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From Crisis to Stability in the Armenian Power Sector

*Lessons Learned from Armenia's Energy Reform
Experience*

*Gevorg Sargsyan
Ani Balabanyan
Denzel Hankinson*



THE WORLD BANK

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Gevorg Sargsyan is a Senior Infrastructure Specialist at the World Bank in the Energy and Infrastructure Department, Europe and Central Asia Region. Ani Balabanyan is an Operations Analyst in the World Bank's Armenia Country Office. Denzel Hankinson is a manager with Castalia Strategic Advisors.

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PPIAF
c/o the World Bank
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Fax: 202-522-7466
www.ppiaf.org
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Acronyms and Abbreviations

AERC	Armenian Energy Regulatory Commission
AMD	Armenian dram
AMDAS	Automated Metering and Data Acquisition System
CIS	Commonwealth of Independent States
ECA	Europe and Central Asia
EDC	Electricity Distribution Company
ENA	Electricity Network of Armenia
GDP	Gross domestic product
GoA	Government of Armenia
GWh	Gigawatt hours
HPP	Hydropower plant
IMF	International Monetary Fund
IFC	International Finance Corporation
IFIs	International financial institutions
kgoe	Kilograms of oil equivalent
km	Kilometers
kV	Kilovolt
kWh	Kilowatt hour
MRH	Midland Resources Holding
MW	Megawatt
m ³	Cubic meters
PFBP	Poverty Family Benefit Program
PSP	Private sector participation
PSRC	Public Services Regulatory Commission
RAO UES	Russia's Unified Energy Systems (Russian electricity company)
SAC	Structural Adjustment Credit
TPP	Thermal power plant
USAID	U.S. Agency for International Development
WDI	World Development Indicators (World Bank database)

Executive Summary

In the wake of the Soviet Union's collapse, Armenia, like other former Soviet republics, began to struggle with the implications of its newfound independence. In the electricity sector, this meant learning how to manage and sustain a fragment of a system that had never been designed to function as a stand-alone grid. Armenia's electricity system—and, indeed, its entire energy supply system—had been designed to operate as part of a much larger, integrated Trans-Caucasus system. Plants were built to run on fuel imported from thousands of miles away, from neighbors who, with the Soviet Union gone, could offer little certainty that such supply would continue under terms that Armenia could afford.

The problems with this system began to show in 1992. The start of the war over Nagorno Karabakh, and the resulting imposition by Azerbaijan and Turkey of an economic blockade, cut off Armenia's only source of gas and oil for its thermal plants. Four years prior to that, a massive earthquake had forced a shut down of the Medzamor nuclear power plant, a source of roughly one-third of Armenia's generating capacity. Supply from a new gas pipeline, built in 1993 through neighboring Georgia, was regularly interrupted by acts of sabotage. Armenia was left to rely almost entirely on its hydropower resources, at great expense to Lake Sevan, one of the country's most precious natural resources. Between 1992 and 1996, customers suffered through several of Armenia's brutal winters with little more than two hours of electricity per day. The hardship was compounded by the economic collapse that followed independence and was more severe in Armenia than in other countries because of the economic blockade.

End of the Power Crisis and Beginning of Reform

By late 1996 a number of measures had been taken to restore 24-hour supply. The Government of Armenia (GoA), with donor assistance, had begun to take measures to impress upon customers the link between service quality and payment of bills. Tariffs for industrial, commercial, and household customers were set at equal levels, beginning a process of tariff rebalancing to remove cross-subsidies. Medzamor was restarted, and the gas pipeline sabotage abated, at least in part as a consequence of Medzamor's restart.

Significant problems remained, however. The sector was hemorrhaging money. Fiscal and quasi-fiscal subsidies to the power sector had reached a level equivalent to roughly 11 percent of Armenia's gross domestic product (GDP) by 1995. Collections were barely above 50 percent, and nearly 25 percent of all power produced disappeared before the meter as commercial losses (mostly electricity theft). The system remained dilapidated from years of crisis operation and underinvestment and was dependent upon massive public subsidies.

A number of reformers within the GoA and donor agencies saw a clear need to put the power sector assets into the hands of an entity with stronger incentives to improve their performance. Armenia embarked on a path to power sector privatization in 1997, selling several small hydropower generation assets. The biggest source of its problems was the distribution company, the entity that oversaw the final point of service delivery and payment. Efforts to privatize the distribution company began in earnest in 1998.

The GoA had set the stage for privatization in 1995 with an ambitious process of power sector restructuring, unbundling the vertically integrated state utility Armenergo into sep-

arate companies for generation, transmission, and distribution. An independent regulator, the Armenian Energy Regulatory Commission (AERC) was put in place, led by a highly competent team of reformers. With extensive donor support, the GoA began tackling the sources of the power sector's two most significant problems: commercial losses and non-payment (or undercollection). Existing household meters were relocated to common areas of apartment blocks as a means of discouraging meter tampering and facilitating accurate meter reading. Twelve thousand new tamper-proof meters were installed throughout the system at a variety of voltage levels down to 0.4 kV. An Automated Metering and Data Acquisition System (AMDAS) and a customer information system were installed so that the GoA could begin to learn the extent and source of the system's problems.

Successful Privatization Through Trial and Error

A first attempt to privatize the distribution system in 2001 enjoyed only limited support and suffered considerable obstruction from within the GoA. The tender documents were flawed and the legal and regulatory framework incomplete. However, the fact that the tender had actually taken place, and some major international operators had expressed interest, inspired many within the GoA to give the effort more serious consideration. The GoA hired new transaction advisors and set about overhauling the tender documents and legal and regulatory framework.

By autumn 2001, the GoA was ready to launch its second tender for the distribution system. The bidders by that time, however, had other matters on their mind. A “perfect storm” had hit the market for international power sector investment: the September 11, 2001, terrorist attacks on the World Trade Center, Enron's collapse in October/November 2001, and the litigation and investigations into the causes of the California electricity crisis. Few large, international operators had any appetite for new purchases in emerging markets in a sector with regulated returns in an untested regulatory framework. Armenia's drive toward privatization seemed to have stalled.

By late 2002 the GoA had begun looking for a management contractor instead of an owner when a little-known company, Midland Resources Holding (MRH), stepped forward to express interest. The U.K. Guernsey-registered company was primarily a trading company with no experience in any segment of electricity operations. The GoA's donors and transaction advisors remained skeptical and initially distanced themselves from the deal. The GoA proceeded cautiously in discussions with MRH, ultimately finding ways to accommodate this atypical “strategic investor.”

MRH assumed control of Armenia's distribution system in autumn 2002. This paved the way for further privatization in the generation sector: ownership of the Hrazdan thermal power plant, the Sevan-Hrazdan hydropower cascade, and financial control of Medzamor were swapped during 2002–03 to several Russian companies against US\$96 million in state debt forgiveness.

Quantifying the Achievements of the Reform Process

Armenia's power sector has made impressive progress since the beginning of the reforms. Twenty-four hour service has been maintained since 1996 throughout the country. Col-

lections are at nearly 100 percent of sales. Only 4 percent of what should be delivered to customers become “commercial” losses. Tariffs are set by a regulator with eight years of sector experience, and they are generally regarded as near medium-term cost recovery levels (that is, recovering short-term cost of service, depreciation, and at least some level of new investment).

The change in electricity price has brought efficiency gains, as users have invested in more energy-efficient technologies. Armenia’s water utilities, for example, facing higher effective electricity prices, have invested heavily in upgrading inefficient electrical pumping systems or changed to gravity-fed systems where pumps are unnecessary. Higher electricity prices have also facilitated expansion of the gas network, and, where possible, users have switched to gas for their heating and cooking needs.

High commercial losses, low collections, and below cost recovery tariffs once required the GoA to provide massive explicit and implicit subsidies to keep the power sector operating. The reforms have relieved the GoA of the need to provide this support, saving roughly US\$386 million since 1994. The distribution company has gone from being one of the GoA’s largest debtors to one of its largest sources of tax revenue.

Distribution of Benefits

The poorest Armenians have undoubtedly found it harder to pay higher electricity prices. A failure to implement power sector reform, however, is not likely to have made them any better off. As the country’s experience with the energy crisis showed, Armenia faced a choice between having a functional electricity sector and not having one and of having lower priced power with limited supply and reliability or higher priced power with 24-hour service.

Moreover, the parties responsible for most of the fiscal deficit were industrial customers or GoA budgetary institutions receiving free power (sometimes authorized to do so and sometimes not). As in many countries, Armenia’s poor customers generally have good records of paying as much of their utility bills as they can, as often as they are able. The customers benefiting most from the preprivatization *status quo* were generally large power consumers, and often state-owned, not poor residential customers.

Social transfers may not yet be sufficient to offset the effect of tariff increases on the poor, but at least the GoA now has the funds with which it could increase those transfers. There is evidence that it is doing so. GoA social spending increased from 31.3 to 38.2 percent of all fiscal expenditure between 2001 and 2004 and from 6.5 to 7.2 percent of GDP, despite an overall decrease in fiscal expenditure.

How Armenia Did It

The relocation of meters from apartments to public areas proved an essential first step in tackling the high commercial losses and low collections that lay at the heart of the power sector’s problems. Relocation of existing meters, instead of widespread replacement of old meters with new, proved to be a much more cost-effective approach than that used by Armenia’s neighbors elsewhere in the Commonwealth of Independent States (CIS). As a supplement to this effort, the donor-supported installation of the AMDAS and customer information systems let the GoA know precisely where its problems were.

These technical improvements to the system, and the politically contentious task of tariff rebalancing, were completed well before privatization was attempted. This was not the case in some neighboring countries (or even elsewhere in the world), where the governments looked to the private operator to undertake tariff reform and significant levels of system investment.

The creation of a highly effective and competent regulatory body helped drive these early reforms. The AERC, from its creation in 1997, was deeply involved in the power sector reform process and widely regarded within the GoA as a trusted and knowledgeable advisor. The success of infrastructure regulators over the past decade, however, has been mixed, and implies that the existence of a regulator is often not enough to guarantee successful reform. The quality of regulation, determined in part by the degree of regulatory role, independence, expertise, and consistency clearly matters.

The AERC's effectiveness relative to its peers in neighboring countries may stem, in part, from the fact that it had several opponents during the early stages of reform, and therefore learned early on to defend its role and mission. The AERC's independence very likely derives from the makeup of its early leadership. The first commissioners were well-respected reformers from outside the line ministry (Ministry of Energy). Their advice and involvement was sought early on by the GoA and donor agencies.

The GoA, AERC, donors, and transaction advisors learned and incorporated a number of important lessons from the first failed tender for privatizing the distribution system. Care was taken to recognize buyer concerns with the initial tender package. Other changes included the consolidation of two distribution companies into a single asset, removal of prohibitions against cross ownership of distribution and generation, the offer of indemnity against contingent liabilities, registration of the assets of the EDC with the GoA to prevent asset stripping, and the inclusion of 110 kV substations—previously a source of considerable commercial losses beyond the EDC's control—as part of the tender.

Care was also taken to rectify weaknesses in the legal and regulatory framework. A government decree was passed, legally authorizing the EDC to disconnect customers defaulting on payment. A guarantee mechanism was put in place to ensure the bills of so-called VIP customers—mostly government agencies and state-owned enterprises afforded preferential treatment by the electric utility—would be paid directly from the Central Bank. As one of the more radical changes, the GoA changed the Law on Electricity Distribution Company (EDC) Privatization, dropping the requirement that the new owners commit to a fixed level of investment (US\$80 million). Instead the GoA resolved to put in place a set of explicit service quality standards against which the licensee's performance would be judged by the regulator.

The privatization effort regained momentum with a change in ministerial leadership of the privatization effort, from the Ministry of Energy to a non-line ministry, the Ministry of Justice. Though the Ministry of Energy was instrumental in the early years of power sector reform, its involvement in privatization process eventually came to be characterized by conflict of interest, political infighting, and obstruction.

Though the emergence of MRH as a potential buyer was initially met with skepticism from donors and transaction advisors, the GoA proved willing to consider a different kind of strategic investor. While eager to find a buyer, the GoA went to extensive lengths to conduct its own due diligence on MRH and impose additional safeguards to accommodate a little-known financial investor:

- To ensure MRH would have the technical ability to run a distribution company, the GoA initially required the company to hire a management contractor with power sector experience.

- To safeguard the EDC's cash flows, MRH was required to deposit all funds collected from customers in an account selected jointly with power generators as collateral against payments to generators. Generators were to be paid first on a monthly basis, before the EDC could make any other expenditures.
- To further guard against misuse of cash flows and prevent the possible stripping of assets, the EDC was prohibited from selling more than 25 percent of its shares without approval of the GoA and Public Services Regulatory Commission (PSRC).

The GoA's willingness to take the risk on MRH appears to have paid off. Neither the GoA nor MRH have backed down from commitments to disconnect nonpaying customers. Several GoA officials were shocked when MRH disconnected a number of prominent non-payers in early 2003. The list of organizations disconnected included the Ministry of Internal Affairs, a Russian military base, the mayor's office, Yerevan city government offices, and the Ministry of Energy. Furthermore, the GoA's ability to stay the course and learn from experience, despite changes in leadership and a difficult market, is testimony to the political will of those who led the process at different stages.

MRH's gamble has paid off as well. The company has made a profitable and well-run enterprise out of what other investors would not touch. All suppliers are now being paid in full and on time. The company has raised its employees' base salaries dramatically, begun paying salaries consistently on time, and paid off six months of salary arrears. An innovative compensation scheme lies at the heart of MRH's efforts to control nontechnical losses. The company has raised salaries of directors, engineers, and inspectors by five to tenfold and offers a significant variable component to its employees based on improvements in losses, collections, and repeat performance.

Sustained donor support was significant in driving and sustaining operational and financial reform of the utilities as well as broader institutional and legal reform in the sector. The pattern of donor support suggests an extended presence, and a staged approach may be more appropriate than a sudden rush to privatization. Donor representatives developed a tight relationship with their counterparts in the GoA and developed conditionalities only through extensive discussions. Though not all World Bank structural adjustment loan conditions were always met on time, most were indeed met, suggesting the importance of flexibility on timing but not on conditionality. The pattern of lending also suggests the need for a balanced mix of structural adjustment loans and sector-specific investment lending. Just as power sector reform is more effective if undertaken in conjunction with broader institutional and legal reforms, investment lending is similarly more effective if undertaken in conjunction with legal and regulatory reform.

Generalizing Armenia's Lessons for Other Reforms

Armenia's experience offers 12 lessons that may have relevance to other countries undertaking similar reforms:

1. *As a first and most important lesson, political will is paramount.* The best efforts of donors will ultimately prove ineffective if government officials have no interest in making the reforms stick.
2. *A corollary to the first lesson: personalities matter.* A successful reform process will be driven by influential champions within the government who enjoy broad respect and influence, and who are not perceived to have a vested interest in pushing the

reforms along a particular path. Both donors and governments can help enable these champions through early and substantive consultation on power sector reform.

3. *Distance control of the process from vested interests.* This means looking for reformers who have the right set of skills, a broad base of respect and credibility, but who do not come directly from entities within the sector itself.
4. *Enable the champions through early and substantive contact.* Donors can increase the stature of reform champions by including them in substantive discussions from the outset of the reform process. These champions may be found in regulatory commissions (as with the PSRC in Armenia) or in nonline ministries.
5. *Initial failure may be better than not trying at all.* The bidding documents and legal and regulatory framework benefited substantially in Armenia from the lessons of the first, failed tender.
6. *The more frequent and substantive communication between bidders and the owner, the better.* One of the advantages of the extensive interaction between the GoA and MRH was that both sides were able to assess the credentials and the intentions of the other. As a way of institutionalizing this, some governments have used a two-stage bidding process for tendering other private sector participation (PSP) contracts.
7. *In terms of actual implementation of reforms, an integrated, cross-sectoral approach is important.* The pace and benefits of power sector reform can be enhanced, for example, by also reforming major users in the water sector and other industries.
8. *A comprehensive approach also means consideration of the social impact of reform as an element separate from power sector reform.* Social protection mechanisms should be implemented in parallel, but not at the expense of the power sector reform program.
9. *It makes sense for the government to do as much improvement as possible in the sector before privatization.* The more a government can do up front, the better. A solid legal and regulatory framework cannot wait until after, or during, privatization, but needs to be in place well before hand to attract serious bidders.
10. *It is important for donors to provide the right mix of structural adjustment and investment financing.* One specific donor-funded effort offers an example that other countries may want to consider when undertaking power sector reform: meter relocation is cheaper, and often just as effective as installation of new meters. A great deal of progress can be made in tackling early the problems that are easiest and cheapest to solve.
11. *In contracting with a private operator, it makes sense to focus less on the level of investment an operator is willing to commit, and more on service quality or other outputs.* As with all types of PSP contracts, the government need only be worried about *inputs* if it is certain what *outputs* it wants to achieve.
12. *Governments and donors should consider adapting standard bidding requirements and procedures to accommodate a new kind of strategic investor.* Experience from Armenia and PSP in a number of other countries has shown that consortia of companies rather than large, international operators may make suitable bidders. Current donor-designed frameworks for privatization do not sufficiently accommodate such nontraditional strategic investors. Rather than force governments to go it alone with these investors in direct negotiations, a framework should be established through which such bidders can be included in an open tender process satisfactory to donors.

How Did It Happen? A Brief Overview of Power Sector Reform

The last 15 years have seen Armenia emerge from Soviet rule and a severe economic and energy crisis, both complicated by its newfound political surroundings. The last 10 years have seen significant reform and progress in the power sector which, when compared to the progress made by its neighbors, is all the more remarkable. The benefits of reform have not been easily won, however, and Armenia's success is a tribute to its ability to learn from mistakes and persevere. A combination of improper planning and bad fortune forced the Government of Armenia (GoA) to go through three separate tenders for its privatization assets. A combination of good planning and good fortune ultimately allowed for what has turned out to be one of the region's most successful infrastructure privatizations so far.

Why Reform was Necessary

In the wake of the Soviet Union's collapse, Armenia, like other former Soviet republics, began to struggle with the implications of its newfound independence. Independence brought with it abstract questions about national identity as well as more concrete—but often inseparable—questions about property rights, both between and within each of the republics. That is, when the central planner disappears, who controls what?

Armenia's electricity system had been developed as part of a much larger, Trans-Caucasus electrical grid and not as an independent system. Dispatch and planning decisions to serve load in Armenia were integrated with the much larger planning decisions of a regional system. Plants were built to run on fuel imported from thousands of miles away, from neighbors that, with the Soviet Union gone, could offer little certainty that such supply would continue or under terms that Armenia could afford.

Natural gas for thermal plants came exclusively from Russia and Iran through Azerbaijan. Nuclear fuel for the Medzamor plant came exclusively from Russia. Table 1.1 shows the current level of installed capacity in Armenia, which has remained unchanged since the country declared independence, except for roughly 30 MW new small hydropower capacity. From the perspective of national energy security, Armenia found itself in a very uncertain position.

Generation Type and Name	Capacity	Owner
Thermal	1756	
Hrazdan TPP	1100	Russian Federation
Yerevan TPP	550	Ministry of Energy, GoA
Vanadzor TPP	96	Zakneftgasstroy-Promethey
Hydropower	1032	
Sevan-Hrazdan cascade	556	RAO "Nordic"
Vorotan cascade	400	Ministry of Energy, GoA
Small HPPs	76	Various private owners
Nuclear	408	
Medzamor Unit 2	408	GoA (but under financial management of INTER RAO EES)
Total	3196	

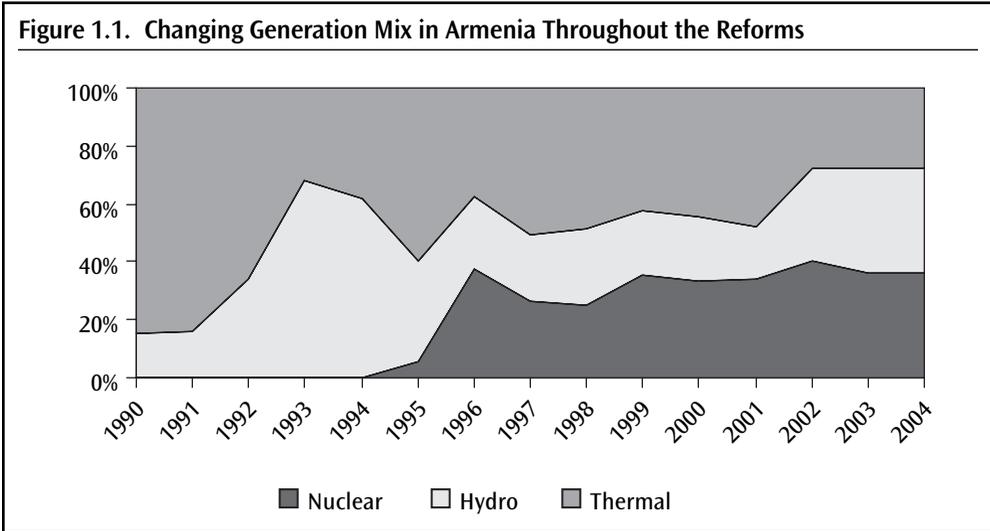
Note: TPP, thermal power plant; HPP, hydropower plants.

The delicacy of the country's energy balance began to manifest itself in 1992 with the start of the war over Nagorno Karabakh, and the resulting imposition by Azerbaijan and Turkey of an economic blockade. A massive 1988 earthquake had forced a shut down of Medzamor, a source of roughly one-third of Armenia's generating capacity. Without Medzamor, and without access to gas supply through Azerbaijan, Armenia was forced to rely heavily on domestic hydropower resources and imports of fuel oil through Georgia.

Though an alternative Georgian gas pipeline was completed in 1993, sabotage and separatist strife in that country regularly disrupted supply. Electricity service dwindled to two to four hours per day, and the entire system—generating stations, grid infrastructure, and users' equipment—began to suffer the effects of repeated, unpredictable outages and restarts.

Armenia's water resources also suffered as a result of increased reliance on hydropower generation. Output at the Sevan-Hrazdan hydropower unit was boosted in an effort to alleviate power shortages. Lake Sevan, Armenia's largest hydropower resource had been severely depleted by 1994. Lake Sevan is the largest lake in the Transcaucuses, one of the world's largest high altitude lakes, and is of tremendous cultural and symbolic significance to Armenia and to the Armenian people. The consequences of Lake Sevan's depletion goes far beyond its immediate economic value as a source of water for irrigation, drinking, and hydropower generation. Figure 1.1¹ shows the change in generation mix over the past 10 years.

1. This and much of the data used in this report have been taken from a dataset compiled for Lampietti, Julian A., ed. 2004. *Power's Promise: Electricity Reforms in Eastern Europe and Central Asia*. World Bank Working Paper No. 40. Washington, D.C.

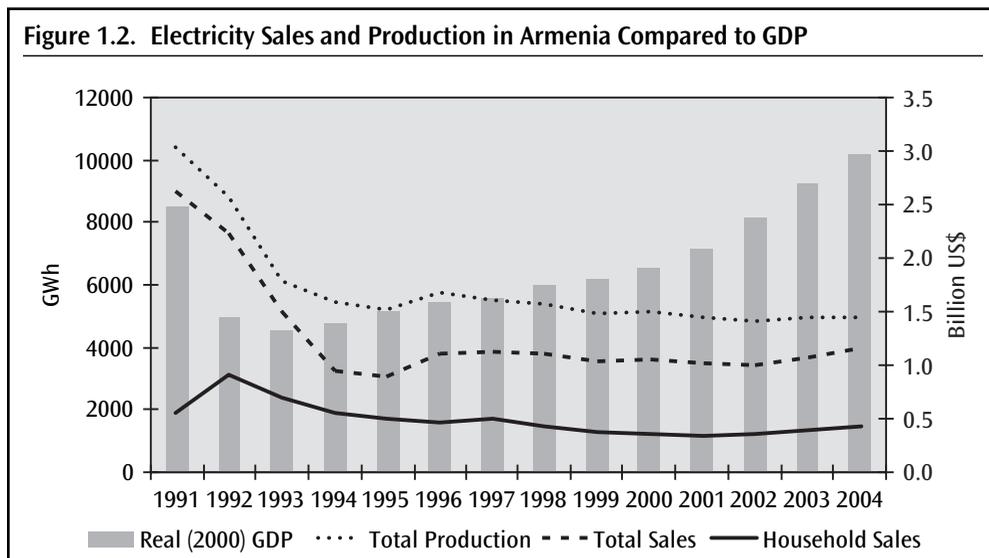


Source: Power's Promise Dataset.

