Electricity Sector Restructuring in Transition Economies: What Does It Mean for Energy Efficiency?

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ABSTRACT

Transition economies have experienced dramatic changes in their electricity sectors since 1990, yet few studies have looked at the impact of this restructuring on energy efficiency. The Czech Republic, Russia, Ukraine and Kazakhstan had centralized electric monopolies in 1990 with set, subsidized rates and utility sponsored energy efficiency programs were unheard of. Today, the electricity sectors in each country are in various stages of privatization, restructuring, and planning for competition. The Czech government has gradually removed subsidies and it is introducing open access to the grid for competitors since the beginning of 2002. Kazakhstan has privatized its power generators and has introduced tariffs designed to recover full costs, but retail competition does not yet exist. Ukraine has privatized much of its power sector and has wholesale competition, but non-payments have been a major impediment to real competition. In Russia, single power company, RAO EES, still produces and supplies the overwhelming majority of power in Russia. All these countries currently have significant excess power capacity, and they are planning to bring new capacity on line.

The paper assesses several characteristics of the power systems in each of the three countries considered: ownership status, pricing, and competition between different types of energy sources. The paper then assesses qualitatively how these changes have impacted energy use and efficiency. For example, competition may help improve supply-side efficiency and ensure that power companies do not invest in uneconomic power projects. The paper concludes with a brief evaluation of lesson learned and recommendations on ways to improve incentives for energy efficiency through electricity sector restructuring.

Introduction

In the late 1980s, the power sectors in most countries in transition were heavily centralized and subsidized. They were designed to encourage and promote heavy industry and provide the population with basic services. They were not designed for efficiency, either in power production or end use. As the countries of the former East Bloc began transitioning to a market economy, the design of these electricity systems often became a liability. Countries no longer could afford the subsidies necessary to make them work, yet there were no models of how to reform such systems. Each country took a different approach. This paper examines four countries to provide an overview of the changes underway and to describe how these changes may have impacted energy efficiency.

The impact of power sector reforms on energy efficiency is a subject of great debate in the West. Some argue that deregulation and competition have gutted demand-side management (DSM) programs, thus decreasing already limited funding for efficiency at the same time that deregulation often decreased prices (and hence the incentive to economize). Others would argue that as long as power companies could profit by building more plants and requiring consumers to pay, these companies would continue to build economically irrational power plants, thus defeating a major economic benefit of efficiency (reduced capital costs for power plant construction). The debate in the East is quite different: there were no utility-sponsored energy efficiency programs before 1990, and rate structures encouraged irrational energy use from the perspective of the overall economy. Moreover, power companies themselves had little incentive to produce power efficiently as they were paid for power on a cost plus basis (the higher the costs, the higher the profits they were allowed).

While it is not generally possible to attribute a specific reform or set of reforms to a quantitative improvement in energy intensity, it is possible to qualitatively examine the system and consider the impacts of various reform options on efficiency. This paper focuses on three factors in particular: ownership status, pricing, and competition.

The countries considered here each have unique stories to tell, although they are all similar in that they began their transformation with inefficient, planned economies. The authors selected these countries for two reasons. First, they represent a fairly broad spectrum in terms of economic development and electricity reforms. Second, they each have something unique to say about the link between power sector reform and energy efficiency. Table 1 below provides basic energy and economic information on the four countries considered in this article.

Table 1. Key Leononic and Energy indicators							
Country	GDP, 1999	Change in GDP,	Electricity Demand,	Total Primary Energy Supply,			
	(Bill. USD)	1990-1999	1999 (TWh)	1999 (Mill. tons oil equiv.)			
Czech Republic	128.6	1%	51.18	38.58			
Kazakhstan	69.4	-50%	50.49	35.44			
Russia	1,002.9	-40%	832.07	602.93			
Ukraine	162.7	-56%	168.68	148.39			

Table 1. Key Economic and Energy Indicators

Notes: GDP data are calculated in 1995 USD using purchasing power parity. Electricity demand refers to total net domestic supply and thus includes transmission losses.

Sources: IEA 2001a, 2001b, 2001c, 2001d; IMF 2001; Chandler 2000; OECD statistics database.

