-subsidy here refers to the fact that some consumers pay much higher prices than others for reasons unrelated to the cost of serving each class.

Table 2: Electricity Tariff Structure in CAREC Countries

Item	Azerbaijan	China, People's Republic of	Kazakhstan	Kyrgyz Republic	Mongolia	Tajikistan	Uzbekistan
Structure	Generation and transmission tariffs are bundled. Distribution tariffs are separate.	Transmission, distribution, and retail are bundled. Generation tariff is separate.	Situation varies with industry structure. Unbundled tariffs are preferred, but are not possible in vertically integrated service areas.	Unbundled	Unbundled	Bundled	Bundled
Generation tariff (\$/KWh)	0.014 (including transmission)	Varies, 0.037 may be taken as a crude average.	Set by contracts and spot market	—	0.0282–0.0366	—	—
Transmission tariff	—	—	Varies with distance under 600 km. \$ 0.039/kWh for over 600 km.	—	—	—	—
Retail tariff levels (\$/KWh)	Residential: 0.020 Industrial: 0.030 Commercial: 0.060	Varies, 0.00527 may be taken as a crude average.	0.032–0.035 in Astana. Tariffs vary by location.	Residential: 0.0115 Industrial: 0.0173 Commercial: 0.0189 Agricultural and Government: 0.184	0.0410	Regular/Summer: Higher rate Industrial: 0.0089 Agricultural: 0.0166 Pumps: 0.56/ 0.028 Commercial: 0.166 Budget 0.056/ 0.028 Municipal 0.056 Municipal transport 0.017 TADAZ: 0.094/ 0.05	0.0285 residential tariffs are 0.0239
Number of consumer classes for tariff purposes	3	7	8	5	3	10	5
Lowest reported retail usage tariff (\$/KWh)*	Residential: 0.020	Fertilizer (Beijing): 0.0341	Industry (Astana): 0.0271	Residential (Saver): 0.011	Central system, Ger residents: 0.044	Pumps: 0.56 May-Sep: 0.28	0.0239
Highest retail usage tariff (\$/KWh)*	Commercial: 0.060	Commercial at 10 and 35 kV: 0.0819	Others (Astana): 0.0284	Commercial (Osh): 0.0205	Central system, Apartments: 0.046	Agriculture and non-budget organizations: 0.016	Commercial: 0.0325
Lifeline tariff policy	None	None	None. Social protection policy separately administered by local authorities	Everybody is entitled.	Administrative decision on who qualifies	Everybody is entitled. Separate budgetary support for utility bills of the poor also exists.	None
Lifeline tariff level (\$/KWh)	—	—	—	0.0108	Varies across and domicile type, roughly 20% discount on marginal tariff	Usually: 0.053 May to Sep.: 0.26	—
Lifeline amount (kWh/ month)	—	—	—	150	Varies across DISCOs and domicile type, 30–75	250	—

DISCO = distribution company, kV = kilovolt, kWh = kilowatt-hour, TADAZ = Tursonzoda aluminium smelter.

* Tariffs for all regions and consumer classes were not available in each country. These figures provide an indication of the range of tariffs in effect.

Table 3: Institutional Framework for Tariff Setting in CAREC Countries

Item	Azerbaijan	China, People's Republic of	Kazakhstan	Kyrgyz Republic	Mongolia	Tajikistan	Uzbekistan
Agency clearing tariffs	President, on advice by the Tariff Council	Provincial authority submits tariffs to NDRC for approval	AREM for wholesale tariffs; CPC for retail tariffs	Government, on advice by SEA	ERA	President, on advice of AAMP	Pricing Department of MOF (but political approval required)
Objectives in setting tariffs	Recover some percentage of costs	Mix of objectives including cost recovery and political/social concerns	Promote competition	Abolish cross-subsidies and approach economic cost recovery; in the meantime, cover variable costs	Mixed objectives including cost recovery and political and social concerns; aiming to reach efficient tariffs	Defend consumers, keep costs of production low, ensure production is profitable; encourage investment	Recover a higher percentage of production costs (which are subsidized through lower gas prices)

AAMP = Agency on Antimonopoly Policy and Entrepreneurship, AREM = Agency for the Regulation of Natural Monopolies, CPC = Competition Protection Committee; ERA = Energy Regulatory Authority, MOF = Ministry of Finance, NDRC = National Development and Reform Commission, SEA = State Energy Authority.

resulting in phased increases in tariffs over the last two decades. Cost recovery is identified as a goal and appears to have been achieved recently. Once wholesale markets become fully operational, generation tariffs will be market-determined, with the State Electricity Regulatory Commission taking responsibility for regulating the wholesale markets.