Lingering Soviet energy policies served to worsen the effect of Armenia's supply constraints. Under the Soviet system, industrial and commercial customers subsidized consumption by lower voltage customers. Below-cost pricing encouraged electricity utilization at more than twice current levels. Average tariffs in 1992 and 1993 were roughly one-tenth of current average tariffs. Under the rationing system created during the energy crisis, many industries had electricity quotas far in excess of their needs, and simply resold the excess power at a higher price. As the Soviet Union's economic engine ground to a halt, this practice became increasingly common.

The industrial collapse that in many republics accompanied the fall of the Soviet Union was particularly severe in Armenia because of the economic blockade and energy crisis. Armenia's industries relied extensively on a range of imported raw materials, with energy significant among them. Between 1991 and 1994, electricity sales plummeted. Figure 1.2 shows how sales and production changed dramatically after independence. The gap between the total production and total sales represents total losses (commercial and technical); a gap that widens during the years of energy crisis and narrows gradually since the beginning of reforms. Gross domestic product (GDP) is also plotted in this figure (versus the right-most Y axis) to illustrate the relationship between the energy crisis and economic collapse.

The restart of Medzamor Unit 2 is sometimes credited as having ended the energy crisis, but 24-hour service had been restored several months before the restart. As Figure 1.2 shows, household sales changed very little during the energy crisis, and as Figure 1.1 shows, hydropower was run (albeit at the expense of Lake Sevan) to compensate for the loss of Medzamor. Medzamor's recommissioning in November 1995 was essential for guaranteeing Armenia's long-term energy security. The gas pipeline attacks halted when Medzamor restarted, as saboteurs perhaps realized the destruction was no longer as effective in disrupting Armenia's electricity supply. The protection of Lake Sevan also returned to the GoA's agenda. The GoA imposed strict new regulation on water use at Lake Sevan, limiting the Sevan-Hrazdan cascade's utilization of the lake's waters to the water available as a byproduct of seasonal irrigation.



Source: Power's Promise Dataset and (for GDP data) World Bank WDI database.

The end of the immediate energy crisis allowed the GoA to begin implementing a program of deeper energy sector reform. Fiscal and quasi-fiscal subsidies to the power sector had reached a level equivalent to roughly 11 percent of Armenia's GDP by 1995. Collections were barely above 50 percent, and nearly 25 percent of all power produced disappeared before the meter as commercial losses. The system remained dilapidated from years of crisis operation and underinvestment, and dependent upon massive public subsidies. Many within the GoA began to see no other solution but to restructure and consider some form of private management or ownership for its troubled power sector enterprises.

Steps Armenia Took Toward Reform

The GoA took early steps to impress upon Armenians the notion that electricity was a commodity, like any other good, and no longer an entitlement. Even before 24-hour service was restored, the GoA and donors took measures to establish in customers' minds a link between service quality and price. The utility began offering more continuous supply to apartment blocks whose residents could organize themselves to pay their bills. With industrial demand flagging, the residential customer base became the sector's primary source of revenues.

Efforts to combat commercial losses, begun during the energy crisis simply as a means of maintaining adequate supply, also took on increased importance after 1994. These efforts had to be redoubled once 24-hour service was restored, as continuous supply and higher tariffs created greater incentives for power theft. The Electricity Distribution Company (EDC) responded by hiring an army of inspectors to reduce illegal connections. In a twist of irony, these inspectors later proved to be the source of significant collections problems, colluding with customers to keep payments below metered values. These problems eventually forced the EDC to develop, in 1999, a new collections scheme that required payment of bills at post offices rather than cash payments to local EDC offices.

The GoA's institutional and regulatory changes largely followed conventional prescriptions for power sector reform. At the core of the reform program were: (a) a gradual transition to cost-based tariffs; (b) unbundling of part of the state-owned, vertically integrated utility; and (c) imposition of a new regulatory framework. The transition to cost-based tariffs had begun in late 1994, when household tariffs were first raised to the level of other retail tariffs, and a schedule was established for further household tariff hikes. Household tariffs were raised to the level of average industrial and commercial tariffs in 1994, and since 1999 have remained well above the overall average tariff.

The unbundling process began in March 1995 with the creation, from the state-owned, vertically integrated Armenergo, of separate generation and distribution entities. Regulatory reform was launched by Presidential Order in March 1997, and supported by the Energy Law that formalized the separation of generation, distribution, transmission, and dispatch into separate companies and established an independent sector regulator, the Armenian Energy Regulatory Commission (AERC).

The institutional and regulatory reforms were coupled with an ambitious metering and meter relocation program, installation of an Automated Metering and Data Acquisition System (AMDAS), and creation of a computerized customer billing system. Twelve thousand new tamper-proof meters were also installed throughout the power system between 1997 and 1998, at a variety of voltage levels down to 0.4 kV. Existing household customer meters were relocated from individual apartments to public areas of apartment blocks. This effort contributed substantially to the reduction of meter tampering, and the facilitation of accurate meter reading. The AMDAS system, completed in 2001, relied on newly installed automated digital meters at the 110 kV level and above, connected by telephone lines to a centralized settlement center. A complete customer information system was also put in place at the EDC to more accurately track utilization and billing.

The first attempt to privatize the low-voltage network suffered from a mix of insufficient preparation and obstruction from vested interests. The GoA passed a Law on Privatization in 1997, defining the power sector companies and assets to be privatized. Privatization of 25 small hydropower plants took place gradually between 1997 and 2002. Privatization of the distribution system—then grouped as four regional entities—would not prove to be quite as easy. The GoA first hired a transaction advisor in December 1998. Prequalification documents for the first tender were issued in late 1999, and by early 2000 had attracted five major international energy companies as bidders. Four of those companies successfully prequalified, but none ultimately submitted offers by the April 2001 deadline.

The tender documents and legal framework had substantial flaws, and leadership of the process remained under the Ministry of Energy, the same entity that controlled and was still tightly integrated in the operations of Armenergo. Privatization met considerable resistance from within the very ministry that was meant to spearhead the process. Many politicians connected to the sector, whether formally or informally, also fiercely resisted giving up control of what was one of the most politically powerful and potentially lucrative segments of the energy sector.

The GoA responded by rectifying flaws in the bidding documents and the legal framework and by shifting responsibility for privatization away from the line ministry. The GoA revised the Energy Law in April 2001 (See Box 1.1), and appointed new transaction advisors (International Finance Corporation [IFC] Private Sector Advisory Services) and new legal advisors. Political obstruction of the privatization process slackened as responsibility for the

Box 1.1. Refinements to the Legal Framework

The Energy Law was revised in April 2001 to reduce the potential for government interference in sector operations. In particular, the government was forbidden from appropriating any revenues from the sector (to direct to one entity or another) if collections were less than 100 percent. The revised Law on EDC Privatization was passed in August 2001. Among its more important changes, the law:

- ◆ Removed any requirement that bidders commit to a fixed amount of investment amount,
- ◆ Relaxed certain provisions on losses,
- ◆ Allowed bidders to bid on both distribution companies and not just one, and
- ◆ Limited the risk of bidders of contingent liabilities of the distribution entities.

tender shifted to the Ministry of Justice, a ministry under new, progressive leadership. By autumn 2001, the GoA was ready to launch its second tender.

By the time of the second tender, however, the bidders had world events on their minds. A “perfect storm” was buffeting financial markets, and the power sector in particular: the September 11 terrorist attacks on the World Trade Center, Enron’s collapse in October/November 2001, and the litigation and investigations into the causes of the California electricity crisis (See Box 1.2). Had the climate for international power sector investment been different in October 2001, Armenia’s second attempt to privatize may indeed have succeeded. By late 2001, the GoA had resigned itself to finding a management contractor instead of an owner for the EDC. In early 2002, however, a little-known company stepped forward to express interest.

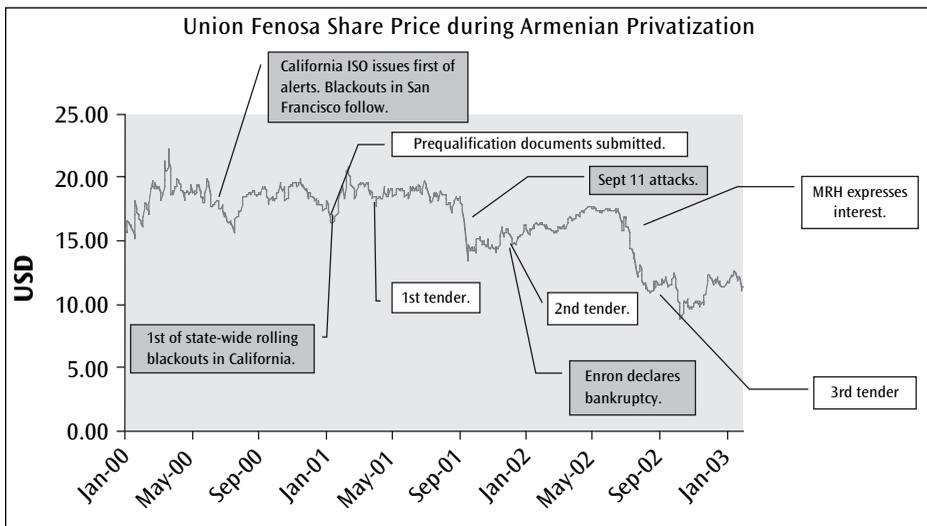
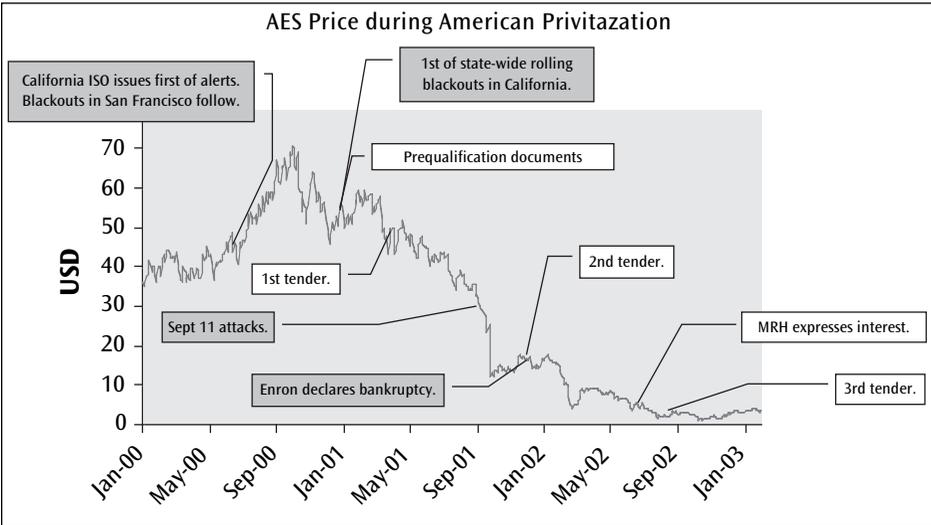
The offer from a new bidder, Midland Resources Holding (MRH), at first received a cautious welcome. MRH failed to fit the mould of strategic investor originally envisioned by the GoA, its donors, and transaction advisors (a profile of MRH is included in Box 1.3). The original tender documents were drafted to accommodate bids from an international energy company, with previous experience operating distribution networks. MRH was a purely financial investor, with no experience in any segment of electricity operations.² MRH’s status as an off-shore company (registered in U.K.’s Guernsey) was also cause for concern. The company’s exemption from external financial, accounting, and corporate governance regulations carried reputational baggage as well as practical implications for evaluating compliance with the requirements of the tender documents. Though the tender documents prepared by the IFC’s Private Sector Advisory Services were used for the transaction with MRH, these advisors ultimately distanced themselves from the deal.

MRH assumed control of the EDC in autumn 2002, and ownership transfer of several major generating plants followed soon after. Ownership of the Hrazdan thermal power plant, the Sevan-Hrazdan hydropower cascade, and financial control of Medzamor, were swapped during 2002–03 against US\$96 million in state debt forgiveness: The Hrazdan thermal power plant was swapped to a company owned by the Russian government for US\$31 million; the Sevan-Hrazdan cascade was swapped to RAO Nordic (a subsidiary company of RAO United

2. Although MRH had, at one point in the mid-1990s, owned part of a regional energy distributor in the Ukraine in connection with its ownership of the Ukrainian steel plant Zaporizhstal.

Box 1.2. Armenia Launches its Second Tender Amid the Perfect Storm

Few companies had a taste for overseas electricity investments during autumn 2001, and in December no bids were received. The California Electricity Crisis, 9/11, and Enron took their toll on international energy companies' balance sheets as well as their appetites for risk. The following charts show the equity prices of two prequalified bidders, AES and Union Fenosa, relative to these events, and the timing of Armenia's various attempts to privatize its distribution network.



Source: Equity price data taken from Yahoo Finance (whose provider is Commodity Systems, Inc.).

Box 1.3. Profile of Midland Resources Holding

Midland Resources Holding is part of the Midland Group, a privately owned company registered in Guernsey in the UK's Channel Islands. MRH describes itself as "a trading and investment organization . . .," with "interests in a broad range of industries including steel, shipping, construction and real estate, energy distribution, and agriculture." MRH has its roots in steel trading, having set up shop in Ukraine in the early years after independence, and eventually acquiring ownership in Zaporizhstal, one of Ukraine's largest steel mills. MRH now owns the Red October Steel Mill in Volgograd, Russia, recently listed in *Forbes* as one of Russia's 200 largest privately held companies. Midland Group companies have also held ownership of a Ukrainian scrap metal processor and linen manufacturer.

Some of MRH's recent, more visible acquisitions include the purchase of the Jordan Formula 1 team, and a majority equity stake in the new Trump International Hotel and Tower in Toronto, planned to be Canada's tallest building.

For more information see www.midland.gg and Brown, Heidi, and Nathan Vardi. 2005. "Man of Steel." *Forbes*, March 28.

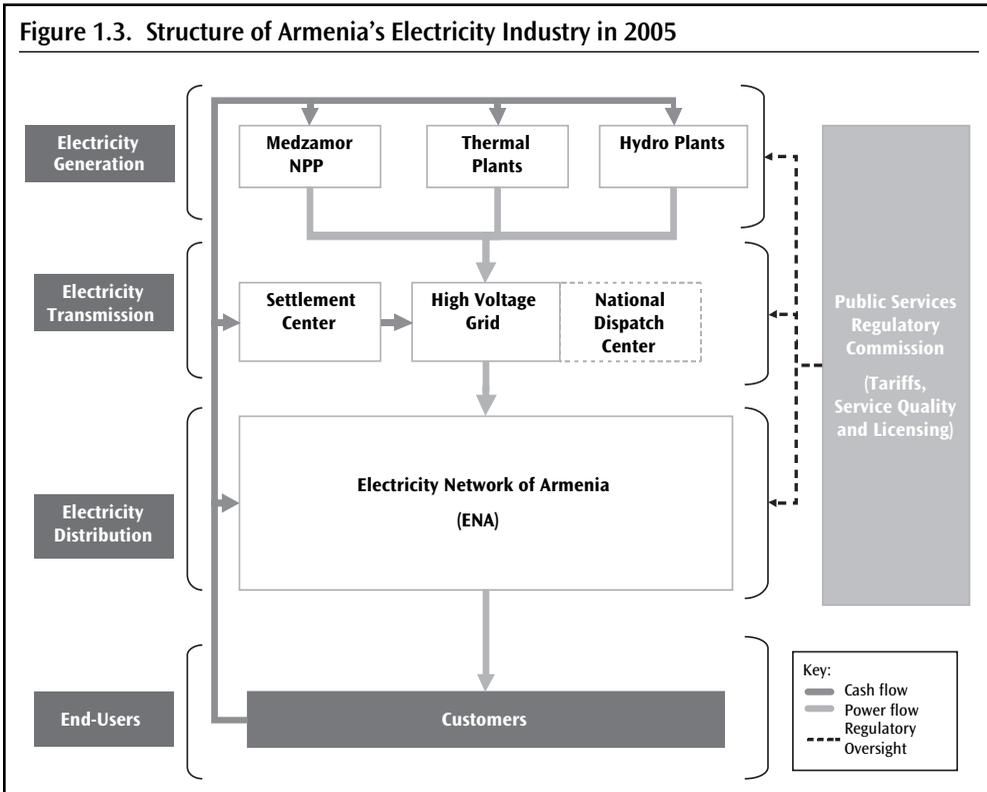
Electricity Network of Russia) for US\$25 million; and financial management of Medzamor was given to another RAO subsidiary, Inter-RAO EES, in exchange for US\$40 million in debt for nuclear fuel. Under this arrangement, Inter-RAO must approve all of Medzamor's financial transactions, and has the right to recover their full cost of delivered nuclear fuel, but receives no other compensation.

What Reform Has Achieved

The picture of the power sector in 2005 is very different than 10 years earlier. Armenergo, the state-owned, vertically integrated utility no longer exists. In its place are separate transmission, dispatch, and settlements companies tasked with delivering power from diversely owned generating facilities to a single, privately owned distribution entity now called Electricity Network of Armenia (ENA). Figure 1.3 shows the current structure of Armenia's power sector.

Collections are at nearly 100 percent of sales, and only 4 percent of what should be delivered to customers become commercial losses. Tariffs are set by a regulator with eight years of regulatory experience and are—despite some ongoing debate between the regulator and its licensees—generally regarded as near medium-term cost recovery levels (that is, recovering short-term cost of service, depreciation, and at least some level of new investment). Twenty-four hour service has been maintained since 1995 throughout the country. Some problems with voltage fluctuations persist, but the distribution company has measures in place for reimbursing customers for appliances damaged by supply interruptions or irregularities. Rural areas also continue to experience more frequent outages owing to the poor physical condition of poles and lines, but the ENA's investment program now includes replacement of poles and lines in these areas.

The reform has achieved the objective of unburdening the GoA of fiscal and quasi-fiscal support to the power sector. Armenia clearly did not undertake privatization for privatization's sake. The GoA was backed into a corner by the cumulative effect of commercial losses,



below-cost tariffs, and poor collections. The annual fiscal deficit attributable to the power sector peaked in 1995, at US\$141 million, and has steadily decreased since. The economic welfare benefits of power sector reform, and the longer-term financial benefits, have been even greater, and are addressed in more detail in Chapter 2.

Despite initial misgivings about MRH, the results of distribution privatization have not been disappointing. Many involved in the privatization process, including its opponents, recognize that the distribution network has fared much better than expected under MRH. Very few changes to the tender documents were ultimately made to accommodate MRH’s bid. Those made were to compensate for certain financial weaknesses in MRH’s bid and its lack of sector-specific experience. The company began fulfilling its obligations almost immediately upon taking control in October 2002. Total collections increased from 81 percent of total sales in 2001 to close to 100 percent by end-2004. Commercial losses decreased from 12 percent to 4 percent of total production during the same period. MRH turned the distribution company into a profitable enterprise, for which it received at least two purchase offers during 2004.³

The introduction of private sector participation (PSP) in small hydropower generation has also shown promising results. Private investment has flown readily into small hydropower generation. In addition to the 25 hydropower plants privatized, the AERC (now

3. As indicated in the postscript to this paper, MRH eventually sold its equity in ENA for more than seven times the initial purchase price.

called the Public Services Regulatory Commission [PSRC] as its powers were extended to cover the water and telecommunications sectors in 2003) has granted 6 new construction licenses for privately owned small hydropower plants (HPPs), and another 11 are currently under construction. Small HPPs, most of which had large unpaid receivables with Armen-ergo, are now guaranteed payment in full for all of the power they generate. Whereas most of the new small HPPs were developed by domestic investors with borrowed capital, Armenian Diaspora have been showing increasing interest in these plants, often investing without guarantees offered by the GoA for investments in renewable energy. The European Bank for Reconstruction and Development (EBRD) also recently waived the GoA guarantee in agreeing to invest 1.1 million Euro in a new mini-hydropower plant to be built along the Yeghegis River.

Domestic and foreign interest in larger-scale energy infrastructure has also increased. Armenia's gas supply network has expanded rapidly since the beginning of power sector reform. Iran and Armenia are currently building a major gas pipeline linking the two countries, with Iran financing the cost of completing the Armenian portion, in return for future electricity supply. Armenia commissioned a 2.6 MW wind plant in its northern Lori region in December 2005, built with the assistance of a US\$3.5 million loan from Iran. Iran has also agreed to invest US\$150 million to completing a fifth unit of the Hrazdan thermal power plant (TPP), and will provide financing for a major new hydropower plant at Megri. The Japan Bank for International Cooperation has extended a US\$150 million loan to build a new combined cycle plan in Yerevan to generate power at a cost of roughly US\$.02/kWh, roughly half the cost of the Hrazdan TPP. A private sector U.S. firm, ESI, is also currently building a 5 MW hydropower facility, Jradzor, in the Shirak region.

Though the large generators were not subject to an orthodox privatization process, simply putting different owners in charge seems to have made a difference. Before its transfer to Russia's Unified Energy Systems' (RAO UES) subsidiary, International Energy Company CJSC, the Sevan-Hrazdan hydropower plant received payment for only 20–30 percent of the electricity it generated, leaving enough cash after operation and maintenance for only 5–10 percent of necessary maintenance and 5–6 percent of total arrears in salaries. Despite the high collections and low commercial losses achieved by the distribution company, the state-owned single buyer, Armenergo, remained a bottleneck for payments to generators until its dissolution in December 2004. The International Energy Company, upon taking ownership of Sevan-Hrazdan, financed the company's cash shortfall. Between the third quarter 2003 and third quarter 2004, salaries were raised by 20–30 percent, electricity generation increased by 15 percent, all debts and wage arrears were paid down, all maintenance needs were addressed (repair and operations expenditures doubled), and the company was able to start making some new investments and renovations. Even Medzamor's performance has reportedly improved. In 2004 the plant produced a record volume of electricity (2 million GWh), balanced its books for the first time since its 1995 restart, and avoided the refueling delays that had plagued its operations in years past.⁴

4. "Russian Utility 'Rescued Armenian Nuclear Plan.'" 2005. Radio Free Europe/Radio Liberty. March 16.

Was It Worth It? The Economic and Fiscal Outcomes of Armenia's Power Sector Reforms

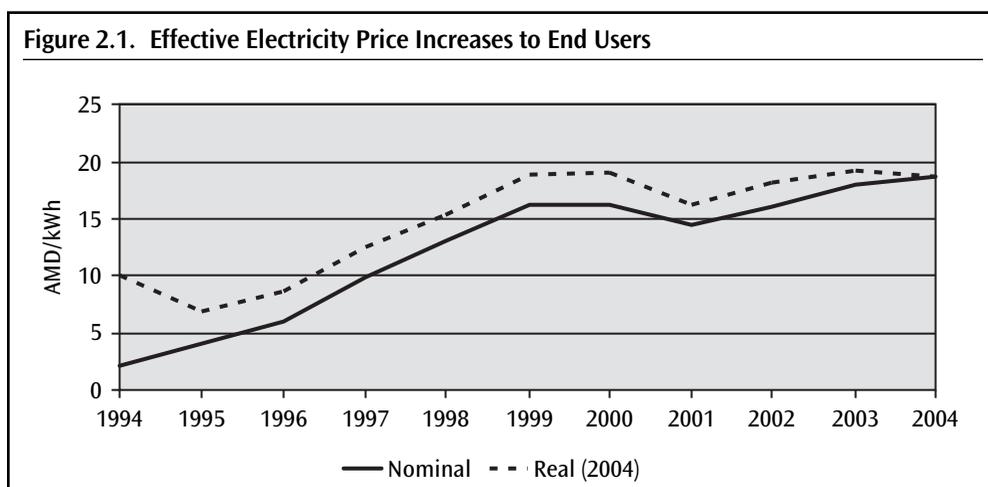
The benefits of power sector reform in Armenia are unambiguous. Aggressive efforts to improve collections and curtail commercial losses have meant consumers *pay for more of the volume* of electricity they use. A movement toward full cost-of-service tariffs has meant consumers *pay more for each unit* of electricity they use. Consumption has accordingly declined, though sales have increased, suggesting that at least some of the power previously stolen is now metered and paid for.

The single largest benefit of the power sector reform has been the removal of the GoA's obligation to provide financial support for power sector operations. Annual fiscal support to the sector in 1995, through explicit and implicit subsidization, represented as much as 11 percent of Armenia's GDP. The long-term value of this fiscal subsidy alone is worth well over US\$1 billion. Other gains can be found in the so-called deadweight loss recovered as a result of the reforms. Changes in the electricity price have forced industries and end-users to use energy more efficiently, curtail inefficient use, and switch to lower-cost fuels. At least some of the benefit of deadweight loss recovery may be offset, however, by some consumers having been forced to curtail consumption or switch fuels at the expense of their health and the health of their environment.