Table 2 summarizes where the Czech Republic, Ukraine, Russia and Kazakhstan are with their electricity sector reforms. In table 2, "Separation" stands for whether generation, transmission and distribution functions have been separated and are controlled by separate legal entities. "Ownership" indicates whether the sector has been privatized and if so, to what extent. "Competition" examines whether there is wholesale competition for selling power to the grid. "Tariffs" refers to the degree to which electricity prices are subsidized or controlled by factors other than cost.

Table 3 provides information on recent electricity tariffs in the countries considered in this article. Figure 1 summarizes the trends for energy intensity in each country. Interestingly, Kazakhstan and the Czech Republic, which have taken the greatest steps toward reforming their power sectors and insuring full cost recovery, saw the largest declines in intensity in the 1990s (Figure 1 provides information on energy intensity over time in each of the four countries).

Country	Separation	Ownership	Competition	Tariffs
Czech Republic	Yes	Partial privatization (30- 50% of shares in individual companies are	Yes, 30% of retail market open for	The regulatory office controls tariffs for captured customers; cross-subsidies were removed in
Kazakhstan	Yes	Generation and distribution primarily private	Yes	Set by government commission; some cross-subsidization
Russia	No	Government owns 51% of main power company	No	Set by government commission; low tariffs due to domestic gas sale requirements (effective subsidy); cross-subsidization
Ukraine	Yes	Partial; privatization of distribution due to restart in 2002	Yes, but large non-payments	Set by government commission; cross-subsidization

 Table 2. Status of Electricity Sector Reforms

Table 3. 1999 Electricity Tariffs (in US Cents per kWh Using Purchasing Power Parity)

Tariff Category	Using Exchange Rates	Using PPP
Russian Average	1.5	4.7
Ukrainian Industrial	3.07	11.9
Ukrainian Residential	3.31	12.9
Czech Industrial	4.9	12.0
Czech Residential	5.1	12.5
Kazakhstani Industrial	0.97	4.0
Kazakhstani Residential	2.31	8.7

Note: The Russian tariff is for 2000.

Figure 1. Energy Intensity



Russia

Russia is the fourth largest producer of power in the world, after the U.S., Japan and China. Its electricity sector is the single largest source of greenhouse gas emissions in the country and the emissions of RAO-EES, the main power company, rival those of many countries. Russia has a total installed power capacity of 205 GW, though only 188 GW of this is considered operational. Peak system demand was 145 GW in 2001. Total power production fell from 1,082 TWh in 1990 to 827 TWh in 1998 and appears to have increased slightly since then (IEA 2002; International Private Power Quarterly 2001).

Industry accounts for half of Russia's power demand, while the residential and commercial sectors account for 24 and 10 per cent of power demand, respectively. Thus, compared to most industrialized nations, demand is heavily concentrated in industry (IEA 2002).

As Russia's economy has declined in the past decade, its energy and electricity intensities remained roughly stable. Despite this, energy efficiency has been a booming business in Russia in recent years; the lack of progress on energy intensity indicates the severity of the economic decline and how much more room there is for improvement. Companies selling efficient motors, controls, and other energy efficiency products have seen strong demand and the Russian Energy Efficiency Center estimates that over a billion dollars has been invested in efficiency in the past five years. Much of this comes from international projects such as the World Bank's Enterprise Housing Divestiture Project, but industrial companies, cities and private individuals have also made major investments using their own funds.

Status of Russian Electricity Reforms

President Yeltsin restructured the electricity sector by decree in 1992, establishing RAO EES (Unified Electricity System of Russia Joint Stock Company) as the owner and manager of the electricity infrastructure except for nuclear power plants. RAO EES owns the transmission grids and controlling or blocking shares in virtually all of the regional generation/distribution companies, called energos. It also controls the dispatch functions and manages the wholesale market.

In July 2001, the Russian government announced plans for major restructuring of the power industry. The planned reforms will take place in three stages continuing through 2009. The first stage involves splitting generation, transmission and distribution functions so they are controlled by separate legal entities. The government plans to create 8-12 national generation companies, laying the groundwork for wholesale competition. The second stage, which goes through mid 2007, involves launching a competitive wholesale market. The government envisions full liberalization of wholesale and retail markets in the final stage of the reforms.

Russia's Ministry of Energy has a division dedicated to energy efficiency and renewable energy, which among other things, includes an energy efficiency inspectorate to conduct energy audits of federal and major industrial facilities. Some of the most progressive energy efficiency policy in Russia comes from the regions and municipalities, which have taken the lead on implementing new energy-efficient building codes and establishing energy efficiency funds using special energy taxes.