Transmission tariffs in Kazakhstan are set to permit recovery of reasonable costs, including accrual of a budget for future investments and adjustments for permissible losses by distance. Until recently, retail tariffs were approved by local branches of the Agency for the Regulation of Natural Monopolies. These were supposed to be determined on a cost-recovery basis. However, the methodology is reportedly not consistently applied to all local branches. Retail tariff setting authority has recently been shifted to the Competition Protection Committee, in anticipation of the establishment of retail competition.

Cash Flow and Transparency

State-owned distribution companies (DISCOs) in Azerbaijan, Kyrgyz Republic, Mongolia, and Tajikistan have historically failed on a massive scale to stem losses, meter consumption, issue accurate bills, and collect cash (Table 4).² As a result, the cash flow in their electricity sectors is insufficient to sustain efficient delivery of electricity. This represents a

commercial failure, which should be resolved by shareholders (i.e., the government).

There have been some attempts to solve this cash flow problem. Aggressive campaigns to increase end-user metering are underway in Kyrgyz Republic, Tajikistan, and Uzbekistan. This is important for introducing DSM to cope with costly capacity constraints and save fuel resources. Tajikistan and Uzbekistan also claim significant progress in loss reduction. Azerbaijan has awarded concessions to run its DISCOs and Mongolia has done the same for one DISCO. Nevertheless, based on the findings of the individual country assessments, the cash flow positions of all CAREC country power sectors—except the PRC and Kazakhstan—remain weak and unstable.

The lack of discipline among DISCOs and retail companies greatly reduces the power of the regulator to provide direction to the sector through tariff decisions. The inability to make some consumers pay mandated tariffs renders these tariffs irrelevant to them. For producers or potential investors who do not anticipate receiving the amounts due them at official tariff levels, these tariff levels can become similarly irrelevant. Thus, a key challenge for governments is to empower regulators and ensure that tariffs obtain traction on the sector by improving discipline in the distribution and retail companies.

The government's inability to improve DISCO performance has forced regulators to take on roles that they should not be involved with. For example, regulators in the Kyrgyz Republic and Mongolia have become involved in the distribution of scarce cash

² The data in Table 4 for Azerbaijan correspond to rates reported since it has issued concessions for private management of its DISCOs.

Table 4: Power Losses in CAREC Countries

Item	Azerbaijan	PRC	Kazakhstan	Kyrgyz Republic	Mongolia	Tajikistan	Uzbekistan
Year of estimate	2004	2004	2002	2004	2003	2002	2002
T and D losses (% of net generation that is not billed)	20.9 ^a	6.93	19.3 ^b	42.0 ^c	21.9 ^d	21.7 ^e	17.2 ^f
Transmission (%)	5.2 ^a	5 ^g	NSI	6.3 ⁱ	4.0 ⁱ	NSI	NSI
Distribution (%)	15.7 ^k	1.93	NSI	38 ^j	National average NSI. UB distribution losses 30.64 ⁿ	NSI	NSI
Collection rate (% of billings collected)	53.3 ^k	—	92 ^h	86.6 ^l	97 ^m	70 ⁿ	74 ⁿ
Noncash collection rate (% of collection not in cash)	—	—	45 ^h	55 ⁿ (2002 figure) 2004 figures show 51.2-80.9% ^o of billings not collected in cash	—	60 ⁿ	45 ⁿ

NSI = not separately identified, T and D = transmission and distribution, UB = Ulaanbaatar.

Sources:

^a State Statistical Bureau of Azerbaijan Republic. *Balance of Fuel-Energy and Material Resources*.

^b Calculated from the World Bank (WB) figures of 15% technical losses and 5% non-billing.

^c Based on calculation from T and D losses. Note that T and D loss numbers are from different sources.

^d Mongolia's Energy Regulatory Authority. 2003. *Annual Report*. Ulaanbaatar.

^e Calculated from WB figures of 11% technical losses and 12% non-billing.

^f Calculated from WB figures of 10% technical losses and 8% non-billing.

^g Imputed from total losses and distribution losses.