Economic Benefits

The most immediate and noticeable effect of the reforms was an increase in the average effective price of electricity paid by consumers. The average effective price of electricity paid by

customers in 1995 was much lower than the regulated tariff.⁵ Regulated tariffs fail to reflect the fact that much of the power produced was being consumed for free, given the low levels of collection, high commercial losses, and tariffs that failed to reflect underlying supply costs. At the core of the reform process were three initiatives: (a) bringing tariffs to levels reflective of actual cost of service, (b) reducing commercial losses, and (c) improving collections. All of these measures have the effect of raising the effective price of electricity faced by end-users. Figure 2.1 shows the increase in the effective price of electricity paid by end users.



Source: Power's Promise Dataset and (for CPI data) WDI database.

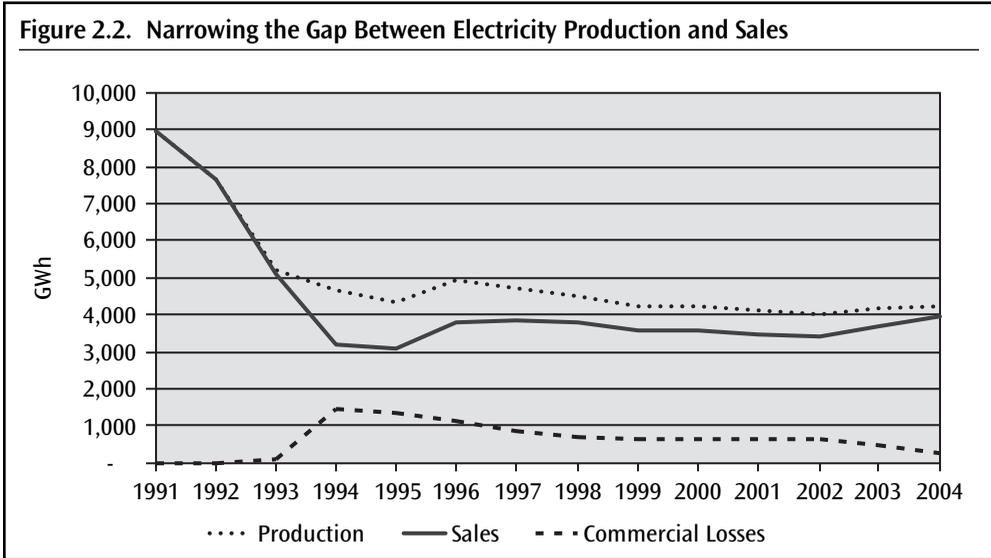
The effective price increase has been accompanied by a decrease in electricity production since 1994, but an increase in sales (see Figure 2.2). Sales figures reflect metered consumption only, and fail to reflect electricity stolen before the meter. As the reforms took hold, some customers stealing electricity began to pay for it, while others decided that legal consumption at the regulated price (or its alternative, the cost of theft) was simply too expensive, and cut their usage.⁶ The net effect was an increase in sales, as some of the consumption formerly stolen became metered sales, and a decrease in production, as some of the electricity formerly stolen is simply no longer desired if it cannot be taken for free.⁷ Figure 2.2 shows this trend in Armenia, with a slight narrowing in the gap between metered sales and production of electricity since 1995 and a return to pre-1993 levels of commercial losses.⁸ As would be expected, the amount of "paid-for" power demanded by the customer has decreased as the effective price of that power has increased.

5. Throughout this paper, the term *effective price* refers to the average currency amount per kWh actually paid for electricity and collected by the utility (as opposed to the regulated tariff). The effective price is the same as the average actual revenue per customer and is different from the regulated tariff because of a combination of theft and low collections.

6. This is an oversimplification. In reality, customers who formerly stole power would likely reduce their usage overall, but more of their total consumption would become metered sales.

7. Losses were not likely zero, as the figure suggests, between 1991 and 1993, but little reliable data exist on actual losses during these years.

8. Production shown in this figure is taken as net of actual technical losses, which vary between 14 and 18 percent.



Source: Power's Promise Dataset.

By using these observations, the potential benefits to the economy of reforming the power sector can be illustrated within a standard microeconomic framework. The change in welfare from power sector reform can be expressed in terms of: (a) fiscal subsidy to the power sector and (b) deadweight loss. Removing the fiscal subsidy means the GoA pays less and customers pay more for the cost of running and maintaining the electricity network. This represents a welfare transfer from customers to the GoA. Deadweight loss, in contrast, represents inefficient utilization of resources within the economy. Removing this deadweight loss frees up resources for more efficient use elsewhere. By using a partial equilibrium model, the total welfare change as a result of power sector reform can be estimated at US\$121 million, or roughly 10 percent of Armenia's GDP in 1995. The deadweight loss avoided by power sector reform can be estimated at US\$18 million, roughly 1 percent of Armenia's 1995 GDP. The removal of the fiscal deficit attributable to power sector reform (the transfer in welfare from consumers to the GoA) is US\$102 million (roughly 8 percent of Armenia's 1995 GDP). The details of this analysis are included in Appendix A.

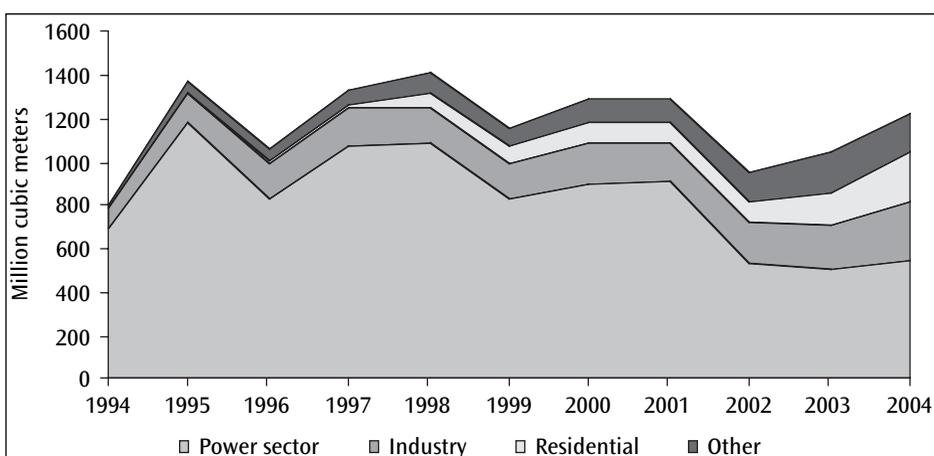
The overall welfare change attributable to power sector reform depends on the magnitude of the effective price change (in the case of power sector reform, a price increase) and the price elasticity of demand for electricity. Faced with higher effective electricity prices customers: (a) substituted the use of cheaper fuels, such as natural gas; (b) simply consumed less than they once did for a given purpose (an increase in energy efficiency or productivity); or (c) went without or found other strategies for coping. Economists view all of these as economically efficient outcomes and as beneficial to overall economic welfare, so long as the price of substitute fuels reflects their actual scarcity value and curtailing electricity use or "going without" does not have negative health or other welfare effects.⁹ This has not entirely been the case in Armenia, and support from the state may not have been sufficient to cushion the impact of power sector reform on the country's poor.

9. Violation of either of these conditions would qualify as an externality.

Box 2.1. Expansion of the Gas Network and Gas Consumption in Armenia

Armrusgasprom, the Armenian-Russian joint stock company in charge of gas transmission and distribution, has made extensive investments in the gas network, gradually restoring Armenia to the high levels of gasification it enjoyed until the various supply and economic crises that followed independence. The number of customers receiving gas service has increased tenfold since 1997. Residential service has seen the largest growth, with consumption increasing nearly sixtyfold since 1995. The table below shows the increase in consumers serviced by the gas network since 1997 and the figure shows gas consumption by customers during that time period. Though overall consumption has remained relatively constant, the figures show that the power sector's consumption of natural gas has decreased considerably and has been replaced by demand from residential, industrial and other users.

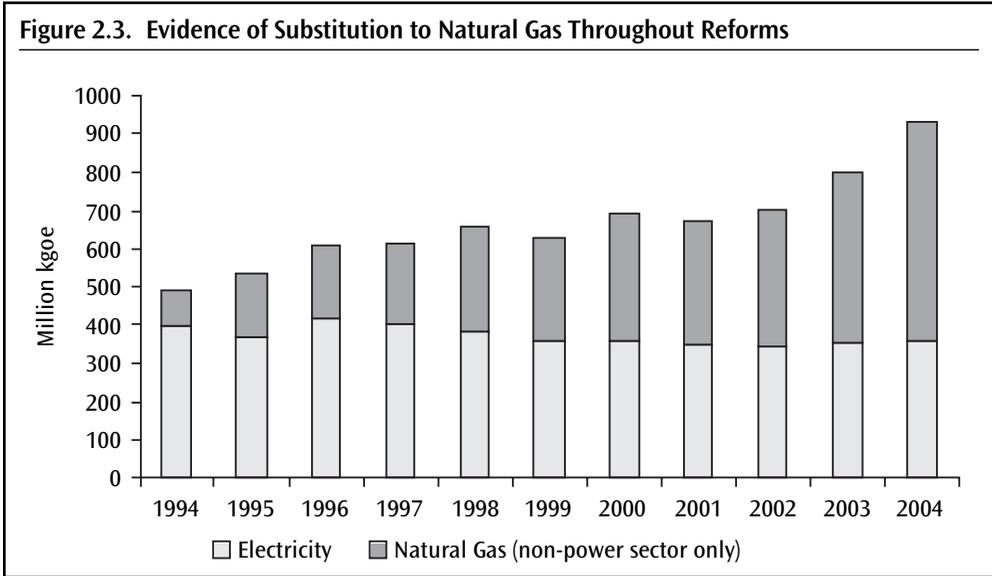
	1997	1998	1999	2000	2001	2002	2003	2004
New customers	28,480	40,734	19,719	12,070	11,466	19,744	54,531	63,391
Total customers	28,480	69,214	88,933	101,003	112,469	132,213	186,744	250,135



Source: Ministry of Energy.

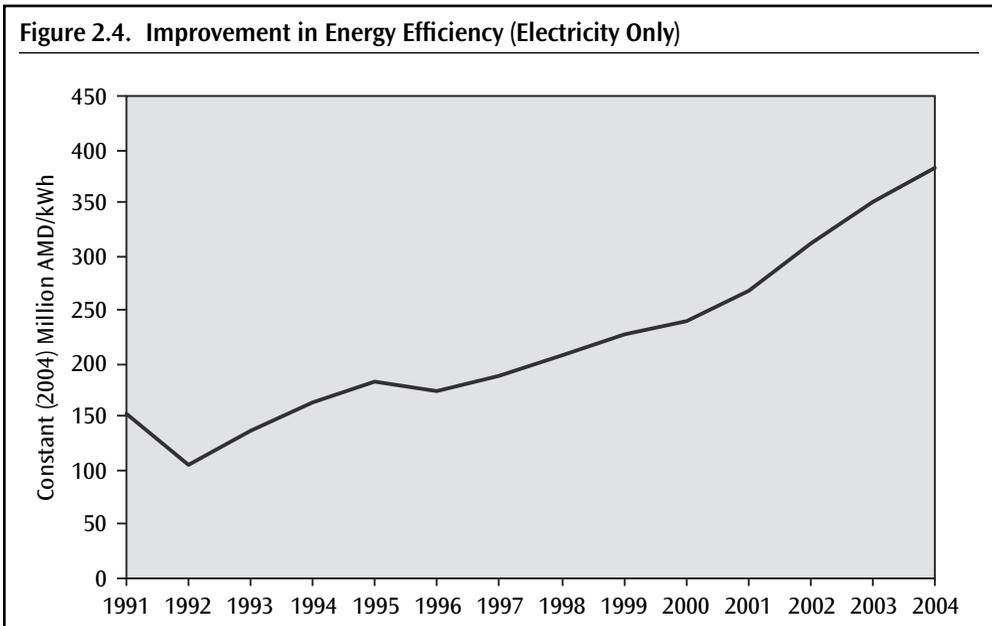
There is evidence of some efficient substitution and coping in Armenia. Armenia's water utilities, for example, faced by higher effective electricity prices, have invested heavily in upgrading inefficient electrical pumping systems or switched to gravity-fed systems where pumps were unnecessary.¹⁰ Many bakeries, then notorious as an industry in Armenia for using electricity without paying, switched to baking with lower cost (and more efficient) gas as efforts to curtail commercial losses were imposed and power prices increased. When compared in terms of kilograms of oil equivalent (kgoe), total energy consumption in Armenia increased by 37 percent between 1995 and 2002, but electricity consumption has declined slightly. Consumption of natural gas (for purposes other than electricity generation), in contrast, nearly doubled (see Box 2.1). Figure 2.3 shows how natural gas usage gradually replaced electricity as a supplier of energy in Armenia between 1994 and 2001. Expansion of the natural gas network would not have been possible (at least not on commercial terms) were it not for the power sector reforms.

10. The use of pumps where gravity would suffice is a fairly common characteristic of water supply systems in countries of the former Soviet Union.

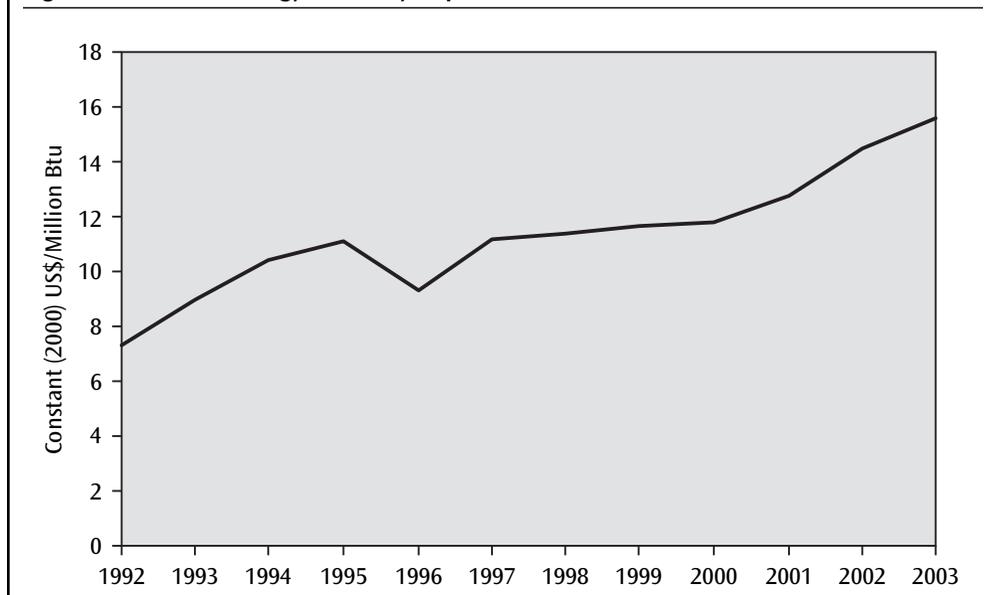


Source: Ministry of Energy.

Aggregate ratios also show greater energy efficiency during the period of power sector reforms. The ratio of kWh/GDP is commonly accepted as a measurement of an economy’s energy intensity, and the reciprocal of energy intensity, GDP/kWh, as a measure of energy efficiency. Measured in terms of electricity production, energy efficiency has clearly increased during the reform period (and intensity has decreased). This is shown in Figure 2.4. Armenia’s overall energy efficiency has also increased (intensity has decreased) during the period of reforms. This is shown in Figure 2.5. It is worth remembering, however, that an



Source: Power’s Promise Dataset and (for GDP data) WDI database.

Figure 2.5. Overall Energy Efficiency Improvement in Armenia

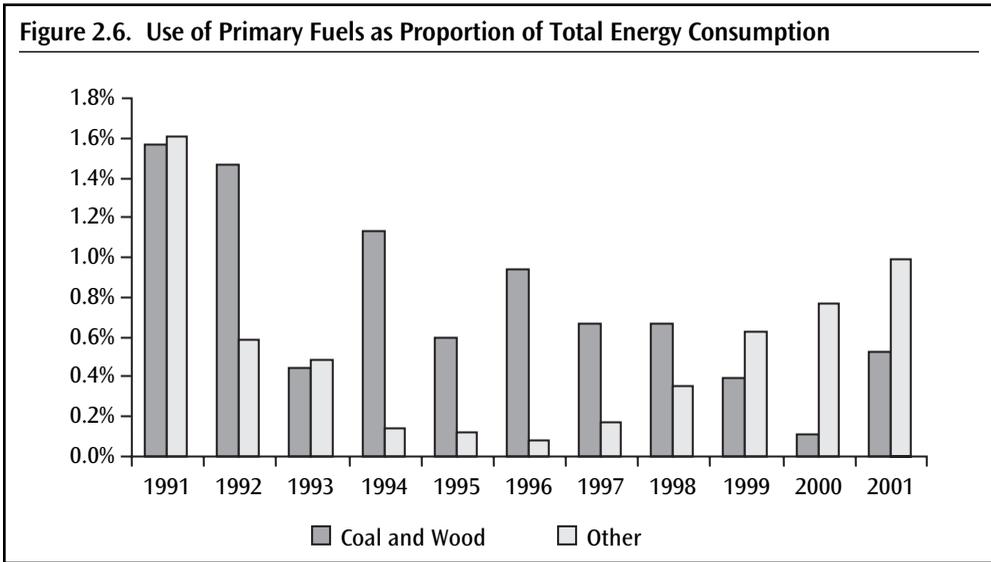
Source: U.S. Department of Energy, Energy Information Administration, *International Energy Annual 2003*.

increase in energy efficiency is the same as a decrease in energy intensity. Treating temporal changes in this ratio as an increase or decrease in the energy efficiency of an entire economy requires some assumptions about causality; that is, that any increase in the level of GDP relative to energy consumed is due to an improvement in energy efficiency and not other factors.¹¹

Existing Externalities and Other Social Costs or Benefits

There is evidence of some substitution and coping that cannot be captured in a partial equilibrium model. Figure 2.6 shows the increasing representation of coal, wood, and other fuels, such as liquid petroleum gas or bituminous coal, in Armenia's overall energy usage. Externalities are costs or benefits (external diseconomies or economies) of transactions that affect third parties (that is, parties outside the market for electricity), because the true costs of production (or in some cases consumption) are not easily discoverable and are therefore not included in supply or demand curves. A study of the costs and benefits of power sector reform is incomplete without some consideration, at least in qualitative terms, of the effects of externalities.

11. This is part of a larger debate that we will not attempt to resolve here, nor will we attempt to prove here that improvements in energy efficiency have concrete benefits for GDP (that is, whether greater energy efficiency mean greater productivity). It would of course be quite another task to justify GDP as a relevant indicator of economic welfare, the subject of ongoing debate.



Source: Ministry of Energy.

Changes in the generation mix can reduce adverse effects of electricity generation on health and human environment, depending on the generating fuels or technologies utilized. In Armenia, changes in the generation mix have meant increased reliance on Medzamor and reduced reliance on thermal and hydropower generation. Utilization of hydropower or thermal resources both have potential diseconomies associated with them: (a) running hydropower plants requires diversion of waterways and depletion of Lake Sevan, environmental costs not currently included in the price to end-users, and (b) running thermal plants increases emissions and has consequent health and environmental effects.

The power sector reforms can be credited for the restart and continued operation of Medzamor Unit 2.¹² Without some mechanism in place to ensure that Medzamor receives payment for its output, is able to continue maintenance and upkeep, and without a mechanism to further ensure that Inter-RAO UES receives payment for its fuel, the plant would not have been able to continue operations without GoA subsidies.

Available data on carbon dioxide emissions for Armenia (1992–2000 only) show mixed results that are of course influenced by changes in the many other CO₂ sources and sinks: per capita emissions have increased, but total emissions, and emissions per unit GDP, have all decreased.¹³

There are likely to be significant positive externalities associated with the diminished reliance on Lake Sevan. Armenia's reliance on hydropower power during the 1992–94 energy crisis nearly exhausted Lake Sevan, which beyond its economic uses for Armenians is regarded as a national treasure of significant symbolic (and recreational) importance. A

12. Though running an old water cooled, water-moderated energy nuclear reactor in an area with high seismic activity has safety risks not included (in terms of probability of an accident) in the dispatch price, the incremental utilization of Medzamor (running the plant more or less) is not likely to have any externalities associated with it, provided utilization is within the plant's safe operating limits.

13. World Bank World Development Indicators (WDI) database.

2004 willingness-to-pay study used several different methodologies to assess the value to Armenians of the water level in Lake Sevan.¹⁴ Roughly half the respondents said they would pay a positive monthly sum, over a period of three years, to maintain the water level in the lake.¹⁵ The average sum offered under this willingness-to-pay methodology was 201 AMD per month. Assuming half of Armenia's households would indeed be willing to pay such a sum over the course of three years, the value of maintaining Lake Sevan can be estimated at US\$4.6 million (at 2003 average exchange rates). Higher average sums, it should be noted, were offered to raise the level of the lake 3 meters. Considering Lake Sevan dropped nearly 18 meters in the 60 years of Soviet occupation between 1930 and 1990, the value to resident Armenians of restoring the level of the lake appears significant.

A contribution to the same cause by Armenian Diaspora raises this value considerably. The country's estimated 3–6 million Diaspora represent a major source of foreign direct investment in the country. A follow-up willingness-to-pay study of Armenian Diaspora by the same authors showed Diaspora households willing to contribute a one-time payment of between US\$81 and US\$281 toward preservation of Lake Sevan. The study postulated that, "if each [household of Armenian Diaspora] were willing to provide a one-time donation equivalent to the average willingness-to-pay estimated in this paper, this would represent between 31 and 108 million dollars."¹⁶

Externalities do not encompass all of the effects of power sector reform. A number of other phenomena can affect demand for electricity, though these are not, strictly speaking, externalities of the electricity market but externalities of markets for electricity's substitutes.¹⁷ These include health and environmental effects of substitution by end-users of apparently lower cost fuels. The true welfare cost of utilizing these fuels is not reflected in their market prices, thereby implying more price elasticity of demand for electricity than is efficient. This includes health effects, or other less tangible quality of life implications resulting from changes in energy consumption patterns or coping strategies. More expensive electricity consumption has meant significant switching to solid fuels (wood, trash, or dung) for heating and cooking, which has very significant detrimental health and environmental effects.

Tariff increases have caused customers to switch to cheaper, often dirtier fuel sources, with costly effects on human health. A 2001 World Bank study assessed the impact of the 1999 household/residential tariff increase in Armenia on various rural and urban income groups.¹⁸ Eighty percent of households surveyed said they had substituted away from electricity, 60 percent substituting wood fuel for electricity, and only 24 percent substituting nat-

14. Wang, Hua, Benoit Laplante, Xun Wu, and Craig Meisner. 2004. "Estimating Willingness-to-Pay with Random Valuation Models: An Application to Lake Sevan, Armenia." Policy Research Working Paper 3367, World Bank, Washington, D.C.

15. For this calculation we use as our value the mean response to the open-ended, personal interview survey approach's question, "What is the most your household would be willing to pay per month for three years to stabilize and prevent a further lowering of the lake?" This same methodology, administered by mail, showed respondents willing to pay, on average, more than twice the mean indicated through personal interviews.

16. Wang, Hua, Benoit Laplante, Xun Wu, and Craig Meisner. 2005. "Environment as Cultural Heritage: The Armenian Diaspora's Willingness-to-Pay to Protect Armenia's Lake Sevan." Policy Research Working Paper 3520, World Bank, Washington, D.C.

17. Whereas this distinction may seem more pedantic than helpful, it has important policy implications. Though not the case in Armenia, the answer to many of these externalities is not to delay power sector reform but to liberalize the prices of competing fuels.