Ownership

RAO-EES is 52.6 percent government-owned. The next largest shareholder is the Bank of New York (19 percent) with the remainder in the hands of employees or floated on the Moscow stock exchange. Rosenergoatom, which owns all but one of the country's nuclear power plants, is fully state owned.

In the second stage of the planned reforms, the government plans to sell off its shares in the generation companies and to use the proceeds to increase its ownership in the planned transmission company. Thus, generation will eventually be entirely in private hands (EEER 2001).

The current ownership structure does not promote energy efficiency at the supply and transmission levels because there is little incentive for efficient production under a monopoly. Regional energos have few if any programs to promote energy efficiency. That said, RAO EES did establish an energy savings center in 2000. This center focuses primarily on efficiency improvements in electricity supply and transmission. It estimates that RAO EES has saved one million tons of oil equivalent (toe) per year with minimal investments to date and that it could create savings of as much as 6 million toe under similar conditions (IEA 2002). The fact that RAO EES did not act earlier on energy efficiency may indicate its lack of interest as a monopoly. Later, when it did pursue conservation, RAO EES appears to have realized the economic benefits of energy efficiency, but it may also have been reacting to the changing political environment as it sought to stave off more radical reforms.

Pricing

The Federal Government sets the maximum electricity tariffs, which it plans to increase over the next several years. Local utility commissions then set the specific tariffs customers in their region must pay. These local commissions are closely connected to local governments, so they lack independence in practice. As a result, they tend to approve low tariffs to meet the short-term political goals of local governments (maintaining their electoral base), rather than the long-term fiscal needs of the distribution companies. While Russia does have a Federal Wholesale Market, known as FOREM, RAO EES regulates FOREM and dispatch activities, so in practice, RAO EES regulates wholesale prices. Until recently, non-payments have been a persistent problem in the Russian power sector. Since 2000, all customers must pay for electricity in cash and can be disconnected for non-payments.

There is also some dispute over whether Russian electricity prices are in fact low. When calculated in dollar terms using prevailing interest rates, the tariffs do seem low compared to rates in Western countries. This was particularly true before 1998 (tariffs have risen by over 270% in ruble terms since). However, such an analysis does not take into account purchasing power parity, which shows the ability of consumers to bear prices based on the prices of other goods on the market. Also, Russia's role as a major energy supplier means that fuel transmission costs are lower than in many other nations. Given the large amount of fuel on the Russian market because of domestic production, it is unlikely that prices would ever reach Western European levels. That said, prices for natural gas, the main fuel for power generation, are regulated and kept low by the fact that the government dictates what percentage of production can be exported. If natural gas prices rise, electricity prices are very

low or just a little low has a large impact on whether prices adequately stimulate energy efficiency. It is difficult to answer the question of whether the prices are right until the free market determines prices at the wholesale level.

Competition

Currently, there is very little true competition in the Russian power sector as RAO EES controls the wholesale market. Industrial companies can decide to self-generate, but they cannot easily sell excess power back to the grid. Still, industrial companies feel that it is typically much less expensive to self-generate than to buy power from regional energos (REMA). This is one of the drivers behind power sector reform.

Competition could affect energy efficiency in Russia in several ways. First, competition will inevitably change the price of power, though it is hard to say to what extent prices might grow. Second, competition will increase incentives for efficient power production. Third, competition would likely also mean that independent generators such as manufacturing facilities would have access to the grid. This would increase the incentive for cogeneration and ensure that low cost waste fuels could be used for power instead of being flared when local power is not needed.

Ukraine

Ukraine has 55 GW of installed power capacity. In 1999, Ukraine produced 172 TWh of power and consumed slightly less than this amount. Nuclear energy makes up a major portion of Ukrainian power production—over 40% through the end of 2000. Since the closure of the Chernobyl nuclear power plant in December 2000, Ukraine has produced slightly more of its power from coal-fired power plants. Overall, Ukraine has significant excess power capacity because of its economic decline and related decline in energy use. Industry dominates power demand (IPPQ 2001, Novyny Enerhetyky, 1999).

Ukraine's economy declined by over 50 percent from 1990 to 1999, although its economy has grown since then. As its economy shrank, its energy intensity grew: industrial companies continued consuming energy without paying, thus extracting an implicit subsidy. The government incurred billions of dollars in natural gas debts as a result of these practices.