^h Study team's estimate based on 2003 data on losses by voltage level from: ADB. 2004. *Technical Assistance to the PRC on Power Pricing Strategy*. Manila.

ⁱ Officials of Joint Stock Company National Grid.

^j Officials of Central Grid Company.

^k Presentation by Ministry of Industry and Energy at the CAREC Members' Electricity Regulators' Forum 2005 meeting.

^l UK Department for International Development (DFID) personnel.

^m Ulaanbaatar Distribution Company. 2004. *Annual Report*. Ulaanbaatar.

ⁿ WB. 2004. *Regional Electricity Export Potential Study*. Washington, D.C.

^o DFID personnel. Note that these figures are not comparable to others in this row. Whereas for other countries, non-cash collection is expressed as a percentage of total collections, these figures express it as a function of total billings.

among power companies. The linkage between the performance of their DISCOs and their share in the cash distribution needs to be strengthened to provide performance incentives. Because the amounts owed when calculated at the mandated tariffs are seldom actually paid, the cash shares are more relevant than tariffs to some companies in the sector. Azerbaijan has developed a sound approach to the distribution of cash. Percentages of the cash owed by the DISCO to the generation-transmission utility were decided several years before the concessions were awarded. DISCOs are responsible for ensuring payment of these percentages that they owe. They may keep any cash collected in excess of these targets for a specified number of years. The Government funds the shortfall in what is owed to Azerenergy. The scheme has resulted in increased collections by the DISCOs, but some of them are allegedly not meeting their upstream payment obligations in full, citing the refusal of some

government agencies to pay their power bills. This experience suggests the importance of a zero-tolerance policy on nonpayment by government entities, if concessions are to work. The scheme also highlights the importance of external financing, probably from the government, to ensure that cash flows are adequate in the interim.

Other technological solutions (e.g., circuit breakers to limit power demand and time-of-day metering) to better manage capacity constraints are not yet in use outside of the PRC. Mongolia is now implementing peak and off-peak tariff charges. Prepaid meters have proven successful in improving the commercial performance of the DISCOs and cutting losses in the PRC. Given the difficulties with attracting investments in capacity expansions in most CAREC countries, regulators will need to examine the feasibility of such technologies from the point of view of consumer protection and cost considerations.

In the vertically integrated sectors of Tajikistan and Uzbekistan (only in practice), transparency is a problem because tariffs are not unbundled into generation, transmission, and distribution components. Cash is disbursed within the sector according to rules determined by the company management. Prospective investors therefore may not have a clear sense of what to expect if they do enter the market. Attracting investors under these conditions is likely to involve the government bearing a substantial amount of commercial risk on behalf of investors.

Countries whose power sector has the greatest transparency in its operations appear to have had greater success in improving overall sector performance (PRC, Kazakhstan, and Mongolia). Conversely, the percentage of power generated that results in payment to the utility is lowest in the sectors with the least transparency (Tajikistan and Uzbekistan). Similarly, countries which have properly unbundled their sectors (PRC, Kazakhstan, Kyrgyz Republic, and Mongolia) were able to identify successfully the sources of their sector's problems, but not necessarily solve them.

Proper unbundling requires that each subsidiary have independent commercial incentives to improve its performance and ensure that the improvements are observable by the public, or at a minimum, by the regulator and commercial managers. This requires electricity and cash flows among subsidiaries becoming public information; and publication of transfer prices among generation, transmission, and distribution. Improved transparency appears to be a necessary condition for improving overall sector performance, but it is not sufficient as shown by the experience of the Kyrgyz Republic and Mongolia. It must be noted that vertical unbundling need not necessarily proceed toward the same industry structure for every country. The costs of unbundling schemes should be weighed against the potential for efficiency improvements.

Incentives to improve the commercial performance of subsidiaries may be enhanced further if the above transparency improvements are supported by commercial, possibly private management. This can be particularly important for DISCOs as demonstrated by the fairly positive experiences in the private management of distribution and retail in Azerbaijan, Kazakhstan, and Mongolia (only one company). However, Azerbaijan's experience, wherein the private DISCO is involved in a dispute with the Government

and is refusing to pay the generation-transmission company what it owes, urges caution. Proper dispute resolution systems are required when privatizing parts of the system. This example might also suggest that Azerbaijan requires an independent regulator with an effective mandate to settle disputes and enforce its decisions.