18. Lampietti, Julian A., Anthony Kolb, Sumila Guliyani, and Vahram Avanesyan. 2001. *Utility Pricing and the Poor: Lessons from Armenia*. World Bank Technical Paper No. 497. Washington, DC.

ural gas. A more recent household survey found that 46 percent of the urban population relies on wood and 27 percent on electricity for heating purposes, and that many poor households do not heat at all. The use of wood for indoor cooking and heating has well-known health consequences that disproportionately affect women and children. A 2002 study conducted as part of the World Bank's urban heating strategy development in Armenia found the cost of ill-health to women and children under age five as a result of indoor urban smoke exposure to be "in the region of US\$3.21 million per year."¹⁹ Households surveyed were exposed to an average level of particulate matter 2.5 particles of 210 micrograms/m³, a level significantly above the international safety standard of 65 micrograms/m³. Fuel switching also brings with it more immediate safety issues, all of which have costs. Reports of emergencies related to equipment misuse (explosions, carbon monoxide poisonings, or fires) nearly doubled between 2003 and 2004 in Armenia's cities.²⁰

Use of fuel wood for heating also has broader environmental consequences. Illegal logging by communities for subsistence purposes has been estimated to be at least 568,000 solid m³ per year, and by commercial operators (for sale in urban areas) at 150,000 solid m³.²¹ Concrete data are lacking on the trend in illegal logging during the entire reform period, but Armenians who lived through the energy crisis report that current levels of illegal logging for fuel wood usage come nowhere near 1992–95 levels, when Armenians burned whatever they could find to live through the winters. Enforcement has become much stricter since those desperate years, raising the effective price of harvesting firewood illegally. An organization called the Armenia Tree Project has estimated that forest coverage shrunk by about half during those years, suggesting that power sector reform, by improving availability of electricity, helped to reduce—not increase—deforestation.

Finally, although the electricity price has increased, service quality has also improved. High electricity tariffs may cause customers to switch to fuels with some negative externalities, but in 1994 Armenia the trade off was between round-the-clock electricity with higher prices or rationed electricity with lower tariffs. Frequent and unpredictable interruptions have severe consequences for industry. In developed electricity markets, the cost to large industries of reliable power is typically capped at the cost of self-generation, but because of the blockade, Armenian industry had few or no options for backup power during 1992–95. The power sector reforms had the effect of lowering the effective price of reliable power, which in turn has had a tangible, if not easily quantifiable, positive impact on economic growth.

Fiscal and Financial Benefits

Most of the benefits of Armenia's power sector reform stemmed from a reduction in the need for GoA implicit and explicit subsidies. A closer look at the fiscal benefits of reform is therefore warranted. A 2004 World Bank Working Paper used an end-product approach (see Box 2.2) to estimate the fiscal and quasi-fiscal budget deficit attributable to the power

19. World Bank. April 21, 2005. "Armenia Urban Heating Strategy." Draft Project Assessment Document. Washington, D.C.

20. As reported to the State Emergency Department and cited in World Bank, "Armenia Urban Heating Strategy."

21. COWI and World Bank. "Armenia Urban Heating Strategy."

Box 2.2. The End-Product Approach

The end-product approach calculates the total official and quasi-fiscal power sector deficit as the gap between current revenues and total revenues at full cost of service, with complete collections, no commercial losses, and a reasonable level of technical losses. The end-product approach calculates the total sector deficit as the sum of:

- ◆ *Commercial losses*: the cost of electricity injected into the transmission system but not metered/billed, minus the cost of electricity lost for technical reasons within nationally accepted norms for unavoidable losses,
- ◆ *Collection losses*: the value of electricity billed but not collected from customers, and
- ◆ *Tariff losses*: the difference between the amount billed (collected and not collected) to consumers and the cost of the corresponding amount of electricity.

sector in several European and Central Asia (ECA) countries, including Armenia.²² The end-product approach is needed because funds officially earmarked for state-owned power sector entities represent only a portion of the total subsidy actually provided by the government. Much of the government subsidy directed to the power sector in transition economies is implicit; that is, the government simply assumes responsibility for offsetting any gap between revenues and costs. The gap persists as long as tariffs remain below actual cost of service, collections remain below 100 percent, and high commercial losses continue. The sum of these implicit subsidies, often called the quasi-fiscal deficit is historically quite high in the power sectors of transition economies. The end-product approach will be replicated here with only minor modifications.

The persistence of fiscal and quasi-fiscal deficits can have significant broader macro-economic implications.²³ Such deficits represent: (a) debts between energy companies and their suppliers, and if some of those are foreign suppliers, represent an ongoing source of external debt, and (b) payment arrears to energy company employees, which over time can reduce a country's labor productivity and increase the potential for production disturbances. Power sector deficits are also more generally distortionary to price incentives in a way that misallocates resource use in the economy as a whole. All of this can be seen in Armenia. Low collections and high transmission losses meant massive bad debts to generators and foreign fuel suppliers. Failure to curb commercial losses and raise tariffs to cost recovery levels meant inefficient utilization of resources and deadweight loss.

The annual sum of explicit and implicit fiscal subsidies to Armenia's power sector reached US\$141 million in 1995, roughly 11 percent of the country's GDP during that year. The first row of Table 2.1 shows the annual fiscal and quasi-fiscal subsidy provided to the power sector from 1994 to 2004. Figure 2.7 shows the breakdown in graphical format of this fiscal and quasi-fiscal power sector debt. The second row of Table 1.1 shows the amount by which the necessary fiscal subsidy was reduced as the effect of power sector reforms took hold (this is simply the difference of US\$137 million and the subsidy required during that year). The third row shows the present value of the subsidy reduction to the

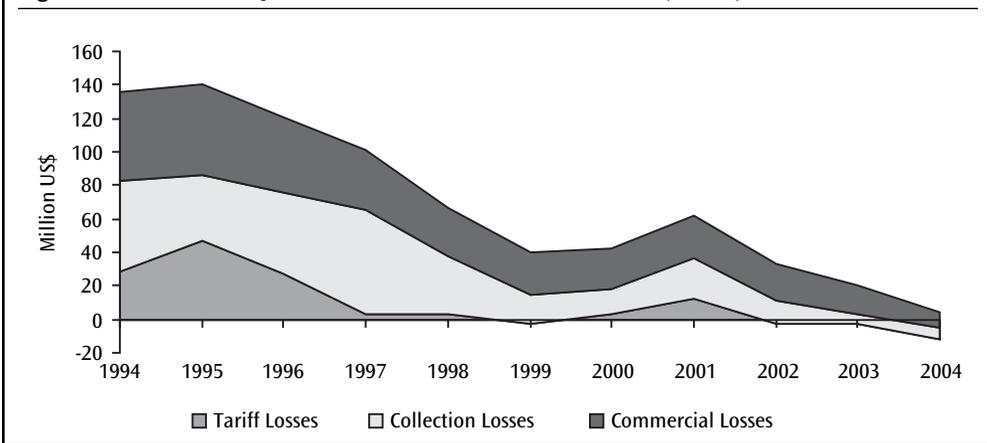
22. Lampietti, ed., *Power's Promise: Electricity Reforms in Eastern Europe and Central Asia*.

23. Saavalainen, Tapio O., and Joy ten Berge. 2003. "Energy Conditionality in Poor CIS Countries." International Monetary Fund, Washington, D.C. Processed.

Table 2.1. Fiscal and Quasi-Fiscal Power Sector Debt in Armenia

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Sum
	Million US\$ (nominal)											
Fiscal and quasi-fiscal subsidy	137	141	120	101	66	40	43	63	33	21	5	
Subsidy deferred	0	-4	17	36	71	97	94	74	104	116	132	
Present value	0	-4	14	27	48	60	53	38	48	49	51	386

Source: Calculated from Power's Promise Dataset.

Figure 2.7. Fiscal and Quasi-Fiscal Debt Shown as Commercial, Tariff, and Collection Losses

Source: Calculated from Power's Promise Dataset.

GoA in 1994, assuming a discount rate of 10 percent. The sum of the third row shows the present value, in 1994, of the fiscal subsidies avoided as a result of the reform program: US\$386 million.

Armenia's power sector deficit was financed primarily through direct government's subsidies, default on payables, the depletion of existing energy sector assets, the proceeds from the privatization of Armrusgasprom, and poor service to customers. Armenergo owed arrears to nearly every entity with which it did business, including its employees, fuel and equipment suppliers, and the GoA (for taxes and duties). Other financing came from the cannibalization of existing energy sector assets. Already depreciated generating equipment was scrapped in an effort to keep the less depreciated units running. As discussed earlier, natural resources suffered too, with near irreversible damage to Lake Sevan as a result of excessive dependence on hydropower generation and extensive deforestation as a result of inadequate power supply. In some sense, the deficit was also financed by customers, who had no choice but to accept a much lower level of service quality and reliability. Finally, an additional portion of financing came from the 1997 privatization of Armenia's gas network. Itera and Gazprom's commitments as half owners of Armrusgasprom included an agreement for the newly privatized gas supplier to provide around US\$150 million in gas to Armenergo's generating plants.

This sum, however, captures only the annual fiscal benefits of reform, from 1994 to 2004, not the long-term financial benefits. Assuming that the fiscal benefits of power sector reform persist, the subsidy in 1995 will be forever deferred, permanently removing around US\$132 million from the GoA's annual power sector obligations.²⁴ This can be valued as a perpetuity, which at a discount rate of 10 percent yields a present value of US\$1.32 billion (more than one-third of Armenia's 2004 GDP).²⁵ The economic benefits identified in the partial-equilibrium analysis were likewise only annual, and not reflective of the long-term gains to the economy. The long-term benefits of recovering deadweight loss can similarly be treated as a perpetuity. A perpetuity worth US\$18 million—the value of deadweight loss estimated above and in Appendix E—at a 10 percent discount rate, has a present value of US\$180 million. The value of offsetting the GoA's fiscal obligations to the power sector is clearly the most significant achievement of Armenia's power sector reform.

This analysis is conservative in that it presumes the GoA could have preserved the same level of fiscal and quasi-fiscal deficit over time without additional deleterious effects to sector infrastructure. However, as a recent study of energy sector donor conditionality in the CIS has posited, “Eventually, a failure to eliminate the energy sector's quasi-fiscal deficits will lead to a gradually decaying capital stock and increasing supply shortages.”²⁶ The cost of increasingly frequent and severe supply interruptions adds considerably to the overall cost of prolonged fiscal and quasi-fiscal sector deficits, thereby increasing the potential benefit of removing them. As several highly industrialized countries have found in recent years, the cost of a single, widespread blackout can impose costs that far exceed the cost of upgrade or maintenance that would have been required to avoid it.

Other Fiscal Benefits

The purchase price of Armenia's privatized entities yields the most obvious, yet least significant long-term gain. Table 2.2 shows the purchase prices of the assets privatized or swapped in Armenia. Of these values, only US\$142 million went to the GoA, as US\$22 million of ENA's debt was owed to Armenian commercial banks. As has been shown by other recent studies in the region, purchase prices represent only a small portion of the total fiscal gains attributable to power sector reform.²⁷ As shown in the previous section, far larger fiscal benefits come from the reduction in public sector financing required to keep the sector on its feet.

Power sector reform also has the benefit of bringing the “shadow” economy into the light. Reforms allow for the pass-through of taxes that may not otherwise have been collected and forces greater transparency and accountability on fiscal expenditure. Within the shadow economy is a group of economic activities that manage to avoid paying taxes. Increased collections, tariff increases and curtailment of commercial losses will all increase collection

24. The analysis is highly dependent upon what is assumed to be the cost recovery level tariff. This analysis assumes a cost recovery tariff of 4.8 cents/kWh for all years under consideration, implying a US\$45 million subsidy (mostly a tariff subsidy) is still required from the GoA. This is likely to be an overstatement of quasi-fiscal subsidies in Armenia as many in the country's power sector believe electricity tariffs are now roughly at long-run marginal cost of supply levels.

25. The formula for calculation of a perpetuity is C/r , where C is the annual cash payment and r is the discount rate. Hence, $141/.1 = 1440$.

26. Saavalainen and ten Berge, “Energy Conditionality in Poor CIS Countries.”

27. Lampietti, ed., *Power's Promise: Electricity Reforms in Eastern Europe and Central Asia*.

Table 2.2. Purchase Prices of Armenia Power Sector Assets

Asset	Purchase Price (US\$ Million)
Electricity Network of Armenia	Equity: 12.015
	Debt: 27.985
	Total: 40.000
Asset-for-debt swapped units	Medazmor: 40.000
	Hrazdan TPP: 31.000
	Sevan-Hrazdan HPP: 25.000

of taxes based on utility sales (such as value-added tax) or profit (such as corporate tax). Box 2.3²⁸ discusses in more detail the tax gains of Armenia's power sector reforms.

Beyond the direct fiscal benefit of increased tax revenues, the power sector reform initiated a chain reaction of more transparent fiscal accounting because of the electricity industry's link to so many other industries. Exposure of the power sector deficit and efforts to control that deficit led to more scrutiny and more explicit budgeting of state guaranteed loans to budgetary organizations and quasi-public corporations. As Table 2.3 shows, nearly half of the top 13 taxpayers in Armenia are energy companies (the energy companies are bold). These same companies were the biggest nonpayers until several years ago.

How Costs and Benefits Were Distributed

Consumption per customer and expenditure per customer has changed relatively little since the beginning of the reforms. Figure 2.8 shows the change in annual average per capita electricity consumption and expenditure by household customers since 1994. Higher tariffs and increased collections inevitably mean less available to spend on other goods, so electricity customers are spending more on electricity than they once did, with the exception of expenditure for 1994, which was affected by the then still high levels of inflation experienced during the tail end of Armenia's economic crisis. Figure 2.8 shows average electricity sales per customer during the course of the reform period.

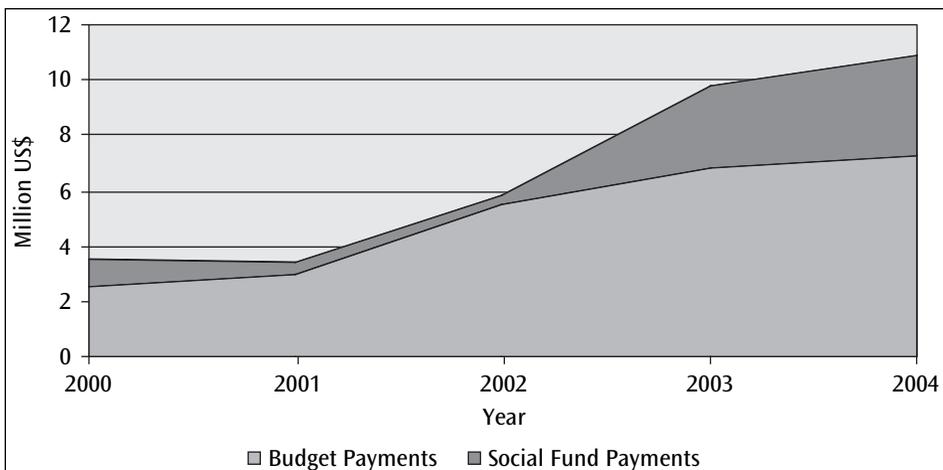
There is little doubt that the poor disproportionately suffered the effects of tariff rationalization that came with power sector reform, though macroeconomic trends suggest, overall, a more even distribution of income within Armenia. World Bank surveys have found that poor households spend relatively more of their income on energy, and for heating in particular, than do nonpoor households, even though they heat fewer rooms, heat at lower temperatures, and heat with dirtier fuels.²⁹ Other, albeit more general data from Armenia's statistical agency suggests that income distribution has been improving over the reform period. The Gini coefficient for income has steadily decreased since 1996, from .602 to .438

28. Phillips, Charles F., Jr. 1993. *The Regulation of Public Utilities*. Arlington, Va.: Public Utilities Reports.

29. World Bank, "Armenia Urban Heating Strategy."

Box 2.3. Public Utilities are “Tax Collectors Par Excellence”

Power sector reform can affect a government’s tax collections in a number of ways, depending on the specifics of the tax regime. Armenia’s current tax system is regulated by the Law on Taxes, adopted in April 1997. The Law on Taxes includes an enterprise profit tax (corporate tax), personal income tax, value-added tax, excise tax, import and export duties, and property and land taxes. GoA collections on all of these taxes is likely to have changed as a result of the power sector reforms: land and property tax collections can change with the revaluation of the utility’s assets that typically accompanies power sector reform and privatization, and personal income tax collections change as utility employee salaries change. The impact of these changes on GoA revenues are likely to be minor, however, compared to the more direct effect of the value-added tax and corporate tax. The figure below shows that the EDC’s tax payments have increased substantially since 1998, despite the gradual decline in electricity consumption. ENA is exempt from paying corporate tax during the first two years of operation and is responsible for paying only 50 percent of its corporate taxes between 2004 and 2008, consistent with Armenia’s tax rules for all new foreign investments.



Source: ENA.

The economy-wide net increase in the value-added tax payments depends on what electricity customers did before with the money they now use to pay their electric bills. Two possibilities exist: Customers were either saving or consuming other goods. To the extent that customers were spending on other goods, the GoA’s increase in the value-added tax collection will in turn depend on whether their spending was on shadow economy goods (with prices that include the value-added tax and from firms that, even if they charge a value-added tax, actually pass it through to the GoA). If consumers are simply shifting their purchases from one value-added tax-inclusive purchase to another, however, there is obviously no net effect on the GoA’s value-added tax collections. To the extent that EDC customers are now paying their electricity bills with money they previously spent on other shadow economy goods or saved, increased electricity expenditure would indeed show as an increase in overall GoA collection of the value-added tax (though a decrease in private savings may eventually have deleterious effects on the budget and on the Armenian economy as a whole).

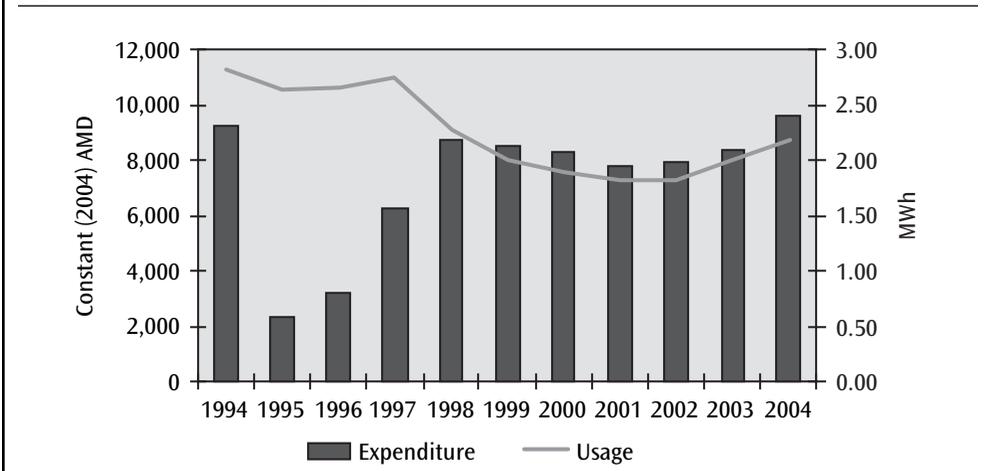
in 2003. More importantly, the Gini coefficient for consumption has also decreased, from 0.44 to 0.33 during the same time period.

Government transfers do exist, but are generally regarded as insufficient. A Poverty Family Benefit Program (PFBP) has existed since January 1999, which offers cash payments to a targeted group of poor households. The PFBP was intended as a substitute for earlier

Table 2.3. Top 13 Taxpayers in Armenia

Taxpayer	Taxes Collected, Million USDs					
	Total	Profit Tax	VAT	Excise	Presumptive	Other
1 Zangezur Copper Plant	12.39	3.35	8.07	0.00	0.00	0.97
2 Armrusgasard	6.70	0.03	6.59	0.00	0.00	0.08
3 Armenia Telephone Company	4.58	0.84	3.42	0.00	0.00	0.32
4 Grand Tobacco	3.11	0.11	0.00	0.00	2.97	0.03
5 Armenian Electricity Network	3.01	0.21	2.23	0.00	0.00	0.56
6 Medzamor Nuclear Power Plant	2.04	0.21	1.65	0.00	0.00	0.18
7 Irrigation	1.99	0.00	1.99	0.00	0.00	0.00
8 Vortan Hydro Plant	1.10	0.10	0.97	0.00	0.00	0.03
9 International Masis Tobacco	0.98	0.01	0.09	0.00	0.88	0.00
10 Avshary Winery	0.87	0.02	0.11	0.74	0.00	0.00
11 Hrazdan Energy Company	0.79	0.02	0.71	0.00	0.00	0.06
12 High-Voltage Network	0.67	0.15	0.45	0.00	0.00	0.07
13 Transgas	0.64	0.01	0.61	0.00	0.00	0.02

Source: Armenian State Tax Service.

Figure 2.8. Annual Electricity Expenditure and Use of Household Customers

Source: Power's Promise Dataset and (for CPI data) WDI database.

benefits programs that had provided support to a variety of social groups such as war veterans, current military personnel, pensioners, and single mothers. Additional one-off payments were made through this program in 1999 and 2000 in an effort to offset the 1999 electricity tariff increase mandated by the AERC and the removal of the lowest block (lifeline) tariff.³⁰ World Bank surveys have found that the level of support it provides is still insufficient to have much of an impact on heating costs: “It costs about US\$50/MWh to heat one room during the winter season with electricity vs. US\$25/MWh for alternatives, where 1 MWh is the minimum amount of heat necessary. For comparison, PFBP payments are about US\$14 per household per month, and the cost of the minimum consumer basket is estimated at about AMD 30,000 (US\$52) per month.”³¹ Moreover, PFBP is currently only available to 18 percent of Armenia’s households, though 42.9 percent fall below the poverty line (income below US\$21 per month), and 7.4 percent live in extreme poverty (income below US\$14 per month).³²

Social transfers may not yet be sufficient, but the reform process at least frees up the funds to potentially increase those transfers. There is evidence that the GoA is indeed increasing its social transfers. For example, GoA fiscal spending has decreased from 20.8 percent to 18.7 percent of GDP since 2001. Social spending has increased from 31.3 percent to 38.2 percent of all fiscal expenditure during the same time period, from 6.5 to 7.2 percent of GDP. The PFBP is considered to be one of the best designed transfer schemes in the region, and the Ministry of Social issues (which oversees the program) is considering providing additional earmarked funds for utility payments through this program.

The poor have undoubtedly felt the effects of electricity tariff increases, but the consequences of power sector reform have not necessarily been inequitable, nor would the poor have fared any better in the absence of power sector reform. It is worth remembering that the parties responsible for most of the fiscal deficit were industrial customers or GoA budgetary institutions receiving free power (whether authorized to do so or not). Poor customers generally have good records of paying as much of their utility bills as they can as often as they are able. In general, the power sector reforms have eliminated an enormous source of potential waste and misappropriation of resources in the Armenian economy. Before power sector reform, everyone was paying someone for electricity, but the payments collected were often not used to operate and maintain the power supply system. Poverty was used as a justification for commercial losses whether the industries or households stealing that power could truly afford it or not. Now, at least, the amount of benefit needed by poor households can be measured, and payments directed to those households, rather than letting ability or opportunity to cheat the system determine who receives discounted electricity.

30. “To soften the impact, a direct cash transfer of 1,450 AMD was provided to approximately 30 percent of households (230,000 households) eligible for the family benefit, plus an additional 9 percent (70,000) expected to have difficulty meeting their electricity payments.” From Lampietti et al., *Utility Pricing and the Poor: Lessons from Armenia*.

31. World Bank, “Armenia Urban Heating Strategy.”

32. Armenian National Statistical Services data for 2003. The Armenia Integrated Living Conditions Survey 2003 has different estimates. According to this survey, only 29.1 percent live below the poverty line. Of this group, 4.6 percent are classified as living in extreme poverty.

Lessons Learned From Armenia's Reform

Many of those close to Armenia's power sector reform and privatization process—including those who opposed it at various stages—view it as a success. The reform program appears to have been successful in turning what once was a significant burden on state coffers into a source of revenue for the GoA, creating a profitable asset out of what once was a loss-making enterprise and establishing a framework for sustainable power sector growth. Armenia succeeded by focusing its technical, regulatory and legal reforms on the two factors that lay at the heart of Armenia's power sector troubles: high commercial losses and low collections.