Non-payments and barter have been major problems throughout the economy, but the power sector has been particularly hard hit. Numerous offshore intermediary companies were set up to arrange barter transaction (typically involving energy); these intermediaries separated manufacturers from their customers and were able to extract huge profits from these transactions.

Ukraine has frequently listed energy efficiency as one of its top economic and energy priorities, but in practice, little government funding has gone to energy efficiency. Ukraine does have a State Committee on Energy Conservation, which has created the first true energy service company in the former Soviet Union. In 2001, the Committee also successfully convinced the government to allocated approximately \$5 million for energy efficiency in government facilities and this funding will likely grow in future years.

Status of Ukrainian Electricity Reforms

Ukraine has undertaken rather comprehensive power sector reforms, although in practice, not all the reforms have proven as effective or as easy to implement as initially planned. Ukraine began by separating its generation, transmission and distribution activities into separate legal entities. There are several regional thermal generation companies as well as a nuclear power entity and hydroelectric power companies. Soon after it unbundled the power sector, the government launched the Ukrainian power pool (Enerhorynok) to all the generation companies to compete. In practice, non-payments have made the power pool difficult to operate and dispatch in practice gives preference to certain generators, making power supply less than economically optimal. Also, the most profitable, liquid private companies have signed power supply contracts with individual generators to get a better price, thus by-passing the pool. This has left Enerhorynok to trade electricity sold ultimately to the end-users least able to pay, magnifying the non-payment problems of the pool.

Ownership

Ukraine has privatized much of the power sector. It began selling its thermal power generation companies in 1996, and these companies are now traded on the Ukrainian stock market. The nuclear power company, EnergoAtom, is state-owned, as are the two peaking hydroelectric pumped storage companies. Ukraine began to privatize the distribution companies in 2001. The government has sold majority shares in over half of its 27 distribution companies in two privatization rounds, though President Kuchma placed a moratorium on further energy company sales in 2001.

Private ownership has not attracted significant investment to modernize the generation capacity because of low electricity tariffs and the generally difficult investment climate. Private ownership of distribution companies may eventually improve customer service, although it is difficult to see how this might have a direct impact on end-users' efficiency. As the investment climate improves, generation and distribution companies will likely see greater incentives to invest in supply-side efficiency improvements.

Pricing

There are two important elements of electricity prices in Ukraine. One is the nominal price charged (which has often been pegged to the dollar de facto or in fact). The other is non-payment, which effectively lowers the price of power. In dollar terms, industrial electricity tariffs have risen from 0.05 cents in 1991 to over 3 cents in 1999. Power prices are higher in dollar or ruble terms than in neighboring regions of Russia, causing manufacturers to complain about unfair pricing and industrial competition. Power prices actually declined in real terms from 1996 to 1999. The national regulatory commission limits power prices and then specific prices for different types of end-users are set on a regional basis. The regulatory commission has been reluctant to raise tariffs for fear of worsening the non-payments problem and causing economic hardship; politics has played a large role in rate setting despite the stated independence of the national and regional commissions.

Ukraine made major progress in addressing the non-payment problem when Viktor Yushchenko was prime minister (2000-2001), and non-payments have continued to decrease, albeit at a slower rate. Non-payments were running at over 90% in some years.

Ukraine is not a major energy producer, so it is heavily dependent on imported Russian fuel for all its energy needs. Ukraine gets most or all of its natural gas, oil and nuclear fuel from Russia. Natural gas prices in cash terms have risen recently and will likely continue to rise. In addition, coal is heavily subsidized in Ukraine, which relieves pressure on power producers to push for higher prices, but ultimately, coal prices will have to rise. Thus in the long term, power prices in Ukraine will almost certainly go up.

Because of the tariff structure, some energy efficiency measures are not as cost effective as they might be in the West. This includes efficient motors, lighting, and refrigerators. This has certainly deterred some from making energy efficiency investments. In general, there is more interest in Ukraine in energy efficiency measures that save natural gas or heat, although there is growing interest and investment in energy efficiency in all areas. Increased power prices would obviously stimulate more energy efficiency investments.

Competition

Ukraine has operated a power pool, called Enerhorynok, since 1996. Non-payments and uneconomic dispatch practices have impaired the system. Arrears are down significantly since the beginning of 2000, but outstanding debts have yet to be settled in full and payment is still rarely in full. Distribution companies paid Enerhorynok for 65 percent of the electricity they bought in 2001, which is more than double the percentage they paid in 2000 ("Ukrainian..." 2002).