The PRC's experience with DISCOs run by local bureaucracies provides a counter example. Through application of a zero-tolerance policy on nonpayment with solid commitment from the Government, independent monitoring of hard commercial targets, and management structures that provide solid incentives to perform, the commercial performance of DISCOs has been maintained at very high levels.

Conversely, all the publicly run transmission companies whose performance are readily observable have made significant efficiency improvements (Kazakhstan, Kyrgyz Republic, and Mongolia), or have maintained a high level of performance (the PRC). The stark contrast in the performance of distribution/retail and transmission companies under public management appears to be due to the relative complexity, in terms of human management issues, of managing a DISCO or a retail company.

Regulatory Issues

The overall picture that emerges from these comparisons is clear. Countries vary with respect to the sequencing of sector reforms. However, the elements of these reform packages either already include or are likely to include the following: (i) improvements in transparency, with proper publicly available tracking of power losses and cash flow in the system; (ii) vertical unbundling, which includes measures to make the performance of each company transparent and to publish transfer prices among generation, transmission, and distribution; (iii) commercialization, and often, privatization of at least some DISCO functions; (iv) increased regulatory independence; (v) reduction in the number of competing objectives regulators are required to meet; and (vi) tariff reforms accompanied by budget support and/or lifeline tariffs for poor consumers.

Many CAREC countries are also interested in establishing market mechanisms for determining wholesale power prices as Kazakhstan has done and

the PRC is doing. Whether this will be feasible or not depends on the underlying cost structure of each country's power sector. The Kyrgyz Republic and Tajikistan, where generation is dominated by large cascades of hydroelectric generators—most of which have limited storage capacity—would find it difficult to establish robust national electricity markets. Regional wholesale markets provide a much more practical option to obtain benefits from trading power.

A further difficulty in designing power markets in the region is the pricing of outputs from combined heat and power (CHP) plants. Kazakhstan, for instance, has market-determined wholesale electricity tariffs and is seeking to refine its tariff setting methods for heat from CHPs. Mongolia, whose central grid is dominated by five CHPs often obliged to run to provide heat and steam locally, is having difficulty ascertaining the correct principles for economic dispatch of power and pricing the outputs of the combined plants.

It is clear that in some CAREC countries, a large number of consumers cannot afford to pay tariffs that fully recover the costs of running and maintaining the power system. Where previously this has been supported through costly implicit subsidies, there is an urgent need now to make subsidies explicit and non-distortionary through the use of lifeline tariffs or discounted connection charges. Subsidies must also be properly funded by governments and should not prevent the utilities from covering reasonable costs and accruing funds for future maintenance, rehabilitation, and upgrading. Serious policy debate is required regarding the level and quality of electricity service that governments would like to support.

Finally, in most CAREC countries, restoring the ability of tariffs to provide economic incentives to consumers and producers is critical. Without proper price signals, transition to market-determined pricing cannot be made, DSM cannot take root, and private investors cannot be enticed to enter the sector. As indicated above, this means that the problems of the DISCOs must be fixed with all due haste in order to

force consumers to pay regulated prices. While weak DISCO performance is primarily the responsibility of DISCO shareholders and management, and cannot be solved without strong government commitment, it weakens the regulators who have a role to play in fixing the problems. As consumer advocates, regulators must consider whether to publish problems on commercial performance. In the same capacity, they must be able to offer well-informed opinions to policymakers on potential policy solutions to these problems. Finally, when called upon to arbitrate on disputes regarding the distribution of cash, the regulators must do so in a manner that is predictable and undermines the price signals provided by tariffs as little as possible.

Regional Power Trade

High levels of electricity losses and low billing and collection rates suggest that there are considerable economic rents being generated in most power sectors in the CAREC region. It is impossible to measure these rents or see how they are distributed because of the low accuracy of existing metering systems. Power losses “vanish”, so they remain unknowable. It is possible that these rents act as a frictional force against formalized power trade. Formalizing power trade would result in significant changes in the level and distribution of rents, largely because of the improved metering of electricity flows both within and across borders. This is yet another argument for increasing transparency in the sectors.

Finally, inappropriate industry structures pose a significant barrier to the development of regional power trade. If the transmission company and some generators are government-owned, it seems unlikely that cheaper power will be imported from abroad while local generators remain idle. Regional energy trade will therefore require the commercial interests of the transmission company and its managers to be completely separated from those of the generators.