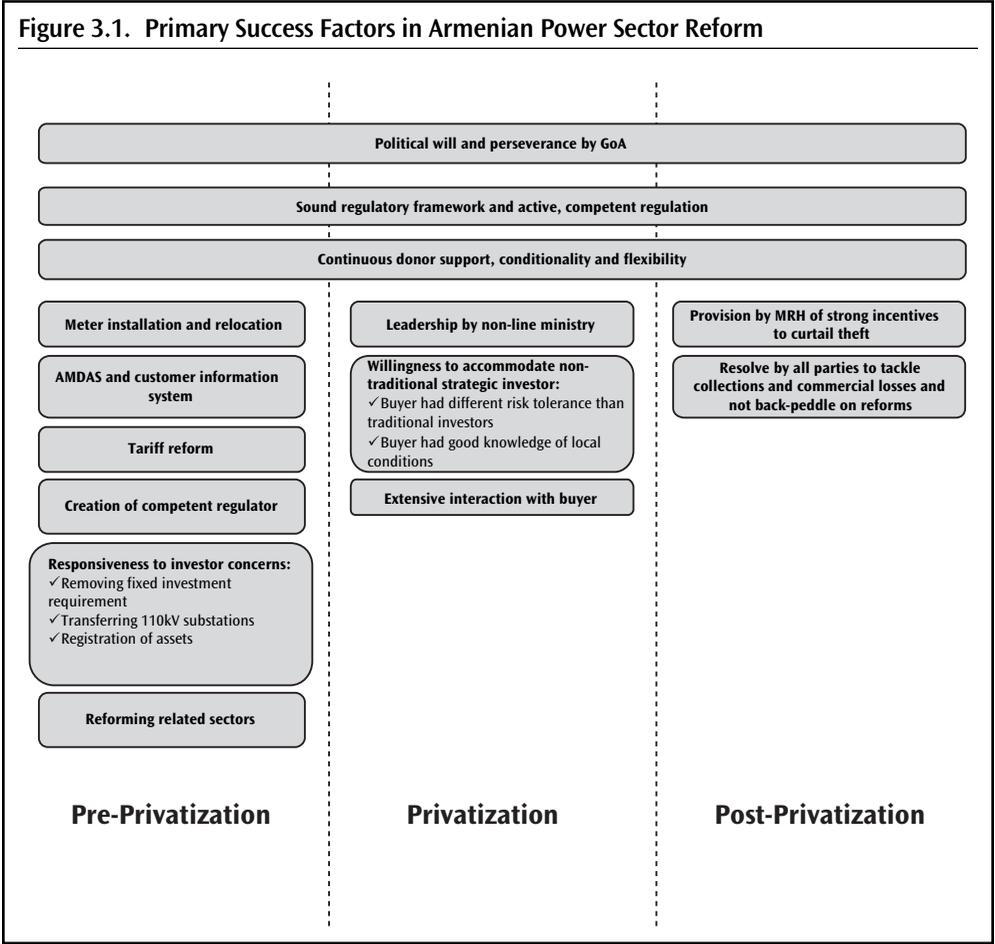
There are arguably many alternative ways to achieve similar results. Power sector reform need not precede privatization, nor is privatization the only desirable final phase of power sector reform. A management contract or concession, adopted earlier in the reform process may, for example, have achieved comparable, or even better, results. The goal of this chapter is therefore not to argue that Armenia's path to reform produces the best possible outcomes, or that it represents a comprehensive model. This chapter instead focuses on drawing out the lessons of Armenia's experience: What seemed to work well and why.

Wherever possible, comparisons are drawn to other countries in the region that are undertaking or undertook reforms and privatization of their power sectors over the past decade. Many of the lessons drawn from Armenia's power sector privatization are similar to lessons drawn by a 2003 comparative study of power sector privatization programs in the ECA region.³³ Appendix D lists the key lessons presented in the 2003 report, and indicates whether, and to what extent, Armenia's experience reaffirms these lessons. Compar-

33. Krishnaswamy, Venkataraman, and Gary Stuggins. 2003. *Private Sector Participation in the Power Sector in Europe and Central Asia: Lessons from the Past Decade*. World Bank Working Paper No. 8. Washington, D.C.

isions are also drawn to Armenia’s other privatization effort of the decade, the sale of the telephone network, Armentel.

Figure 3.1 shows the factors that were more important in bringing about the success Armenia has enjoyed in rehabilitating its power sector. Specific factors are grouped according to whether they were important before, during, or after the privatization process. Three less specific but more important factors are shown spanning the entire reform period. These relate to the role of the GoA, the regulator (AERC, now PSRC) and donors. The sum of the specific actions of these entities cannot capture the full contribution made by each, nor can specific actions easily be isolated to a particular stage of the reform process. It was rather their enduring involvement and commitment that underpinned the success of Armenia’s power sector reform.



As a final note of qualification to policymakers looking to emulate Armenia’s approach, we also consider several possible drawbacks to the particular path followed.

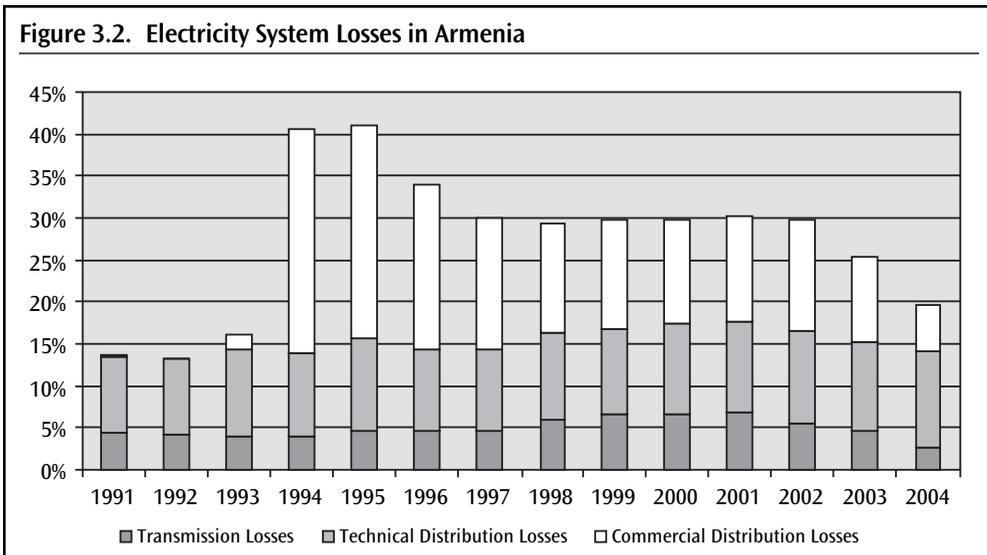
Preprivatization

The relocation of meters from apartments to public areas proved essential to reducing commercial losses and making enforcement of collections possible. High commercial losses and

low collections defined the heart of the power sector's problems in Armenia. As described before, the country began an ambitious remetering program in 1994. This involved relocating *existing* meters from individual apartments to public areas of buildings. Some meters (roughly 10 percent) did need to be replaced, but the emphasis of the program was on meter relocation.

Remetering was undertaken earlier and in a more cost-effective manner than in neighboring countries attempting to privatize their distribution networks. Armenia had remetered 70 percent of electricity customers by the time of the first privatization attempt. Many other countries have left metering investments to the buyer. This early effort in Armenia ensured that, by the time MRH assumed control of the EDC, commercial losses had already been reduced from 27 to 13 percent. Moreover, many countries' remetering efforts involve replacement of end-user meters rather than relocation.

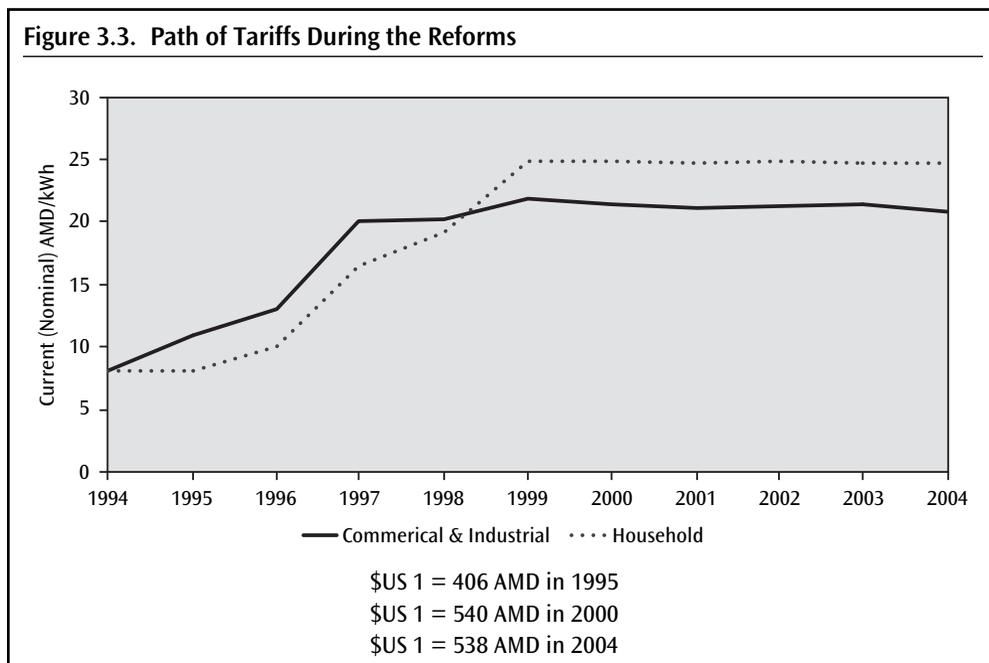
Installation of the AMDAS and customer information systems, coupled with a near complete metering of the network, let the GoA know the extent and location of the system's problems. The installation of 12,000 meters, at a variety of voltage levels down to 0.4 kV, and installation of the AMDAS and customer information systems, allowed Armenia to become one of the only countries in the former Soviet Union capable of balancing and metering at all points along its network. Technical and commercial losses were therefore known, and the source of specific problems along the network could be easily identified. Figure 3.2 shows the reduction in commercial losses since 1994. The metering and remetering activities were completed by 1998. Installation of the AMDAS system, financed by the U.S. Agency for International Development (USAID) was completed in 2001.



Source: Power's Promise Dataset.

Tariffs were brought to cost recovery levels before privatization was launched. Tariff rationalization in Armenia began in 1994 and was complete by 1999, sparing the private operator of having to weather the political fallout from tariff increases. As mentioned in Chapter 1, the GoA also took efforts, early on, to establish a link in customers' minds between quality of service and price. The GoA thereby took responsibility for effecting this change in thinking, a task often left to private operators once they take ownership.

The GoA, AERC and its donors sought to avoid passing system inefficiencies through to end-users. Tariff hikes in a poorly-run system can mean that the costs of system inefficiencies are simply passed along to consumers and where widespread theft (commercial losses) occurs, the market price of stolen power also rises. The GoA, AERC, and its donors were cognizant of these dangers and therefore raised the tariffs gradually in line with reductions in commercial losses. Figure 3.3 shows the path of the gradual tariff increase during the reform period.



A highly effective and competent regulatory body helped drive these early reforms. Creation of the AERC was one of the single most important institutional reforms undertaken during this preprivatization period. The creation of an independent regulator, in and of itself, is generally viewed by students of infrastructure reform as a positive step. The success of infrastructure regulators over the past decade, however, has been mixed, and implies that the existence of a regulator is often not enough to guarantee successful reform. The quality of regulation, determined in part by the degree of regulatory role, independence, expertise, and consistency clearly matters. The AERC, from its creation in 1997, was deeply involved in the power sector reform process and widely regarded within the GoA as a trusted and knowledgeable advisor.

The collective effectiveness of these pre-privatization measures is evident in comparison to experience with power sector privatization elsewhere in the region. The AES experience in purchasing Tbilisi's distribution network has been perhaps the best documented, and presents a mirror image of MRH's experience in Armenia.³⁴ AES purchased a system badly in

34. The documentary film, *Power Trip*, produced by journalist Paul Devlin, presents a relatively recent and entertaining version of this story.

need of repair. Collections were 10–20 percent. Only 10 percent of the meters had been replaced. Tariffs were still well below cost recovery levels. AES set about replacing the rest of the meters with new ones, a significant investment. Nor is Georgia alone in its lackluster experience with privatization. Table 3.1 shows the data available on losses and collections for Tbilisi, Georgia, as a whole, and Kazakhstan and Azerbaijan, two other countries in the region that have undertaken some degree of power sector reform. Tbilisi managed to improve collections, but losses remained relatively high and constant. Though Kazakhstan and Azerbaijan managed to reduce losses, collections have decreased or remained relatively constant, and tariffs remain below cost recovery levels. Only Armenia managed to unambiguously improve in both collections and commercial losses during this time period.

Losses									
	1994	1995	1996	1997	1998	1999	2000	2001	2002
Kazakhstan	13%	15%	18%	20%	21%	21%	13%	13%	
Armenia	40%	40%	34%	29%	26%	27%	25%	26%	26%
Georgia						50%	50%	50%	50%
Tbilisi						37%	52%	48%	38%
Azerbaijan	18%	21%	19%	21%	17%	16%	15%	12%	16%
Collections									
	1994	1995	1996	1997	1998	1999	2000	2001	2002
Kazakhstan	99%	77%	85%	63%	82%	74%	62%	62%	
Armenia	39%	54%	60%	61%	77%	88%	89%	81%	90%
Georgia	20%	22%	42%	38%	39%	40%	42%	45%	47%
Tbilisi						32%	44%	77%	91%
Azerbaijan	35%	39%	57%	50%	43%	46%	18%	26%	34%

Source: Power's Promise Dataset.

Armenia's experience with privatization in other sectors also offers some useful points of comparison. The privatization of Armenia's telephone network is described briefly in Box 3.1. Hellenic Telecommunications Organization (OTE), the Greek buyer of Armenia's telecom monopoly, purchased a system in need of massive investment. The GoA/Trans-World Telecom joint venture that preceded OTE's ownership had begun refurbishing basic telephone infrastructure to Armenia's five largest cities, but the fixed-line network in Armenia remained incomplete, and other telephony services nonexistent. OTE's experience stands in stark contrast to MRH's where, by the time the private operator took control, the system was complete and, though dependent on government subsidies, already had in place cost recovery tariffs and greatly reduced levels of commercial losses and non-payment.

Clearly, the power sector reform could not have been so successful without a number of additional supporting measures. Highlighted above are only those that distinguish Armenia's power sector privatization from similar efforts elsewhere. None of the above-mentioned

Box 3.1. The Results of Armentel's Privatization Have Been Poor

Armenia's privatization of its telephone monopoly, Armentel, has not gone nearly as well as the privatization of ENA. Armentel was established in 1995 as a joint venture between Armenia's Ministry of Communications and Transport (with 51 percent of the shares) and a consortium of U.S. and Russian companies called Trans-World Telecom Ltd. Armentel was fully privatized in 1998, after two rounds of bidding, to the Greek government-owned Hellenic Telecommunications Organization (OTE). Progress under Armentel has been lackluster. According to government officials, Armentel has failed to make many of the investments promised by its license, and development of Armenia's telephone system has languished behind those of its neighbors. Compared to Azerbaijan and Georgia, fixed-line and mobile tariffs are higher, fixed-line teledensity has grown at only half the pace, and mobile penetration is at only 0.2 percent of the population (compared to 3.5 percent and 1.8 percent in Azerbaijan and Georgia, respectively; see the World Bank).³⁵ Armenia also enjoys the dubious distinction of being one of the only CIS countries where mobile phone SIM cards are available almost exclusively through the black market.

According to anecdotal stories, Armentel is perceived to have inflated its reported investment plan and stifled growth in potentially competitive markets for Internet service provision and cable television through prohibitive access fees for international data transfer, another service over which Armentel has exclusive monopoly rights. The GoA unilaterally amended Armentel's license in 2003, revoking its monopoly over mobile phone services, provoking Armentel to initiate arbitration. The GoA and OTE settled their dispute in November 2004, facilitating the entry of a new mobile service provider, cutting Armentel's license from 15 to 11 years (if tariff rebalancing is achieved by that time; that is, the cross-subsidy between different services is eliminated), and formally including license provisions that subject Armentel to regulation by the PSRC.

An obvious problem with Armentel's license was its exclusivity over fixed-line and mobile services, just as mobile telephony and Internet communications entered the mainstream and began to be established as competitors with fixed-line telephone service.³⁶ OTE was given a 15-year exclusive license for fixed-line telephony (local, long distance, and international) and GSM services. Though it could be argued that exclusivity in one service area is necessary for investors to recover the fixed costs associated with building out the network, exclusivity over fixed-line and mobile telephony for 15 years clearly stifled the growth of telecommunications infrastructure in Armenia.

Other problems with the Armentel concession included a lack of appropriate regulation and lack of appropriate incentives embedded in the legal and regulatory framework and licenses.

measures could have taken place without the unbundling and corporatization of the system, and the establishment of a strong, supporting legal and regulatory framework. Also essential was simultaneous reform in sectors that represented major sources of (often wasteful) electricity consumption. Armenia's drinking water and irrigation sectors began a process of reform in the late 1990s. One of the significant operational improvements that came out of this process involved investments in more energy-efficient methods of water delivery.

35 World Bank. "Regional Study on Telecommunications in the Caucasus." <http://lnweb18.worldbank.org/eca/eca.nsf/0/3b66d94159dfd968852568fc005d7716?OpenDocument>.

36 Exclusivity in electricity distribution is inherently less problematic, though the risk is not entirely absent, because distribution has already been unbundled from energy supply. The distribution company exists only as a conduit for suppliers and customers. Armentel has responsibility for operation of the conduit as well as the services provided over that conduit, giving it an incentive to block new entrants or make operations difficult for existing suppliers using its networks.

Privatization

The GoA and its transaction advisors learned a number of useful lessons from the first failed tender and successfully applied them to subsequent attempts. Preparations for the first tender lacked political momentum and a clear champion anywhere within the GoA. Many opposed it, and many others simply did not take it seriously. Once investors began visiting Armenia, however, and taking active interest in the EDC, there was a more widespread realization that: privatization was possible, but the privatization package the GoA was offering had serious flaws.

The GoA and its advisors took extensive measures after the first failed tender to recognize buyers' concerns. On one level, this meant simply making the assets more attractive. The first tender had offered two separate distribution companies. Several buyers said they would only be interested in bidding on the combined set of Armenia's distribution assets. Bidders also said the purchase was ultimately of little interest to them as long as restrictions existed on cross ownership of distribution and generation assets. The revised Law on EDC Privatization responded to these points, bundling the distribution companies into a single package and lifting restrictions on ownership of generating assets. The new law also indemnified the buyer against the risk of any liabilities not identified in the tender documents (contingent liabilities).

Other changes to the tender package were aimed at giving buyers better control of key operational risks (that is, the factors causing high commercial losses and low collections). This meant that all 110 kV substations were included as part of the privatization package to avoid an ongoing problem of Armenergo, with the cooperation of certain hydropower plants, selling power directly to distribution customers connected to those substations. This eliminated a significant potential source of commercial transmission losses. It meant putting in place a government decree that allowed the EDC to disconnect customers in default. It also meant putting in place a guarantee mechanism, via the Central Bank, against late payment or nonpayment by so-called VIP customers who continued to benefit from lax payment enforcement and yet were guaranteed uninterrupted supply of power. When the government realized potential cost of VIP electricity customers to the state budget it abolished the practice of granting VIP status. There are no longer any VIP electricity customers in Armenia.

The GoA also took concrete measures to prevent asset stripping. USAID had, before the first tender, financed the creation of a utility chart of accounts for the electric sector, consistent with international accounting standards and the separation of accounts for the various sector entities (generation, transmission, and distribution), but this failed to prevent certain assets being stripped from the distribution companies in the run up to privatization. This had been a problem in other of the region's privatization efforts. In Georgia, once the sale of Tbilisi's distribution network went through, many of what AES supposed to be its assets were contested. Tractebel also found its assets stripped after its purchase of Kazakhstan's Almaty Power Consolidated in 1996. Even before Armenia's second failed tender, some metering and transport assets had been commandeered in certain regions and new companies created out of these assets. To prevent further asset stripping, USAID financed in 2001 the creation of an engineering cadastre of the distribution network's assets, and formally registered these assets with the GoA.

One of the most radical changes to the tender documents was the removal of any fixed investment requirement. The GoA changed the Law on EDC Privatization, dropping the

requirement for a fixed level of investment (US\$80 million) in favor of a set of service quality standards, against which the licensee's performance would be judged by the regulator. Armenia's experience with telecom privatization offers a useful point of comparison and suggests why the GoA may have chosen a different approach to its privatization of the EDC.³⁷ Armentel's license set unrealistic investment targets that the company repeatedly failed to reach.³⁸ This ultimately served neither the customers nor Armentel, and—some believe—provided Armentel with incentives to falsify its reporting of investments. Armenia remains alone among its neighbors (and indeed, alone among most countries) to launch a PSP contract that abandons investment requirements in favor of service standards.

The revisions to the second tender reflect a more general shift in the GoA's goals, away from high privatization values, and toward a focus on the longer-term benefits of PSP. Before the first tender, a number of those involved in the privatization process speculated Armenia might reap as much as US\$400 million for its distribution assets. This assessment was very likely based loosely on replacement cost rather than the economic value of the distribution company. A number of the GoA's advisors, however, had been pushing for more realistic expectations that reflected the affordability of the tariff rather than some notional asset value. By 2001, these arguments were beginning to hold sway. Armentel again serves as a useful contrast on this point. OTE paid US\$142.2 million for Armentel, assumed liability for US\$43 million in supplier credits, and committed in its license to US\$300 million in investments over 10 years. The GoA's objective was to get as high a price as possible for Armentel, which ultimately compelled it to give away a wide spectrum of valuable monopoly services.

The shift in thinking was facilitated by a change in ministerial leadership of the privatization effort. After the failure of the first tender, responsibility for privatization was transferred from the Ministry of Energy to the Ministry of Justice. As in all post-Soviet republics, the Ministry of Energy had enjoyed extremely high status—nearly commensurate with that of law enforcement—and through its oversight of the energy sector directly managed roughly 40 percent of the country's annual cash flows. The Ministry of Energy had been instrumental in the early years of power sector reform. By 1999–2000, however, the effect of the ministry's reforms had begun to plateau, and its involvement in the privatization process came to be characterized by conflict of interest, political infighting, and obstruction. Vested interests within the ministry and other parts of the GoA also pushed for a high target investment price, either to obstruct a successful bid or to raise the value of assets available for so-called shadow economy" commerce.

Though the emergence of MRH as a potential buyer was met with skepticism from donors and transaction advisors, the GoA proved willing to consider a different kind of strategic investor. While eager to find a buyer, the GoA went to extensive lengths to conduct its own due diligence on MRH and impose additional safeguards to accommodate a financial investor. Ultimately only one requirement of the earlier set of tender documents was relaxed: the requirement for a performance bond, a requirement for which at least one of the other prequalified bidders would also have required a waiver.

37. The difficulties of the Armentel privatization are discussed in Box 3.1.

38. Most observers now agree that the levels of investment required by Armentel's license were excessive. The US\$300 million investment program included the requirement to lay 20,000 km of fiber optic cable, and provide digital service to 800 towns and villages.

The GoA, supported by the PSRC, worked extensively with MRH to understand and come to agreement on the terms of the tender documents. This interaction with MRH ultimately satisfied the GoA that its suitor was both qualified and had sound commercial intentions for the distribution network. There was, in contrast, much less communication between the GoA and Armentel and fewer up-front negotiations on specific issues related to license, tariff agreement, and sale and purchase agreements.

In further efforts to protect itself against the risks of engaging MRH, the GoA imposed a number of safeguards additional to those required of investors in the earlier sets of tender documents. Box 3.2 describes those additional safeguards.

Box 3.2. The GoA's Concerns With MRH and the Safeguards Imposed

The GoA and its donors had a number of concerns about MRH. One of MRH's holdings had owned a Ukrainian steel mill that had briefly owned a Ukrainian distribution company, but it was otherwise without any meaningful power sector experience. There were other concerns related to MRH's status as an offshore company and the lack of disclosure that offshore accounting standards allow. Though MRH did have accounts audited back to 1998 by a reputable accounting firm, the auditors issued qualified opinions on the first two years of financial statements. What information was available suggested a lack of fixed assets and quite variable cash flows from trading metals.