Because of the problems with non-payments, few investors and owners have been willing or able to make major improvements to the efficiency of their generating capacity. Moreover, losses in the transmission lines are very high and growing because of lack of maintenance and investment (often due to non-payments). The Ministry of Fuel and Energy reports that losses totaled 21.43 percent of transported power in 2001, which is probably one of the highest loss rates in the world for a system of this size; much of this is illegal acquisition of power from the grid ("Ukrainian..." 2002).

Czech Republic

Demand for electricity reached 54 TWh in 1996 and temporarily declined to 50.8 TWh in 1999 due to an economic recession. The winter peak demand is 10.5 GW. The Czech Republic has 15 GW of installed power capacity, the annual electricity production fluctuates around 60 TWh. In recent years exports of electricity significantly increased and in 2000 they reached almost 10 TWh, which is 19% of national electricity consumption. The major investment in the electricity industry in the last decade included financing the construction of a new 2x1000 MW nuclear power plant. The first block of this Temelín nuclear power plant was put into a testing operation in 2001, and the second block is planned to follow in 2002. The power generating market is dominated by a single producer, ČEZ, whose share in domestic power generation is 70%. The ČEZ company also wholly owns the transmission

company. The other producers are primarily industrial autoproducers and several independent power producers.

The Czech Government has established some programs to promote energy efficiency through the Czech Energy Agency (CEA). In particular, the CEA has provided funding for energy audits in the residential and public sector and has provided grants for energy efficiency projects in households and industry. It also disseminates public information on energy efficiency. However, CEA has a staff of under 20, so it has a limited ability to affect energy efficiency nationwide. ČEZ also ran a small demand-side management program several years ago, focusing on customer information and small rebates for efficient lamps.

Status of Czech Electricity Reforms

The original national vertically integrated power utility was unbundled in the 1990s; this involved creating eight regional distribution companies and a dominant generation company, ČEZ. Several primarily municipal heat and power generation companies have been separated from ČEZ and established as independent power producers. The dominant power generator ČEZ also owns the transmission grid company, ČEPS (IEA 2001a). The Czech Republic adopted a new Energy Act in 2000 (Energy Act #458/2000), which guarantees regulated access of third parties to the grid. The retail electricity market will be opened for competition in four steps starting in 2002 with the largest customers (some 30% of the market) and reaching 100% of retail market opened for competition in 2006. The customers eligible for access to a competitive market since January 2002 are those who previously consumed more than 40 GWh per year. (Eligibility requirements will gradually ease so that after January 2005 the annual consumption threshold drops again to 100 MWh). Starting in January 2006 all consumers, including residential customers will have access to a competitive market.

In 2001, the government established two new institutions: an independent regulator and a market operator. The market operator runs a spot electricity power exchange and is responsible for power settlement.

Ownership

Czech electricity utilities were partially privatized in early 1990s. The state still controls 68% of the shares in the dominant power producer, ČEZ, 51-54% in five regional distribution utilities, and less than 50% in another three distributors. The plans to privatize the remaining shares in electricity utilities have not been implemented so far. The government approved in 2001 a plan to privatize its shares in all utilities (including the dominant power producer and eight regional distributors) to a single investor. However, the conditions of privatization, including the requirement to produce a minimum amount of electricity, the obligation to purchase a minimum amount of domestic coal, the non-resale of assets for eight years, the required minimum price for the privatized shares, and the reintegration of the industry (including of the controversial Temelín nuclear power plant) made the whole privatization unattractive for investors. The government was thus forced to scrap its privatization plans in 2002. Shortly before the parliamentary elections in 2002, the government decided to merge the power utilities. The state should sell shares in all regional

distributors to the dominant state controlled power producer ČEZ, and ČEZ should sell 66% of its shares in ČEPS, the national transmission company to the government. This merger of production and distribution assets, however, is subject to approval by the local antimonopoly office.