Given these concerns, the GoA talked directly with MRH's banks about the company's financial status, and included in the tender documents a number of additional requirements of MRH as a relatively unknown financial bidder without power sector experience:

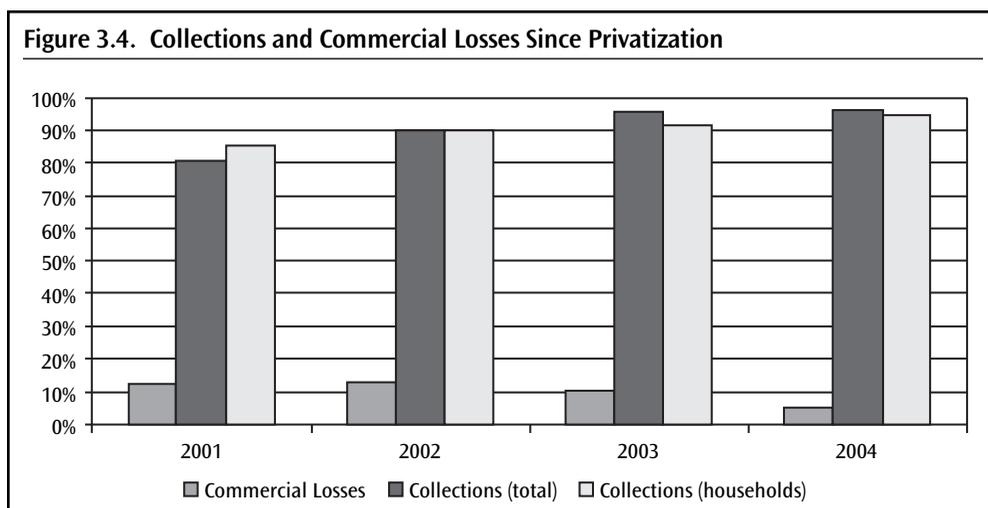
- ◆ To safeguard the EDC's cash flows, MRH was required to deposit all funds collected from customers in an account selected jointly with power generators, as collateral against payments to generators. Generators were to be paid first on a monthly basis before the EDC could make any other expenditures. If proceeds should fail to cover generator debts, the EDC would be required to provide and permanently replenish a US\$600,000 bank guarantee to cover the deficit.
- ◆ To further guard against misuse of cash flows and prevent the possible stripping of assets, the EDC was prohibited from selling more than 25 percent of its shares without approval of the GoA and PSRC. After seven years, the EDC was allowed to sell only one-third of its shares without GoA and PSRC approval.
- ◆ To ensure MRH would have the technical ability to run a distribution company, the GoA initially required the company to hire a management contractor with power sector experience. This arrangement was abandoned after the first several months, and the management contractor replaced by a USAID-funded technical assistance contract with PA Consulting. As an additional safeguard, there is a requirement in the Sale and Purchase Agreement that the buyer's management team have a level of power sector experience equivalent to that the GoA expected from a management contractor.

Postprivatization

The GoA created a solid foundation for private takeover, and has continued to follow through with reform. This has been key to the success of privatization since 2002. MRH's CEO has credited his company's success with ENA to the government's willingness to keep its promises. Most importantly, the GoA and the PSRC have enforced the ENA's mandate

to disconnect nonpaying customers and has maintained tariff levels. MRH reports generally good relationships with government tax and law enforcement officials, and retains an amicable (if sometimes adversarial) relationship with the PSRC.

MRH also deserves credit both for its initial investment decision and for its management of the EDC. MRH appears to have made a profitable and well-run venture out of what other investors would not touch. All suppliers are now being paid in full and on time. The company has raised base salaries dramatically, paid off six months of salary arrears and begun paying employees consistently on time. Figure 3.4 shows the improvements in collections and commercial losses achieved since 2001 (the year before the MRH takeover).³⁹



Source: Power's Promise Dataset.

ENA has provided strong incentives for its employees to stop theft and improve collections. Through its license, MRH itself has clear incentives to reduce commercial losses over time, and an innovative compensation scheme lies at the heart of MRH's efforts to control nontechnical losses. The company has raised salaries of directors, engineers, and inspectors by five to tenfold. In a country where the average annual salary is roughly US\$1200 per year,⁴⁰ meter reader salaries have been raised from US\$50 to US\$300 per month, engineers salaries have been raised to US\$200 per month, and regional distribution company directors salaries have been raised to US\$800–1000 per month. MRH also offers a significant variable component to its employees based on improvements in losses, collections, and repeat performance over two to three pay periods. Regional managers (branch directors) can earn as much as US\$3000 per month if they meet performance requirements, up from a preprivatization base salary of US\$300–350 per month. Penalties are also stricter, however. If targets are not met within two months, employees may be laid off.

39. Actual 2004 collections are probably closer to 100 percent than this graph indicates. The difference is likely the result of cash accounting: the fact that payments for end-of-fiscal year 2004 (December) bills were not collected until the following fiscal year (January 2005). With the onset of colder temperatures, December electricity consumption is typically higher than November consumption.

40. The officially registered annual salary is closer to US\$500 per year.

MRH's management showed steely resolve in tackling collections from the first day of operations, backed by a GoA decree. Its willingness to disconnect VIP customers for nonpayment has undeniably been one of the keys to its success. This success, however, would not have been possible without the GoA's decree allowing the EDC to suspend supply to customers in default. A number of GoA officials were shocked when MRH first declined to maintain connections for certain government customers. A number of VIP customers, including the Ministry of Internal Affairs, a Russian military base, the mayor's office, Yerevan city government offices, the Ministry of Energy, and the PSRC were all disconnected for nonpayment during January 2003, and Yerevan's water utility has many times found itself within an hour of disconnection.

Role of the GoA

The GoA's ability to stay on course, despite changes in leadership and a difficult market, is testimony to the political will of those who led the process at different stages. The initial impetus toward power sector reform, and the existence of the legal and regulatory framework supporting the process, is owed to the work of a reform-minded prime minister and energy minister between 1995 and 1998. Political will was similarly crucial for the final push to privatization after the first failed tender. Leading the charge was a young, progressive minister of justice with support of the president's office who oversaw the wind up of Armenian Airlines and the negotiations of the transfer of Armenian international air rights, introduction of a concession contract for the Yerevan's airports, and efforts to renegotiate the problematic Armentel contract.

Political will, finally, appears to have played a role in the success of MRH's operation of the EDC thus far. Even with a good regulatory framework, a government that does not want to work with a privatized entity can find ways to make life difficult for them (for example, through tax authorities or law enforcement). While MRH does have some complaints about its relationship with the PSRC (as can be expected between any licensee and its regulator) it claims to have generally good relationships with other arms of government. As one Armenian regulatory official quipped, "It isn't so hard to make a distribution company operate if you have the support of local government."

Equally crucial was the GoA's collective ability to learn from the process, and adapt to changing circumstances. When the first tender failed, the GoA revised the legal and regulatory framework, did what it could to make the assets more attractive, and transferred leadership to a different ministry. When presented with an unexpected offer from an unconventional bidder, the GoA showed a willingness to think in different ways about the definition of strategic investor, ultimately breaking with some of its donors in a decision that would foreshadow a growing trend in infrastructure privatization (see Box 3.3).

Role of the AERC

The AERC's role was central and indispensable to the reform process. The specific factors that contributed to the AERC's effectiveness are less obvious, but worth mining for possible lessons, given the difficulty many CIS countries have faced in developing effective regu-

Box 3.3. The Emergence of Financial Companies as Strategic Investors

Armenia's experience represents an early example of a developing trend. Many countries have found far less interest in their infrastructure assets in recent years, with very few large international operators expressing interest and willing to take significant equity positions. Financial investors using highly geared financial structures are increasingly taking their place as bidders. The current bidders for the recent sale of the Karachi Electric Supply Corporation are all financial investors, with no power sector experience. The 2003 purchase of Northumbrian Water, in the United Kingdom, was undertaken by Macquarie, an international investment bank with a record of infrastructure purchases (though mostly in industrialized countries)

Though the GoA split with the IFC and EBRD in its final decision, there is a growing recognition in the donor community of this trend and the need for a framework to possibly accommodate such investors.

lators. Some veterans of the reform process have observed that the AERC ultimately turned out to be stronger, more independent, and more effective than many within the GoA had envisioned or desired, and that it was established initially as a nod to donor requirements only. Indeed, the AERC's effectiveness may stem, in part, from the fact that it had several government opponents during the early stages of power sector reform, and therefore learned early on to defend its role and mission. Armenia now has one of the region's strongest legal frameworks supporting its regulator, through legislation the AERC has itself actively helped to draft.

The AERC's independence very likely derives from the make-up of its early leadership. The first commissioners had the benevolent combination of substantial power sector experience yet lack of serious conflicts of interest. The AERC's first chairman, though he had some energy sector experience, came from the Ministry of Economy, not from the Ministry of Energy or from the energy sector itself. The chairman and his fellow commissioners had all been involved, to some degree, in Armenia's broader program of economic reforms since independence, and all enjoyed substantial respect within the GoA for the roles they had played. The early AERC stands in contrast with regulators established elsewhere in the region (and elsewhere in the world) that often consist of former utility executives or line-ministry officials.

Donor aid and recognition also made a significant difference. The AERC benefited early on, and continues to benefit from extensive technical and material support from the World Bank and USAID. The donors recognized the nascent AERC as a potentially important force in the energy sector. As mentioned, the commissioners had all been involved in other aspects of Armenia's economic reforms. All were known to the donors and respected for their earlier roles in other arenas. Whereas donors frequently engage first on the most substantive matters with ministerial-level bodies, they proved willing to engage with the AERC commissioners extensively from the outset. This helped to raise the AERC's stature and importance within the GoA as a lynchpin in the power sector reform process.

A comparison with other privatization efforts provides evidence of what can happen without a regulator. Georgia's regulator, Georgian National Energy Regulatory Commission, was relatively ineffective, had very little input in the process of privatization, and was given only a very brief period of time to consider AES' bid for the Tbilisi distribution assets. Closer

to home, the privatization of Armentel happened without any regulator. The AERC was not formally given responsibility for telecom regulation until 2003, five years after the privatization of Armentel and well after problems had emerged.⁴¹ The GoA had no knowledgeable ally in the telecom sector to help it in the way the AERC had throughout the power sector reforms. Regulated only by what turned out to be a seriously flawed license, Armentel was not subject to a clear and consistent regime of oversight on pricing and quality of service.

Role of the Donors

Donor support was significant in driving and sustaining operational and financial reform of the utilities as well as broader institutional and legal reform in the sector. Donors helped to shape the agenda primarily through conditional loans and technical assistance. The initial World Bank Structural Adjustment Credit (SAC) for 1996 was conditional upon requirements that collections be improved and tariff levels raised to cover operating costs. SAC II–IV required further progress in these areas, as well as the development and implementation of a comprehensive financial rehabilitation program and privatization strategy for the sector. Appendix C shows World Bank conditionality related to power sector reform over the past 10 years. USAID financed extensive technical assistance for the sector, most significantly for the AERC, through PA Consulting. PA Consulting's work with the AERC included the development of a proposed market design, market rules and procedures, operating procedures and connection requirements, and extensive training on a variety of regulatory issues.

Donor assistance was also essential to the physical rehabilitation of the system. Most of the effort was directed at repairing and upgrading the transmission and distribution network. USAID funded the plan, beginning in 1995, to move meters from individual apartments to public areas of buildings and installation of the AMDAS system. This effort was replicated throughout the country and contributed substantially to the reduction of meter tampering and facilitation of accurate meter reading. USAID also financed, between 1997 and 1998, the installation of the 12,000 tamper-proof meters throughout the power system and implementation of the new customer information system. Kreditanstalt für Wiederaufbau has also been a long-standing donor, financing rehabilitation of the transmission and distribution system, and a number of hydropower plants.

The pattern of donor support suggests an extended presence and a staged approach may be more appropriate than a sudden rush to privatization. Donor support underpinned all stages of reform, and continues to do so. In the power sector, World Bank, International Monetary Fund (IMF), and USAID support were most significant and enduring. Appendix C shows World Bank conditionality from 1994 to 2004, related to the power sector. At the heart of the World Bank reform strategy were development an adequate legal and regulatory framework, improvement of the financial position of the utility (through improved collections), tariff reform, sector restructuring and regulation, and, finally, privatization. World Bank

41. The AERC is in the process of transforming itself into a multi-sector regulator (called the Public Services Regulatory Commission), having recently assumed responsibility for water and wastewater services as well as telecom. There is also speculation that the PSRC may soon be given responsibility for rail transport.

Country	Type of Loans; Period 1	Payables/ Receivables	Tariff	Regulation	Restructuring	Privatization
	Starting year					
Armenia	Rehabilitation Credit, SAC I–IV; 1995–2002	1996	1995	1997	1997	1998
Georgia	SAC I-II, Energy Sector Adjustment Credit; 1996–2001	1996	1996	1996	1996	1996 (prep) 1999 (execute)
Kyrgyz Republic	CSAC; 2000–present		2000	2000	2000	2000 (prep)
Moldova	SALII, SAC, SACIII: 1997–present	1997	1997	1997	1997	1997–1998
Ukraine	PAL; 2001–present	2001	2001			

Source: Saavalainen, Tapio O., and Joy ten Berge. 2003. *Energy Conditionality in Poor CIS Countries*. Processed. Washington, DC: International Monetary Fund.

financing proceeded in a deliberate sequence in Armenia, in contrast to loans to Moldova, Georgia, Ukraine, and the Kyrgyz Republic. Table 3.2, reproduced from a study by Saavalainen and ten Berge study, shows the staging in these countries of various types of reforms.⁴²

Conditionality was effective because it reflected intense discussion and cooperation with the GoA, with flexibility on timing but not substance. The so-called third sector or civil society was absent from the newly independent states of the former Soviet Union. The World Bank and other donors served in those early years as a proxy for the views of non-government stakeholders. Donor representatives developed a tight relationship with their counterparts in the GoA and were able to come to understand the obstacles they faced while arming them with arguments for reform. Conditionalities arose from these discussions, a meeting of the minds articulated as legal conditions. Though not all World Bank loan conditions were always met on time, most were indeed met, a reflection of the fact that power sector reform and privatization often take much longer than planners on either side can predict.

The pattern of lending also suggests the need for a balanced mix of structural adjustment loans and sector-specific investment lending. A World Bank Operations Evaluation Department's (OED) internal review of lending to Armenia found substantial synergies between investment and adjustment lending in the energy sector.⁴³ The OED report also notes that the World Bank's analytical work "facilitated the dialogue with the government and also laid a foundation for lending." The World Bank's approach emphasized consolidation and cost-effective reform of the existing system rather than immediate investment

42. Saavalainen and ten Berge, "Energy Conditionality in Poor CIS Countries."

43. World Bank Operations Evaluation Department. 2004. "Armenia Country Assistance Evaluation." Washington, D.C. Overall, the review found that "Energy sector reforms were politically difficult . . . but largely successful and critical for growth" and that the reforms "helped the country improve its fiscal and quasi-fiscal performance."

in new infrastructure. This can be seen, in particular, in the GoA's approach to reducing commercial losses. It was a World Bank study that influenced the GoA's decision to focus first on the areas of most significant commercial losses: installing new meters in major system loss areas at a cost of US\$20 million (solving roughly 60 percent of the problems with commercial losses), rather than immediately investing the US\$80–100 million estimated to install new meters everywhere (to address 100 percent of the problems with commercial losses). The World Bank also pushed, for example, the cost effectiveness of meter relocation rather than complete meter replacement, and differed from the EBRD in an assessment of the need for an additional unit at the Hrazdan thermal plant.

IMF conditionality largely supported World Bank conditionality by focusing on tariffs and bill collection.⁴⁴ From 1996 to 2001, the IMF set quarterly ceilings on quasi-fiscal balances, but this conditionality was changed to an indicative target in 2002 because of the difficulties associated with measuring quasi-fiscal debt. Armenia ultimately met only 50 percent of the IMF's conditionalities, but proved most successful among the CIS countries in meeting conditionalities related to tariff rationalization, collections, and reduction of quasi-fiscal deficit (though the Saavalainen and ten Berge analysis find that tariffs still fall short of long-run marginal cost supply levels). The single most significant lesson Saavalainen and ten Berge draw from their analysis is that Armenia's experience with collections is "that targets on tariffs and collection rates need to be coupled with other measures to boost payment discipline—such as ability to cut off nonpaying customers, better metering, and strengthened corporate governance. An important condition for a success is that the link between better quality of supply and higher tariffs and collections should be credible."

Role of MRH as a Different Kind of Strategic Investor

The source of MRH's success thus far with Armenia's distribution network defies simple explanation. Other operators in the region have taken similar measures to curb theft and boost collections. The question remains why MRH succeeded where other these other operators have failed. MRH simply appears better able than other foreign operators to do business in the region. The company's operation of the EDC has lacked much of the conflict with the government, customers, the public, and other sector entities that characterized other privatization efforts in the region.

MRH's strong local partner undoubtedly helped it be effective in understanding and managing these risks. As a member of parliament and active in other areas of Armenian business, the local partner was influential in making sure MRH met with the right people, and fully understood the environment in which it would be expected to operate the EDC. There was much more interaction between MRH and relevant government bodies than there had been in previous tenders, and the local partner undoubtedly facilitated this. MRH participated in a multitude of meetings with the PSRC and other GoA officials before submitting its bid, and engaged a special research body under the Ministry of Energy to conduct a technical audit of the entire system over a two-and-a-half-month period. Finally, as mentioned earlier, MRH's relations with GoA authorities (such as tax and law enforcement) have been much more amicable than, for example, AES' in Georgia.

44. This analysis is based entirely on the Saavalainen and ten Berge analysis of IMF power sector conditionality.

The ease with which MRH has done business in Armenia may also be due to the GoA's view that, among potential bidders, MRH was the least political. There was a perception within the GoA that MRH's interest lacked the political elements that RAO UES and AES carried with them. The political overtones of RAO UES' expansion in the former Soviet republics is well known, but AES' involvement was also perceived as politically motivated to some extent, given that company's experience in Georgia. There was a perception within Armenia that AES had been able to enter Georgia thanks to U.S. Overseas Private Investment Corporation guarantees and the promise of ongoing support from USAID. There was consequently some degree of consensus within the GoA that the U.S. government tried hard to keep AES in Georgia, keep RAO UES out, and wanted to do the same in Armenia. MRH may have also been more nimble than other prequalified bidders in that, as a little-known, privately held firm from outside the energy sector, MRH's decisions were not subject to widespread shareholder scrutiny or public perception elsewhere in the world.

There is considerable evidence that MRH understood the risks of purchasing the EDC better than other prequalified bidders. The fact that MRH was the only party interested in buying ENA suggests that it may indeed have had a different understanding of the true level of operational risk and return involved in purchasing the company. Prequalified bidders in the first two tenders expected far higher returns and more limited requirements than those to which MRH eventually agreed. Sources close to the first two tenders say that other prequalified bidders were prepared to offer only US\$1 million in cash, would have required a return on assets in the 20–25 percent range, tariffs in the US\$.02–.025/kwh range, a waiver of any requirement for investment in the system, and no provisions requiring loss reductions. At least one prequalified bidder told the GoA that there were no returns to an investment in the system, suggesting the government would have to pay a strategic investor take over the EDC. There are, as of yet, no signs that MRH miscalculated. The company is reported to have positive cash flows of roughly US\$10 million per year, and is rumored to have recently sold the company to RAO UES for US\$73 million, more than seven times the EDC's US\$12 million sale price (the equity component) in 2002.

It is also possible that MRH may simply have been more willing to tolerate the risks associated with operating Armenia's EDC. The company appears to have a different risk tolerance, and pursue a different category of investments than do large, international power companies. Its record of investments in the rough and volatile Ukrainian and Russian metallurgical industries suggest this is true. MRH was more willing than other prequalified bidders to waive certain contractual safeguards. The company waived, for example, indemnity guarantees as part of the final privatization agreement. AES, RAO UES, and Union Fenosa are all energy companies that look to other energy companies they can purchase, rehabilitate, and operate over several decades. MRH, in contrast, is a fixer, a turnaround firm with a record of rehabilitating troubled companies for resale. MRH's planned (and profitable) sale of ENA—after barely two years of operation—is consistent with its pattern of turnaround investments.

Concluding Lessons of Caution

Most of the lessons cited draw from the successes of Armenia's power sector reforms. The reform process, was not, however, without its complications, failures, and disappointments, all of which also provide potentially useful lessons:

- *The sale to MRH had some characteristics of a direct sale rather than a competitive tender.* The nature of the sale to MRH, all of which took place in less than three months, may have limited the scope for other bidders to express interest. Indeed, the unsolicited nature of MRH's interest as a buyer, and the extensive one-on-one interaction with the GoA, are in some ways more characteristic of a private, one-off direct sale rather than an open bid or auction. And though the tender documents prepared by IFC's Private Sector Advisory Services and PA Consulting were used in the transaction with MRH, criteria relating to firm experience and audited financial statements were tailored to suit MRH as a different kind of bidder and owner than the other prequalified firms.
- *The nature of the sale may have compromised the purchase price and in the longer term raised investor perceptions of risk.* Auctions are organized in such a way as to maximize the bid price for an asset with a given set of characteristics. Compromising the auction mechanisms therefore theoretically compromises the purchase price, or lessens in other ways the value of the bid (for example, by sticking the GoA with less than the best set of contract terms so that it takes on more risk than it might have in an open auction). Potentially more serious for Armenia, however, is the effect on investor perceptions about transparency and fairness. A one-off deal masquerading as the outcome of an auction could indicate to investors that the only way to reliably win business in Armenia is through arbitrary means unrelated to market economics, such as personal connections or graft. This could raise investor perceptions of risk and with it the cost of capital in Armenia. Nevertheless, directly negotiated deals are common in the private sector, and can, to the extent that they allow for better communication between the buyer and seller, yield better prices than auctions. Armenia's experience suggests that making such deals work requires clear communication by the government to its taxpayers (and other financiers, including donors) of the reasons for, and terms of, the direct sale.
- *The nature of the sale had more concrete effects on ENA and its customers.* A less theoretical effect of the sale to MRH was the refusal of international financial institutions (IFIs) such as EBRD and IFC to participate in the process. The withdrawal of the IFIs from the final tender meant MRH has had to take short-term, high interest commercial loans. Tariffs have not been increased since MRH's purchase of ENA, so the higher cost of debt has not been passed along directly to customers. The higher debt costs may, however, have reduced the company's ability to invest in system improvements, meaning customers could suffer longer-term deterioration in service quality.
- *A lack of clear investment requirements and service quality standards may have jeopardized investment in the grid.* As discussed in previous sections, the GoA showed innovation by dropping any required level of investment as part of the sale of ENA, and instead relying on service quality standards. However, there is some fear within the GoA, PSRC, and among donors that the service quality standards were never sufficiently developed to deter MRH from sacrificing investment in the distribution network (and hence longer term service quality) for shorter term profits.
- *If end-user tariffs do indeed reflect long-term costs of service, it may, at least in part, be due to coincidence.* End-user tariffs have remained unchanged since 1999, but tariffs within the sector have changed considerably. Tariffs to the Vorotan cascade and High Voltage Network of Armenia were increased during 2004. ENA was not granted a

tariff increase (and so its margin was reduced) because of a gradual reduction of losses accomplished in accordance with its license and a perception by the PSRC that ENA had failed to make investments required to sustain or improve service quality. Tariffs will undoubtedly need to increase again in the future, and this will be a test of the PSRC's independence and the GoA's political will.

- *Transaction advisors had perverse incentives.* Though not addressed in detail in the body of this report, Armenia's experience with transaction advisory services also proved problematic in different ways throughout the reform process. The transaction advisors were not always well suited for the job, or had conflicts of interest that, if not in practice, in principle could have compromised their ability to effectively represent the interests of their client. Raiffeisen was the only advisor to bid on the first round of transaction advisory services to the GoA, and the services they provided were largely regarded by their client as unsatisfactory. As did Merrill Lynch for its advisory role in the Armentel privatization, Raiffeisen's fee was success-based, tied both to purchase price and future investment commitments by the bidder.⁴⁵
- *Armenergo was left in place too long with no clearly defined replacement.* ENA's collections were at 100 percent nearly immediately after privatization, but generators still were not being paid in full by the single-buyer, Armenergo. Many generators still have outstanding Merrill Lynch receivables with Armenergo, which they will doubtfully ever recover. Removing Armenergo earlier in the process, however, may have proven difficult and added strength to the voices of vested interests that threatened to derail the reform process.

45. Lesson 7 in the conclusion to this paper suggests how governments may be able to reduce the risks of employing transaction advisors on a performance-fee basis.

Generalizing the Lessons Learned

Though power sector reform is never a one size fits all exercise, Armenia's experience offers a number of possible lessons for other countries undertaking similar processes.

1. *As a first and probably most important lesson, political will is paramount.* The best efforts of donors will ultimately prove ineffective if government officials have no interest in making the reforms stick. No contract can protect private operators sufficiently from a government that simply does not want them there. The importance of maintaining political will does not diminish after privatization. MRH itself has said that its success in Armenia is owed to the fact that the government kept its promises and refused to back peddle on any aspect of sector reform.
2. *A corollary to the first lesson: personalities matter.* A successful reform process will be driven by influential champions within government. Enthusiasm within pockets of government may be insufficient if the personality leading the reform lacks sufficient respect or influence, or is perceived to have a vested interest in pushing the reforms along a particular path. This lesson may seem very difficult to replicate from one country to the next, but governments and donors can do a number of things to improve the odds of finding a champion.
3. *Distance control of the process from vested interests.* This means looking for reformers who have the right set of skills, a broad base of respect and credibility, but who do not come directly from entities within the sector itself. The line ministry, for example, may be a poor choice to lead the reform process, and the selection process for regulatory officials should include experts with a broader knowledge of utilities, regulated industries, or competition, but not necessarily those from

the utility or line ministry itself. Some degree of conflict between the champions of reform and the vested interests may in practice be helpful to the success of the overall process.