The major power sector investments in the 1990s were construction of the Temelín nuclear power plant and installation of desulphurization plants at coal-fired power plants to meet the strict requirements of the new Clean Air Act. Construction of Temelín nuclear power plant began in the 1980s under the communist regime. In the early 1990s the planned capacity was reduced to 2x1000 MW instead of 4x1000 MW. In 2001, the first reactor was put into testing operation, and in 2002 the second reactor will be put into operation. The total investment cost of this power plant reached around US\$3 billion. In addition, over US\$1 billion was invested in desulphurization plants in the mid 1990s. Neither of these investments, though, directly relates to energy efficiency, and in fact, Temelín may eventually discourage energy efficiency because of the excess capacity it introduces into the system. Even the reduced Temelín capacity of 2000 MW is too high for the low domestic load in summer and regulation capacity might become scarce. The Temelín power plant, located near the Austrian and German borders, had an interesting impact on power trading agreements even before it was put into a commercial operation. There is broad opposition against the Temelín power plant in Austria and Germany, which has both economic and political impacts. ČEZ was exporting part of its power to E.ON in Germany. However, Bavarian customers' concerns about the Temelín nuclear power put pressure on E.ON to change to another power trader willing to guarantee the supply of non-nuclear power. In short, E.ON has terminated the power agreement with ČEZ in order to retain its German customers on-line. However, ČEZ's power exports have not declined as they now go through another intermediary.

Pricing

Until the electricity market was opened for competition in 2002, the electricity prices of a dominant power producer ČEZ and all retail electricity prices were regulated by the Ministry of Finance and since 2001 by the independent Energy Regulatory Office. During the last decade the remaining cross-subsidies between residential and industrial customers have been slowly removed. The residential electricity prices finally reached their full level in 2002 and the visible cross subsidies have thus been eliminated. The electricity prices for industry are within the range of electricity prices in West European countries. The residential prices are slightly lower than those in the West, partly due to lower distribution costs. Since the electricity market was opened only in January 2002, there has only been a brief period to evaluate its impact on electricity prices. However, the first information available suggests that the electricity prices for large eligible customers have decreased by about 5% on average.

Competition

Czech energy policy, and specifically its liberalization and privatization goals, is inconsistent. On the one hand, the government has implemented legislation that opens the market for competition, and on the other hand it wanted and still plans to re-integrate the utilities into a single group. The market would then be dominated by a single company and there would be no significant competition on the domestic market. There is a clear risk that reintegration of the sector and the increased overcapacity of baseload power, with the commissioning of the two nuclear reactors at Temelín, may dramatically reduce competition on the wholesale market from independent power producers and cogeneration plants (who had a market share of 30% in 2001) as well as from imports. The newly established regulator will face a tremendous challenge to effectively regulate the market power of ČEZ.

The Czech electricity utilities, and especially some of the retailers/distributors have developed, marketed, and offered to customers several new products and services. The services include information centers offering free consulting for example on energy efficient electricity appliances, energy efficiency measures in buildings, efficient lighting, and related services. Some of the utilities have sponsored a large campaign marketing compact fluorescent lamps. Several utilities have also provided discounts for or have organized sales of discounted compact fluorescent lamps. The services offered also include financial leasing for energy appliances (not necessarily only energy efficient) and energy contracting for municipal street lighting. The first distribution utility, ZČE a.s., introduced a new product called Green Energy in April 2002. ZČE a.s. plans to offer it to customers starting in 2003. The company will guarantee that electricity labeled Green Energy will be produced from renewable energy, primarily in small existing hydropower plants. It will be priced slightly above the market level, and the additional revenues shall be used for information campaigns and development of new renewable energy projects.

However, all these activities have been developed in a regulated industry and were not yet exposed to a strong competition for an extended time. Thus we do not yet have any evidence if or how these activities will "survive" on an open market. We can only speculate if market liberalization and retail competition in the long run will push utilities to keep offering new energy efficiency and renewable energy product and services to their customers. What seems to be evident is that liberalized market with weakened regulation, but ineffective competitive enough, will bring few benefits.

Kazakhstan

Kazakhstan is a large country with vast, sparsely populated spaces. Even though Kazakhstan is a significant oil and gas producer, its oil and gas reserves are in the West, far from the major population and industrial centers in the North and Southeast. The country has a unified grid system with two main parts: one serving the North and a second in the Southeast, which is linked into the Central Asian grid. Coal is the main fuel for power and other energy needs with in the country and coal's role in power generation is increasing.