4. *Enable the champions through early and substantive contact.* Donors can increase the stature of reform champions by including them in substantive discussions from the outset of the reform process. These champions may be found in regulatory commissions (as with the PSRC in Armenia) or in nonline ministries.
5. *Initial failure may be better than not trying at all.* The bidding documents and legal and regulatory framework benefited substantially in Armenia from the lessons of the first, failed tender. There were not, in Armenia, high reputational risks associated with failure because very few within the GoA were certain they wanted privatization anyway. The initial privatization effort demonstrated to many that privatization was indeed possible, given certain changes, and warranted more serious consideration.
6. *The experience of the first failed tenders suggests a further lesson: the more frequent and substantive communication between bidders and the owner, the better.* One of the advantages of the extensive interaction between the GoA and MRH was that both sides were able to better assess the credentials and the intentions of the other. Only when serious potential bidders started visiting Armenia did more within the GoA begin to recognize privatization as a possible solution to the power sector's problems. Discussions with bidders during this first tender gave the GoA a better understanding of investor willingness to bear risk, and what needed to be done to prepare an acceptable package. Had world events been different in autumn 2001, the second tender might have been a success.

Notwithstanding the observation about auction prices in the previous section, it is possible that auctions can produce a lower price for an asset than a negotiated deal, given the fact that negotiated deals often allow for better communication between buyer and seller on the terms of purchase, value, and condition of the asset. Some sort of staged bidding process may be a way to capture the benefits of both auctions and directly negotiated deals. This can be hard to institutionalize as part of a normal tender process where interactions between bidders and the government are highly formalized so as not to give any single bidder advantage, but is essential where foreign bidders often do not have sufficient information about the assets they are considering, nor do governments have sufficient information about potential bidders. Some governments have used a two-stage bidding process for tendering other PSP contracts. This involves the initial submission by prequalified bidders of a technical proposal only, and then face-to-face feedback meetings with bidders for the owner to provide feedback on proposals and receive feedback on the bidding documents (which of course includes the draft contract).

Finally, as a matter of policy it should be necessary to test the market through a transparent, competitive process, but Armenia's experience suggest that the seller should also be prepared to suspend the sale if the conditions are not in the public interest and should be prepared to consider unsolicited bids as a fall back.

7. *In terms of actual implementation of reforms, an integrated, cross-sectoral approach is important:* The pace and benefits of power sector reform can be enhanced, for

example, by also reforming major users in the water sector and other industries. Efficiency gains to the economy can be improved and deadweight loss avoided by removing distortions in markets for inputs (for example, by removing fuel subsidies and by rethinking the value of precious natural resources like Lake Sevan). Tackling the shadow economy is similarly easier if there is light coming in from all sides (for example, budgetary and tax reform simultaneous to power sector reform).

8. *A comprehensive approach also means consideration of the social impact of reform, as an element separate from power sector reform.* Social protection mechanisms should be implemented in parallel, but not within the power sector reform program. As the government's power sector financing burden is lightened through higher tariffs, higher collections, and fewer commercial losses, it should use the newly available funds to provide subsidies like the Poverty Family Benefit Program in Armenia. Though the poor are rarely the primary source of large power sector deficits, they will suffer disproportionately the effects of power sector reform unless adequate social protection mechanisms are put in place.
9. *Armenia's experience suggests that it makes sense for the government owner to do as much work as possible before privatization.* The more a government can do upfront, the better. A solid legal and regulatory framework cannot wait until after, or during privatization, but needs to be in place well before to attract serious bidders. Failing to observe this lesson creates opportunities for either government or the private sector buyer to take advantage of the other. It also may create incentives for the transaction advisors, if employed on a performance-fee basis, to press for regulatory and fiscal regimes that will maximize privatization proceeds at the expense of economic efficiency. Armenia's experience with the privatization of Armentel is illustrative of what can happen when privatization is attempted as a first step, before broader legal and regulatory reform. Indeed, many reform tasks may be more effectively addressed by the government than by a private sector operator. Tariff reform and rebalancing is one significant example from Armenia. If a government cannot withstand the political pressure that comes with raising tariffs on its own, then it is even more likely to buckle to pressure when a private sector operator attempts to raise tariffs. Private sector operators will always be perceived as having profit in mind, rather than simple cost recovery. If the government can raise tariffs to cost recovery levels on its own, it is far better placed for subsequent private sector participation.
10. *This lesson in turn suggests (to donors) that it is important to provide the right mix of structural adjustment, investment, and technical assistance financing:* The GoA and its donors appear to have gotten the mix right, in some cases foregoing new investment spending in favor of more cost-effective administrative measures. One specific donor-funded effort offers an example that other countries may want to consider when undertaking power sector reform: Meter relocation is cheaper and often just as effective as installation of new meters. A great deal of progress can be made in tackling early the problems that are easiest and cheapest to solve.
11. *In contracting with a private operator, it makes sense to focus less on the level of investment an operator is willing to commit and more on service quality or other outputs.* As with all types of PSP contracts, the government need only be worried about

inputs if it certain what *outputs* it wants to achieve. To the extent that the government knows what and where the source of its problems are (for example, commercial losses and under collection), it need not worry as much about specifying how the private operator should correct these problems. Investments are needed to either improve quality of service or reduce costs of operation. As long as the utility is prepared to work within the tariff approved by the regulator (or agreed in the contract), there may not be a need for the government to specifically evaluate investment plans as part of the bid.

12. *Governments and donors should consider adapting standard bidding requirements and procedures to accommodate a new kind of strategic investor.* Experience from Armenia and PSP in a number of other countries have shown that consortia of companies other than large, international operators may make suitable bidders. Such consortia may include, for example, international business turnaround or insolvency firms associated with local engineering firms or large international engineering services firms partnered with local consulting firms that have extensive experience with the utility up for tender. The GoA's willingness to consider a different kind of investor paid off in that the government got a firm with a different tolerance for risk, different set of skills, and arguably more local knowledge than most large international operators. Current donor-designed frameworks for privatization do not sufficiently accommodate such nontraditional strategic investors. Rather than force governments to go it alone with these investors in direct negotiations, a framework should be established through which such bidders can be included in an open tender process satisfactory to donors. The framework should include a process through which, if after privatization (as most often happens), the details of tender documents are adjusted through direct negotiations, a framework exists to ensure that the principles and general terms of the open tender are not violated nor the benefits of privatization diminished.

Postscript

Work on this paper began in November 2004, just as press reports first surfaced that MRH was discussing the possible sale of ENA to a subsidiary of Russia's RAO UES. Press in early 2005 added a sale price to the story: US\$73 million.

Initial communication between the GoA and MRH on the subject suggested that RAO UES had been given management rights only. This drew questions and criticism from donors and the media, given the requirement that MRH receive explicit GoA approval before selling more than 25 percent of ENA. The World Bank and USAID questioned publicly the notion of a management contractor paying US\$73 million for the right to manage a utility (rather than receiving a small annual payment to manage a utility, as is the case in most management contracts).

MRH eventually submitted a letter to the GoA and PSRC on September 8, 2005, asking permission to sell 100 percent of its ownership of ENA to Interenergo BV a RAO UES subsidiary. The Armenian cabinet granted the request, in principle, on September 15, 2005, through GoA Decree 1568-A. Final approval is subject to the negotiation and drafting of a contract between the GoA and the new owners under which Interenergo BV will agree to fully undertake the commitments of MRH in the original Sale and Purchase Agreement. The decree requires that RAO UES subsidiaries meet the definition of a strategic investor stipulated in the Law on Privatization, as well as the prequalification criteria specified for the initial tender of the EDC.

APPENDIXES

Overview of the Armenian Power Sector

Market Structure

The power sector reforms in Armenia have resulted in the creation of the following separate entities:

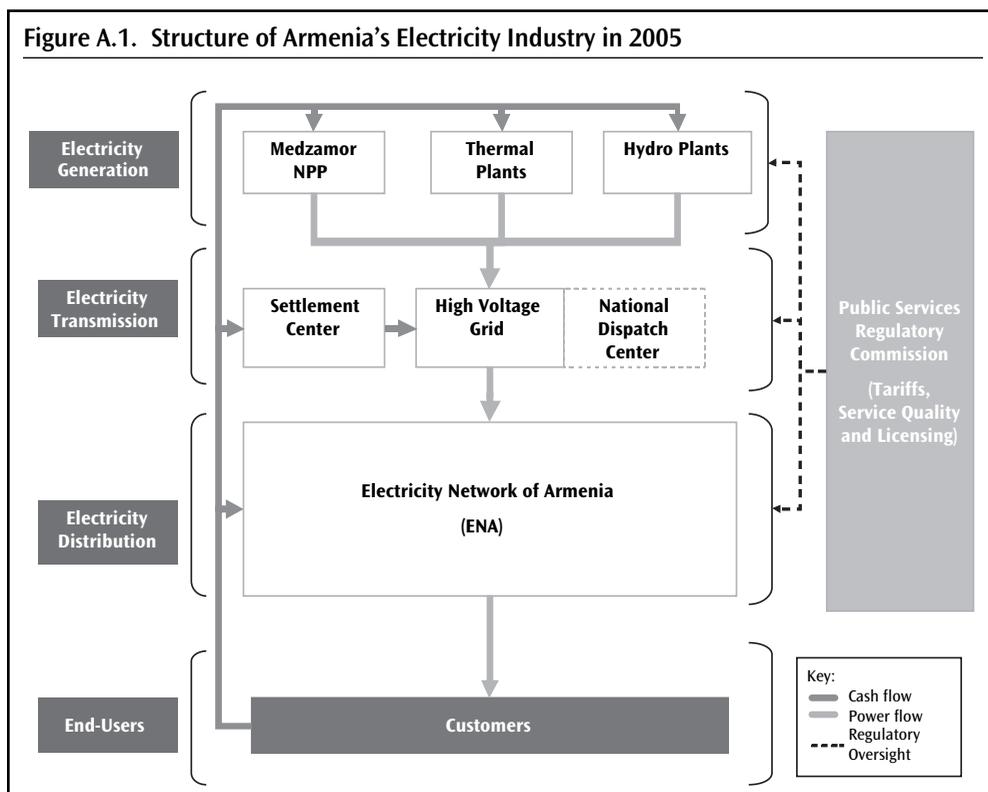
- Power generators,
- A high voltage power transmission network company,
- An electricity distribution company,
- An account settlements center, and
- A power system operator.

Until December 1, 2004, contracting and financial accounting functions were performed by Armenergo CJSC, which acted as a single buyer for the electricity system. ENA has now effectively become the single buyer, and contracts directly with generation companies. A separate grid operator (Power System Operator CJSC) has also been established to take over from Armenergo all dispatch functions. The Japan Bank for International Cooperation has extended loans for implementation of a Supervisory Control and Data Acquisition system for the grid operator.

At present, ENA is the only electricity distribution company. ENA purchases electricity through direct contract from the electricity generating companies and sells it to its customers, and therefore has three separate contracts with:

- High Voltage Grids CJSC,
- Settlement Center CJSC, and
- Power System Operator CJSC.

Figure A.1 shows the current structure of the power sector in Armenia.



Installed Power Generation Capacity

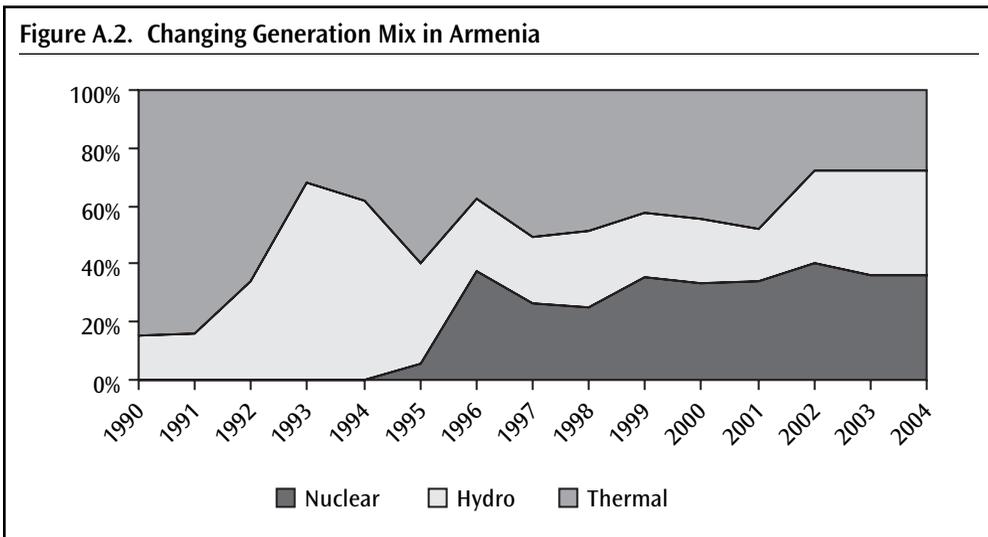
Armenia depends on three types of power generation: thermal, hydropower, and nuclear. The installed capacity of the thermal power plants (TPPs) in Armenia is 1756 MW. Thermal power is primarily needed to cover seasonal peaks during the fall and winter low water and cold seasons. Table A.1 provides data on the capacity and ownership of each of Armenia's

Generation Type and Name	Capacity	Owner
Thermal	1756	
Hrazdan TPP	1100	Russian Federation
Yerevan TPP	550	Ministry of Energy, GoA
Vanadzor TPP	96	Zakneftgasstroy-Promethey
Hydropower	1032	
Sevan-Hrazdan cascade	556	RAO "Nordic"
Vorotan cascade	400	GoA
Small HPPs	76	Various private owners
Nuclear	408	
Medzamor Unit 2	408	GoA (but under financial management of INTER RAO EES)
Total	3196	

Note: TPP, thermal power plant; HPP, hydropower plant.

generators. The installed capacity figures fail to reflect the restricted availability of many of these plants because of their poor operating condition or, in the case of hydropower plants, environmental restrictions.

Figure A.2 shows the shifting mix of power actually generated between 1992 and 2003. The shift from hydropower to nuclear and thermal power since 1995 was due to the restart of Medzamor Unit 2. It was followed by the reduction of generation at the Sevan-Hrazdan hydropower plant (HPP) cascade, caused by strict limitations on water use from the (Sevan) lake for the purpose of irrigation only, with quantity of water use regulated by special decrees of the GoA.



Source: Power's Promise Dataset.

The current generation structure is not likely to change in the near future. Despite some pressure from abroad to shut down Medzamor, the Ministry of Energy is seeking external aid to maintain the safe operation of Unit 2 for another decade, which means that nuclear energy will remain one of the most important energy sources in Armenia.

Medzamor

Medzamor is the only nuclear power plant in the region and contributes significantly to the energy independence of Armenia. Depending on the particular year, Medzamor's share of the generation mix can represent as much as 40 percent. Medzamor was built between 1976 and 1980 with two reactors and 815 MW of generating capacity. Medzamor was the primary power provider of Armenia until 1988, when it was brought to a standstill after a major earthquake. The severe energy crisis that followed the earthquake and the collapse of the Soviet Union obliged the GoA to restart Unit 2 in November 1995 after extensive renovation and additional measures for improving the seismic safety of the plant.

Medzamor Unit 2 is an old Soviet water cooled, water moderated energy reactor, regarded by many in the international community as a very dangerous design.⁴⁶ The Euro-

46. Medzamor is often compared in this context to Chernobyl, also a water cooled, water moderated energy reactor.

pean Union has, in particular, been pressuring Armenia to shut it down, but some Russian and Armenian experts have argued that the plant can continue functioning until 2016. Medzamor has undergone 118 safety and security upgrades since its reopening in 1995. Dialog continues between the European Commission and the GoA regarding the future of Medzamor, but given the country's dependence on the plant's output, an imminent shut-down is unlikely.

Other Thermal Power Plants

Armenia's thermal power plants provide another 40 percent of total electricity generation. The biggest is Hrazdan TPP with a total installed capacity 1,110 MW. TPPs operate with both natural gas and mazut (heavy oil). As mentioned above, however, installed capacity figures fail to reflect the fact that many of these plants have much lower availability due to their poor condition. The Ministry of Energy retains ownership of the 550 MW Yerevan TPP. A Russian company, Zakneftgasstroy-Promethey, owns the 96 MW Vanadzor TPP. The GoA is actively looking to build new, combined cycle plants. A second, 200 MW combined cycle unit, financed by a soft loan from the Japan Bank for International Cooperation, is currently planned for Yerevan TPP. Table A.2 provides data on the capacity and the electricity generated by these plants.

Plant	Units (MW)	Commissioning	Generation (GWh)				
			1997	1998	1999	2000	2001
Hrazdan TPP	1110		2273	2245	1821	2120	2325
Unit 1	2 × 50	1966–67					
	2 × 100	1969					
Unit 2	3 × 200	1971–74					
	1 × 210	1974					
Yerevan TPP	550		758	569	416	360	244
	Unit 1	5 × 50					
	Unit 2	2 × 150					
Vanadzor TPP	96	1964–76	1.9	—	—	—	—

Hydropower Plants

Hydropower is Armenia's only significant indigenous energy resource. The total hydropower installed capacity in the country is 1,032 MW. There are currently two important systems with hydropower plants, the Sevan-Hrazdan HPP cascade system (six plants, 556 MW installed capacity) and the Vorotan HPP cascade (three plants, 400 MW installed capacity), as well as a number of small run-of-river HPPs, with a total capacity of 76 MW. Having transferred the Hrazdan HPP cascade to Russia in 2003, the only remaining state-owned HPP in Armenia is the Vorotan HPP. The Vorotan cascade HPPs have the lowest cost of production in Armenia. The GoA has expressed an intention to eventually privatize the Vorotan HPP cascade.

There are currently 29 small hydropower plants (under 30 MW) operating in Armenia with a combined total capacity of 76 MW. Dzora HPP is the biggest among the small HPPs, with 26 MW of installed capacity. Eleven new HPPs are currently under construction, and the PSRC (formerly AERC) has granted an additional six construction licenses. As these are run-of-river plants, their share of total generation depends on weather conditions.

Transmission and Distribution

The electricity transmission network of Armenia consists of the following:

- 330 kV, 164 km, 1 substation,
- 220 kV, 1,323 km, 14 substations, and
- 110 kV, 3,169 km, 119 substations.

Most of the 110 kV lines have now been transferred to ENA. ENA's other assets include:

- 35 kV, 2,675 km, 278 substations,
- 6(10) kV, 9,740 km overhead and 4955 km cable lines, and
- 0.4 kV, 13,570 km overhead and 2160 km cable lines.

The capacity of the existing high-voltage network is considered sufficient for the current and the forecast domestic loads. Armenia has power interconnections with all neighboring countries. The power interconnections are shown in Table A.3.

Armenia's Intersystem Connections		
Country	Connection Type	Current Status
Azerbaijan	Line HVL-330 kV (100 km)	Out of use
	Line HVL-220 kV (63.5 km)	Out of use
	Line HVL-110 kV (98 km)Out of use	
	Line HVL-110 kV (30 km)Out of use	
Georgia	One line HVL-220 kV (65 km)	Operational
	One line HVL-110 kV (35.8 km)	Operational
	One line HVL-110 kV (19 km)	Operational
Turkey	One line HVL-220 kV (65 km)	Out of use
Iran	One line HVL-220 kV (78.5 km)	Operational
	One line HVL-220 kVOperational	

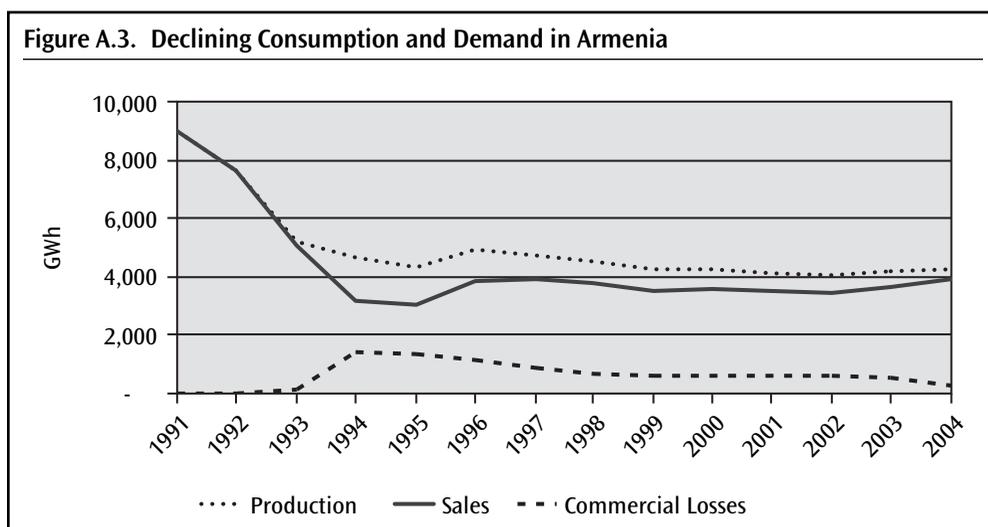
The operator of the transmission system is High Voltage Grids CJSC, a state-owned company.

Work has begun on rehabilitation of 220 kV substations. With loans from Germany's Kreditanstalt für Wiederaufbau, the substations at Vanadzor-2 and Kamo have been completely overhauled. Partial rehabilitation work has started at another eight substations, financed with World Bank loans.

Rehabilitation of 33 110 kV substations is also expected to commence in the near future, using soft loan funding from Japan Bank for International Cooperation. The bank is also planning to finance the procurement and installation of 150,000 new time-of-use electronic meters for low income groups.

Consumption and Demand

Electricity consumption and demand has decreased considerably since Armenia's independence. A number of factors contributed to this, including the decline in Soviet industry, a reduction in technical and commercial losses, gradual increases in tariffs, and expansion of the gas network, which allowed for substitution from electric to gas heat. Figure A.3 illustrates the pattern of consumption between 1994–2004.



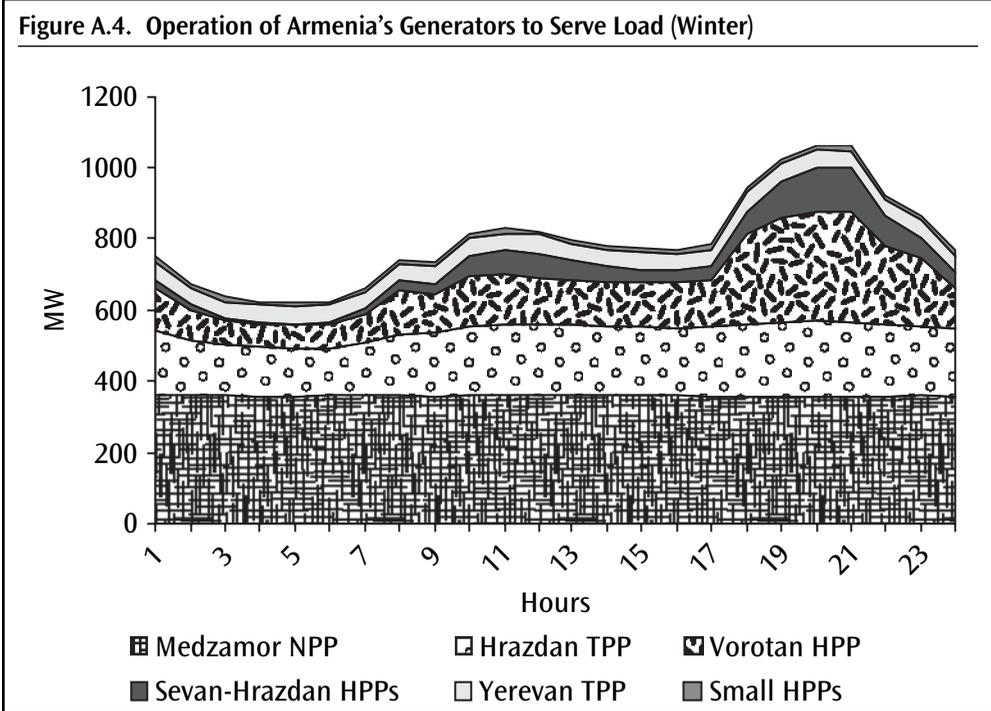
Source: Power's Promise Dataset.