Kazakhstan has a total installed power capacity of 18 GW and it imports about 6% of its total electricity requirements. Kazakhstan's economy declined in the 1990s like most in the former Soviet Union, although Kazakhstan has seen strong economic growth in recent years. It is one of the few transition economies where the decline in electricity consumption significantly exceeded economic decline (energy intensity has dropped by over 50 percent since 1990). Power consumption declined by more than 50 percent the 1990s, from 105 TWh in 1990 to 51 TWh in 1999 (Correspondence with KEGOC 2002, PlanEcon 2000). Much of this decline came from a drop in industrial power consumption. Kazakhstan's non-payment crisis has been less severe than in Ukraine or Russia, which indicates that the hard

budget constraints on firms' energy use may have contributed to the drop in consumption (PlanEcon 2002, Katyshev & Papafanasopulo 2002, Katyshev 2000).

The Kazakhstani government has few dedicated programs to promote energy efficiency and utilities do not generally get involved in demand-side management. Individual manufacturers, building owners and cities have invested in cost-effective energy efficiency measures, though there is little comprehensive information on the scale of these investments.

Status of Kazakhstani Electricity Reforms

Kazakhstan launched a major reform of its electricity system in 1996. It began by separating generating plants from cogeneration facilities and heat only boilers (this boosted the attractiveness of the generation assets by separating them from unprofitable heating assets). The generation stations and distribution networks were then privatized in 1997.¹ The Ministry of Finance agreed to take on most of the past liabilities of the companies being privatized. The government also established a wholesale power market in 1996 and this market works very well overall. Regional regulatory commissions set tariffs for end-users, though as in Russia and Ukraine, these commissions are not entirely independent. Distribution companies have complained about the low tariffs and the problems this creates for cost recovery and profitability. Customers with power demands of over 5 MW and who are connected directly to the transmission grid can buy power from the lowest-cost generators. Customers who do not pay can by and large be disconnected from power supply, although non-payments are a lingering problem.

Ownership

The government has taken two different approaches to involving the private sector in the electricity system: direct sales of shares and long-term concessions. In 1996 and 1997, the government sold the majority of the country's generation companies to strategic investors through international tenders. Investors purchasing the generating companies included large energy firms such as AES, Tractabel and Independent Power Company as well as domestic and foreign manufacturing firms. Most of the distribution assets were turned over to private sector management through long-term concession agreements. The national transmission company, KEGOC, is state-owned. The power market and dispatch are overseen by a separate state-owned entity.

Kazakhstan has attracted significant investments to improve its power generating capacity; privatization appears to have played an important role in stimulating this investment. AES, KazChrome, the World Bank and the European Bank for Reconstruction and Development invested \$482 million in power sector upgrades by the end of 2001 (Borisovsky 2001a, 2001b). \$257 million of these investments are being invested in modernizing the power grid; the rest were a mix of expanding and modernizing generating facilities. While not all of the investments have boosted energy efficiency, it is clear that Kazakhstan has been able to attract money to maintain and improve supply-side power efficiency, something that neither Russia nor Ukraine has succeeding in doing to a meaningful extent.

¹ Some regional distribution companies are still state-owned.

Pricing

Wholesale prices are generally set by the power market. Retail prices are still regulated, except for those paid by the largest consumers who can access the wholesale market directly. The Agency for Regulation of Natural Monopolies, Protection of Competition, and Support for Small Business sets tariff policies at the national level. This agency monitors and under certain circumstances regulates wholesale tariffs. Its regional offices regulate tariffs charged to end-users. The Agency reports directly to the Prime Minister (PlanEcon 2000).

Average tariffs have actually dropped in recent years, going from 3.8 to 1.4 cents per kWh at prevailing exchange rates. Distribution and generation companies complain about the difficulty of recovering costs at these price levels. In fact, the Belgian firm Tractabel recently pulled out of the Kazakhstani market over this issue. While the prices may seem very low compared to U.S. or Western European price levels, these figures are calculated using exchange rates, not purchasing power parity (a dollar can buy more in Kazakhstan than in the U.S. or even Russia). Also, because Kazakhstani incomes are low compared to most industrialized nations, prices at these levels may have a larger impact on modifying consumption than in richer countries. The fact that Kazakhstan has lowered its energy and electricity intensities over the past twelve years indicates that the wholesale market and price levels have had an impact on consumers' behavior.

Competition

Kazakhstan has wholesale competition among generators. Most of the installed capacity is thermal generation, though Kazakhstan also has significant hydropower resources. Kazakhstan's 54 power plants are owned by a total of over ten companies who must compete to produce power at the lowest price. KEGOC then transmits the power to regional distribution companies.

Kazakhstan also allows retail competition for the business of the largest energy consumers. In practice, though, regional distribution companies sell the majority of power to end users in all size categories. Customers who do not have a direct connection to the high voltage transmission lines must pay very high distribution charges, making direct power purchases unattractive.

Wholesale competition has attracted significant investment in power sector modernization as the various generators seek to lower their operating costs. This has improved the efficiency of the generation facilities.

Conclusions

Lessons Learned

Most countries in transition decided to leave power sector reforms for later in the transition process, but because of the economic collapse after the first round of economic reforms, the political will to pursue additional reforms waned before real action was taken on the power sector. Kazakhstan and the Czech Republic are exceptions to this general rule as

they were able to pursue major power sector reforms after the first stage of economic reforms. In Kazakhstan, this was possible because the president has very wide authority.

The lack of power sector reform in most transition economies led to a gradual decline in power plant assets (and their efficiency). Moreover, power plant operators were not able to adapt well to lower power demand: rather than closing some plants or building smaller, more flexible facilities, most power companies opted to operate all their plants at partial capacity, making power production even less efficient. On the demand side, low tariffs, regulated by only partially independent utility and pricing commissions, provided relatively little stimulus to save electricity in many transition economies. Non-payments further lowered the effective price of power.

Privatization and investment are arguably more difficult now because the financial condition of the power generators and the physical condition of their assets makes it difficult to attract investors. Countries are finding it difficult to attract power plant bids and investments as high as they would like. For example, Ukrainian distribution asset bids in 2001 were lower than expected. Also, the Czech government recently canceled a tender to privatize CEZ because of inadequate bid prices (related to unrealistic privatization terms and conditions).

When countries have reformed their power sectors and allowed prices to reflect the full cost of power, they have been able to increase efficiency both on the supply and demand side. Kazakhstan is the best example of this of the countries in this review: the power sector went through major reforms and actual electricity intensity began dropping at a faster rate soon after. While Ukraine took steps to reform its power sector at approximately the same time as Kazakhstan, the large implicit subsidies associated with non-payments effectively canceled the impact of the reforms by giving end-users little incentive to save energy and producers little resources with which to modernize their facilities.

Power sector reforms in transition economies have a more clear-cut potential to reduce energy intensity than those in Western countries because transition economies began with such low prices at the outset of the reforms and because power companies had almost no demand side programs to lose. Western power sector reforms often result in lower prices, which may actually increase demand. That said, it is very difficult to point to any particular reform in a transition economy and demonstrate that it had a positive impact on energy efficiency because too many major structural changes were occurring at the same time.

Recommendations

Governments could undertake several steps in their power sector reforms that would promote energy efficiency. Eliminating non-payments is probably the single most important action in the former Soviet Union as it affects the effective price of power and the money available for maintenance and modernization of power supply. In the absence of markets, ensuring that price and regulatory commissions are truly independent is also very important; independent decision-making can help ensure that power tariffs are based on costs and not artificially deflated for political reasons. Opening up wholesale markets is also an important step in monetizing the true costs of power generation.

Privatization and competition, if done properly, can help attract investment to modernize power generation, transmission and distribution facilities, improving efficiency on the supply side. When countries privatize electricity assets, they should seek to provide the

maximum degree of transparency in the sector and they should also set clear policies on timetables and conditions for increasing electricity tariffs (a key investor concern). Competition stimulates investment by giving producers a strong incentive to cut costs (which often requires initial investments) and to ensure a stable production base. Competition may also help the market determine how much power capacity is actually needed, as almost all countries in transition have significant excess power capacity. Most transition economy governments are actively working to promote additional capacity, which may not be needed for ten years or more on purely economic grounds. It is also very important that government do not inadvertently put up barriers to energy efficiency by directing investments solely to supply-side projects. Governments can have a tremendous impact on where investments flow, both through their relations with development banks and their energy and investment policies (Chandler 2000). All the governments in this assessment list improved energy efficiency among their top energy policy priorities, but in practice, most dedicate significantly more resources to promoting new supply than to promoting energy efficiency even when efficiency is less expensive based on levelized costs. Comprehensive energy planning and further institutional capacity building also have an important role to play in supporting energy efficiency policy.

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