Figures A.4 and A.5 show how daily load during 2003 was typically served during winter and summer months.⁴⁷

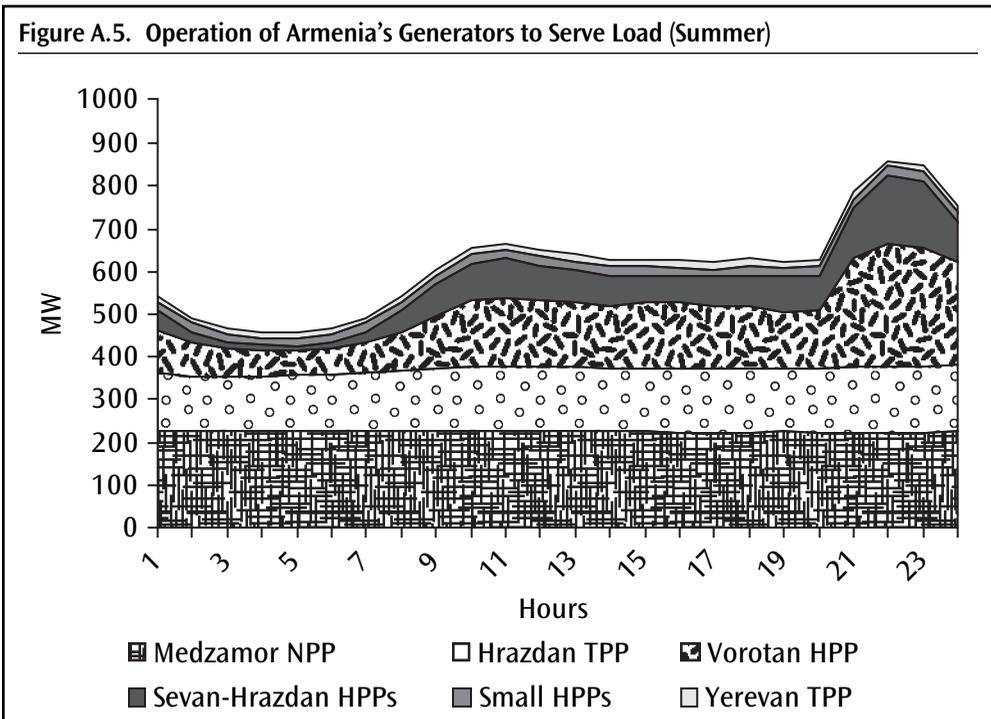
Peak load has decreased considerably over the past decade. Armenia at present possesses substantial surplus of generation capacity. Peak demand in 1989 reached 3300 MW while peak demand in Armenia during the last several years has never exceeded 1100 MW, as Table A.4 illustrates.

Armenia's capacity surplus has allowed it to become a net exporter of power to its neighbors.

47. Based on monthly average production during each hour for the months of January, February, and March (winter) and June, July, and August (summer).



Source: Ministry of Energy.



Source: Ministry of Energy.

	1999	2000	2001	2002	2003
Installed capacity, MW	3190	3190	3190	3190	3190
Available capacity, MW	2,586	2,586	2,586	2,586	2,586
Peak demand, MW	1071	1070	1073	1075	1078

Imports/Exports

Existing intersystem connections and a surplus of generation capacity has allowed Armenia to become actively involved in the electricity trade in the region. This was also the case before independence. As a Soviet republic, the Armenian power sector played an important role in supplying electricity for the region. The recommissioning of Medzamor Unit 2 in 1995 boosted production of electricity considerably and has allowed for expanding electricity export activity. Table A.5 provides historic figures on export/import activities for the period 1991–2003.

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Export, GWh	728	336	134	58	63	0	124	399	704	816	701	586	600	813
Import, GWh	2,299	670	115	12	2	0	67	78	463	352	330	159	300	50

At present, two types of export/import activities are conducted by Armenia:

- Swap of electricity with Iran
- Electricity export to Georgia

Iran and Armenia have linked their electricity grids, allowing for power sales in both directions driven by seasonal differences in demand between the two countries. During the summer months, Armenia exports its power to Iran, and during the winter months it imports from Iran. Armenia also supplies some of its surplus seasonal electricity to Georgia.

Chronology of the Reforms

Chronology of Key Events in the Armenian Energy Crisis and Power Sector Reforms				
Date	Key Events	Commercial Losses (total, as percentage of production)	Collections	Fiscal and Quasi-Fiscal Subsidies to Power Sector (US\$ million)
1988	<ul style="list-style-type: none"> ◆ A massive earthquake (6.9 on the Richter scale) with its epicenter in Spitak forces the shutdown of Medzamor nuclear power plant. ◆ The formal territorial dispute with Azerbaijan begins over Nagorno-Karabakh. 	Near zero	Near 100 percent	Unknown
1991	Armenia declares its independence from the Soviet Union.	Near zero	Near 100 percent	Unknown
1992	<ul style="list-style-type: none"> ◆ The war over Nagorno Karabakh begins. Azerbaijan and Turkey impose an energy and transport blockade, cutting off Armenia's only source of gas and oil for its operable thermal plants. ◆ Electricity supply is rationed, drops to two to four hours per day, and is characterized by frequent supply and frequency fluctuations. ◆ Industrial output collapses and the country suffers severe inflation. 	Near zero	Unknown	Unknown
1993	<ul style="list-style-type: none"> ◆ A new gas pipeline is completed through Georgia but is regularly interrupted by sabotage. ◆ With the adoption of Governmental Decree No. 533 in October, the Yerevan Distribution Company is separated from Armenergo and transferred to the Yerevan Municipality. ◆ In November, with Governmental Decree No. 573, the Armenian Nuclear Regulatory Authority (ANRA) is established as owner and operator of Medzamor. 	2 percent	Unknown	Unknown
1994	<ul style="list-style-type: none"> ◆ Tariff reform begins. Residential and agricultural tariffs are set at 1 AMD/kWh. All other customer tariffs are set at 8.80 AMD/kWh and a schedule is established for gradually raising tariffs for lower voltage customers. ◆ By this point Armenia's near exclusive reliance on hydropower resources has severely depleted Lake Sevan, a lake of great importance to Armenia for cultural, symbolic, and environmental reasons. ◆ In July 1994, Governmental Decree No. 312 effects the transfer of the Yerevan Distribution Company is transferred to the Ministry of Energy. 	27 percent	39 percent	127

1995	<ul style="list-style-type: none"> ◆ 24-hour electricity service is restored. ◆ Consensus builds within the government for restructuring the power sector and introduction of some form of private management or ownership of certain power sector enterprises. Initial work on the unbundling of Armenergo begins in March, with the creation of distinct generation and distribution enterprises. Transmission and dispatch remaining within the remit of Armenergo. ◆ Armenergo's distribution entities hire an army of inspectors to attempt to reduce illegal connections. ◆ Medzamor Unit 2 is restarted in November (the only unit to continue operating after the earthquake), and the gas pipeline sabotage comes to a halt. ◆ Further unbundling begins in December, with the separation of Hrazdan TPP plant and the Sevan-Hrazdan coordinated HPP system from Armenergo. 	25 percent	54 percent	141
1996	<ul style="list-style-type: none"> ◆ The Sevan-Hrazdan coordinated HPP system is formally separated from Armenergo in November, by Resolution No.139-GM of the Ministry of Energy. ◆ In December, the Hrazdan TPP is formally separated from Armenergo and 63 separate distribution enterprises are established through Resolution No. 346 of the government, and Resolution No. 148-GM of the Ministry of Energy. 	20 percent	60 percent	120
1997	<ul style="list-style-type: none"> ◆ State-owned power sector entities are transformed into the state closed joint-stock companies (100 percent of shares is owned by the state). ◆ 13 small HPPs are privatized according to the Law on Privatization. ◆ The Armenian Energy Regulatory Commission (AERC) is established by presidential decree in April. ◆ In April, the Vorotan coordinated HPP system is formally separated from Armenergo by Resolution No. 63-GM of the Ministry of Energy. The Yerevan and Vanadzor TPPs are also separated from Armenergo by Resolution No. 61-GM of the Minister of Energy. ◆ Armenia's 63 electricity distribution networks are merged into 11 regional electricity networks through Resolutions No. 74-GM (May); 4, No. 12-GM (January); and Yerevan DC, No. 55-GM (April). 	16 percent	61 percent	101

(continued)

Chronology of Key Events in the Armenian Energy Crisis and Power Sector Reforms (Continued)				
Date	Key Events	Commercial Losses (total, as percentage of production)	Collections	Fiscal and Quasi-Fiscal Subsidies to Power Sector (US\$ million)
	<ul style="list-style-type: none"> ◆ The Energy Law is passed in June, formalizing the separation of the generation, transmission, dispatch, and distribution functions into separate companies, the creation of the AERC. ◆ In September, the AERC establishes a new, rising block tariff for low-voltage customers. A lifeline tariff, for customers using less than 100 kWh/month, is set at 15 AMD/kWh. Customers using 100–250 kWh/month pay 22 AMD/kWh, and customers using more than 250 kWh/month pay 25 AMD/kWh. ◆ The Law on Privatization is passed in December, defining the power sector companies and assets to be privatized and corporatized. ◆ The first of 25 small hydropower plants slated for privatization are sold. 			
1998	<ul style="list-style-type: none"> ◆ The 11 electricity distribution companies are consolidated into four large regional distribution companies, established as subsidiaries of Armenian Electricity Network CJSC: Yerevan, Northern (covering Shirak, Lori, and Tavush), Central (covering Aragatsotn, Armavir, Kotayk, and Gegharkunik), and Ararat (covering Vayots Dzor and Syunik). ◆ In July, the dispatching and transmission functions are separated in accordance with Government Resolution No. 450. ◆ Governmental Decree No. 555 is issued in September, stipulating a financial rehabilitation plan for the power sector that includes tariff increases, the clearance of budgetary arrears, measures to improve of the payment discipline, and restructuring of power sector debt. ◆ The AERC passes a resolution establishing licensing procedures for activities in the energy sector. ◆ The GoA contracts with a Privatization Adviser (Raiffeisen AG) in December. 	13 percent	77 percent	66

1999	<ul style="list-style-type: none"> ◆ This block power tariff is eliminated in January 1999 in favor of a single end-user tariff of AMD 25/kWh. To compensate for the removal of the lowest block lifeline tariff, the government reshaped and expanded its Poverty Family Benefit Plan, a program of social transfers to low income customers. ◆ Payment of electricity bills is shifted to post offices rather than through bill collectors. ◆ The extensive metering and meter relocation program is completed: 12,000 new tamper-proof meters are installed throughout the power system between 1997 and 1998, at a variety of voltage levels down to 0.4 kV. Existing household customer meters are relocated from individual apartments to public areas of apartment blocks. ◆ In May, Raiffeisen AG initiates design and marketing of the transaction. ◆ Later in October, the Armenian prime minister is assassinated in Parliament. 	13 percent	88 percent	50
2000	<ul style="list-style-type: none"> ◆ Five firms (AES, Union Fenosa, ABB, EdF, Itera) submit prequalification documents in January. A prebid meeting is held in Yerevan in February. Itera is informed in March that it has failed to meet the prequalification criteria. ◆ In April, the GoA suspends the tender, calling for a new Law on EDC Privatization and a broad-based intergovernmental board to oversee the tender. The Law on EDC Privatization is drafted and approved during the coming summer months. ◆ In September, the GoA contracts Chadbourne & Parke as legal adviser to improve the tender documents and legal framework. 	12 percent	89 percent	43
2001	<ul style="list-style-type: none"> ◆ Implementation of the Automated Metering and Data Acquisition System is completed by 2001. ◆ The draft tender documents are issued to the remaining four prequalified bidders in January, but by February one of the bidders has already withdrawn from the process. Final tender documents are issued in March. Another bidder withdraws from the process between March and April. The April 1 deadline passes without any bids having been submitted. ◆ The Energy Law is revised in April to reduce government interference in sector operations, forbidding the government from appropriating any revenue if the EDC collects less than 100 percent. 	13 percent	81 percent	63

(continued)

Chronology of Key Events in the Armenian Energy Crisis and Power Sector Reforms (Continued)				
Date	Key Events	Commercial Losses (total, as percentage of production)	Collections	Fiscal and Quasi-Fiscal Subsidies to Power Sector (US\$ million)
	<ul style="list-style-type: none"> ◆ In June, a revised Law on EDC Privatization is adopted to (a) remove requirements for a fixed amount of investment in the network, (b) relax provisions requiring commercial loss reductions, (c) allow bidders to bid on both distribution companies up for tender, (d) include a requirement for a reserve or transition account to ensure that generators are paid in full before any funds go to the distribution company, and (e) limit the risk of bidders of contingent liabilities. ◆ In August, the GoA engages (with support from USAID) IFC Private Sector Advisory Service and new legal advisers, Manatt, Phelps and Phillips to prepare a new tender. ◆ Revised tender documents are submitted to all bidders in November. ◆ No bids are received by the December deadline, and the tender is canceled. The GoA begin to look to transfer operation and management to a qualified and reputable firm through a management contract while creating a governance structure to support professional management. 			
2002	<ul style="list-style-type: none"> ◆ With the help of the IFC PSAS, the GoA begins to market the management contract and design the tender documents. ◆ In April 2002, the four regional distribution companies are merged into a single company, and all 110 kV substations transferred are transferred to the consolidated EDC. ◆ In June, MRH makes an unsolicited offer for the consolidated EDC. ◆ The tender is re-launched in July with prequalification conditions changed to accommodate a financial investor and tender conditions requiring the successful bidder to contract qualified management (individually or through a firm). All previously prequalified bidders are invited to participate and an advertisement placed in a local paper. Donors and transaction advisors distance themselves from the transaction. 	13 percent	90 percent	33

Chronology of Key Events in the Armenian Energy Crisis and Power Sector Reforms

Date	Key Events	Commercial Losses (total, as percentage of production)	Collections	Fiscal and Quasi-Fiscal Subsidies to Power Sector (US\$ million)
2003	<ul style="list-style-type: none"> ◆ The prequalification for the management contractor continues in parallel but receives no interest and is canceled in August. ◆ No other bidders express interest by the August deadline. The tender documents (Share Purchase Agreement and License) are the same as those developed with the IFC and other consultant assistance during 2001. MRH accepts the conditions, signs the share purchase agreement, agrees to pay US\$12 million for 100 percent of shares and assume US\$25 million of specified debt. The latter expanded to US\$28 million when the EBRD declines to exercise an option to purchase 19.9 percent of the EDC's shares. ◆ The transaction is closed on October 31, and the transfer of funds effected from MRH to the GoA. 	10 percent	96 percent	21
2004	<ul style="list-style-type: none"> ◆ In February, the Energy Law is further amended to deregulated the provision of decentralized heating. ◆ In October, Armenergo's license is suspended; the distribution company signs direct contracts with the generators and service providers. ◆ The Law on Energy Efficiency and Alternative Energy is adopted in November to promote the development of renewable energy and to raise energy independence and security in the country. 	5 percent	100 percent	0

World Bank Power Sector Conditionality in Armenia

Loan	Conditionality
SAC I	<ul style="list-style-type: none"> ◆ The Borrower has furnished to the Association a satisfactory evidence showing that Armenergo's total collection rate for payments from customers has been: (i) during the period from January 1, 1996 to July 1, 1996, sixty percent (60 percent) of total electricity supplied by it; and (ii) during the period from January 1, 1996 to December 31, 1996, seventy-five percent (75 percent) of total electricity supplied. ◆ The Borrower has maintained the average electricity tariffs charged by Armenergo enabling Armenergo to cover operating and maintenance costs.
SAC II	<ul style="list-style-type: none"> ◆ The Borrower has: (i) adopted a Financial Rehabilitation Plan for the power sector; and (ii) achieved satisfactory progress in the implementation of said Plan. ◆ The Borrower has furnished to the Association satisfactory evidence that the rate of collection for payments from end users to power distribution companies (average for the three months immediately preceding the dates referred to in (i) and (ii) below) has reached: (i) by December 31, 1997, seventy-five percent (75 percent) of total electricity supplied by said companies; and (ii) by June 30, 1998, eighty percent (80 percent) of total electricity supplied by said companies; provided, however, that payments in the form of barter shall not exceed twenty-five percent (25 percent) of total collections in the calendar year of 1997. ◆ The Borrower has furnished to the Association satisfactory evidence that, at any time starting from August 1, 1997, no entities owned or controlled by the Borrower have accumulated overdue payment obligations on purchase of gas. ◆ The Borrower has: (i) adopted a privatization strategy for power sector enterprises satisfactory to the Association; and (ii) issued a letter of invitation for international financial advisors to assist in implementing said privatization strategy.
SAC III	<p data-bbox="200 830 330 850"><i>First Tranche</i></p> <ul style="list-style-type: none"> ◆ The Borrower and the Energy Regulatory Commission have completed a review with the Association of the implementation of the Power Sector Financial Rehabilitation Plan and the Borrower has: (i) announced measures to ensure financial sustainability of the power sector enterprises; (ii) implemented a debt restructuring plan for the domestic debt accumulated by power, gas and heat enterprises as of November 1, 1998; and (iii) achieved satisfactory progress in improving payments collection by power distribution companies in accordance with the targets established in the Power Sector Financial Rehabilitation Plan. ◆ The Energy Regulatory Commission has issued licenses to all enterprises in the electricity sector in accordance with the Energy Law dated September 1, 1997. ◆ The Borrower has approved and issued an offering memorandum for privatization of the Yerevan Distribution Company. ◆ The Borrower has publicly announced its district heating strategy, including subsidy cutting measures for the 1999–2000 heating season, satisfactory to the Association.

- Second Tranche**
- ◆ The Borrower and the Energy Regulatory Commission have completed a second review with the Association of the implementation of the Power Sector Financial Rehabilitation Plan and the Borrower has: (a) achieved satisfactory progress in implementing the measures to ensure financial sustainability of the power sector enterprises including, but not limited to, adjustment of energy tariffs; (b) furnished to the Association satisfactory evidence that all power sector enterprises revalued their assets in accordance with the methodology acceptable to the Association; and (c) achieved satisfactory progress in improving payments collection by power distribution companies in accordance with the targets established in the Power Sector Financial Rehabilitation Plan.
 - ◆ The Borrower has issued offering memoranda for at least three (3) power distribution companies selected upon agreement with the Association.
 - ◆ The Borrower has submitted to the Association satisfactory evidence that state-owned public enterprises in the power sector, selected upon agreement with the Association, have used IAS-consistent standards for the preparation of their financial statements for the fiscal year of 1999.
 - ◆ The Borrower has furnished to the Association satisfactory evidence that an audit of the 1998 financial statements of Armenergo, the Yerevan Distribution Company and one additional power distribution enterprise had been completed.
- The Borrower's Tender Commission has completed bid evaluation for the privatization of the Yerevan Distribution Company and three other power distribution companies referred to in paragraph 3 of Section II of this Schedule, and has started negotiations for privatization of said companies.

SAC IV

- First Tranche**
- ◆ The Borrower has adopted a strategy, satisfactory to the Association, for the improvement of the efficiency of the non-privatized sections of the power sector, including identification of the enterprises to be offered for sale during the calendar years 2001–2003 and the method of privatization to be employed.
 - ◆ The Borrower has made satisfactory progress in the preparation of a Comprehensive Heating Strategy and Action Plan.
- Floating Tranche**
- ◆ The Borrower has completed the sale of power distribution companies in accordance with a process satisfactory to the Association.

SAC V

- First Tranche**
- ◆ The Borrower has made adequate provisions in 2003 budget to support the financial recovery plan of the water and transport sectors to ensure their full payments to the energy sector.
- Second Tranche**
- ◆ The VIP customers have made satisfactory payments to the energy sector. The GoA has sustained a satisfactory environment for operations of the privatized firms in the power and utility sectors as indicated by: (i) establishing a single utility regulator, adopting the necessary legal framework to ensure its financial autonomy and transferring economic regulations of energy, water and telecom sectors to the single regulator; (ii) carrying out the agreed Performance Monitoring and Public Dissemination Program; and (iii) ensuring the privatized power distribution company (ArmElNet) compliance with its license.

Lessons from Power Sector Privatizations Elsewhere in Europe and Central Asia

In a 2003 World Bank Working Paper, Venkataraman Kirshnaswamy and Gary Stuggins studied efforts to introduce private participation in the power sectors of a number of countries in Eastern Europe and Central Asia. The paper included case studies from Georgia, Hungary, Kazakhstan, Kyrgyz Republic, Lithuania, Moldova, Poland, Tajikistan, Turkey, and Ukraine.

The study identified a number of similarities between the countries surveyed. These were:

- “All of them (except Turkey) went through the political and economic upheaval of the early 1990s and have recovered or are recovering from them at varying paces.”
- “In all of them, nearly 100 percent of the population has access to electricity and the sector does not suffer from the burden of having to extend supplies to new uneconomic areas.”
- “All of them had a fairly high level of technical competence but had the need to develop skills necessary to operate in a market.”
- “Most of them have excess generation capacity and declining or stagnant demand.”
- “Most of them (especially the FSU countries) had high levels of system losses and theft; they faced very high levels of non-payment and payment through barter, offsets and similar methods of non-cash payment.”

All of these factors also apply to Armenia, and although no case study was conducted, the Armenian experience up until that date was also considered.

The study drew from these case studies a series of lessons on:

- Getting the conditions right,
- Getting the market structure right,

- Private sector participation, and
- Social safety net issues.

Table D.1 compares Armenia's experience to the key lessons presented in this report. A check mark denotes that the lesson identified by the Krishnaswamy and Stuggins study has been reconfirmed by Armenia's experience. Lack of a check mark means the particular lesson is either irrelevant for Armenia, or Armenia's practice differed from what is suggested in the lesson.

Lesson (from Krishnaswamy and Stuggins study)	Applicable to Armenia?	Comment
<i>Getting the conditions right</i>		
When the country is experiencing a deep and prolonged economic and political crisis and is focusing on stabilization, introduction of sector unbundling, competitive markets, and privatization for the power monopoly is counterproductive. It is good to wait for the economy to stabilize.	✓	Armenia did not begin the process of power sector reform until after it had emerged from the economic crisis of the early 1990s.
Attempts at restructuring, privatization, and competition have a chance to succeed only when they are preceded by comprehensive commercialization of the operations of the existing utility. Such commercialization is important to attract the strategic investors, to optimize privatization receipts, and to make the transition to the private sector operations smooth.	✓	Unbundling and commercialization of Armenia's various power sector entities was one of the first steps of the reform process.
Three key steps to precede restructuring and competition are (a) legal reforms, (b) tariff and regulatory reform, and (c) commercialization of operations.	✓	All of these steps were followed in Armenia as part of the restructuring process, and before privatization, though legal reforms had to be further refined after the first failed privatization attempt.
Legal reforms aim at making electricity supply a fully commercial service available only to those who pay the bills.	✓	The legal reforms implemented before MRH's purchase ensured that nonpaying customers could be disconnected.
Tariffs should be adjusted to cover the cost of supply and to reduce, to the extent possible, internal cross subsidies, and the process of tariff adjustments should be de-politicized through the establishment of professional and independent regulatory bodies. Tariff unbundling (that is, final tariff = generation tariff + transmission tariff + distribution tariff + customer related costs) helps make price setting more transparent. Tariff reform must include social protection measures for the targeted poorer segments of the society.	✓	Armenia's primary social protection measure, the Poverty Family Benefit Program, provides cash transfers to poor households identified through a multivariate means testing program. Additional one-off payments were made through this program in 1999 and 2000 in an effort to offset the 1999 electricity tariff increase mandated by the AERC and the removal of the lowest block (lifeline) tariff.
Some of the key elements of commercialization are (a) cutting the utility from routine annual budget support and compel it to operate with the revenues it generates; (b) functional accounting to identify costs and revenues by function; (c) tariff unbundling; (d) organizing genera-	✓	All of these elements were clear part of the Armenian reforms. The compilation of inventories (g) was completed after the initial privatization attempt., but before MRH's purchase.

(continued)

Table D.1 (Continued)		
Lesson (from Krishnaswamy and Stuggins study)	Applicable to Armenia?	Comment
tion, transmission, and distribution functions by business units within the framework of the existing company; (e) evolving transparent transfer pricing among the business units and contract based relationships among the business units; (f) developing meaningful internal and external audits and disclosure procedures; (g) compilation of clear, comprehensive, and unambiguous inventories of all real and fixed assets and debts; and (h) improve metering, billing, and collection procedures and mechanisms to monitor payment defaults and take corrective actions.		
Once the utility has been substantially commercialized and the tariff regimes (including social protection measures) are appropriate, the utilities can access the debt markets on the strength of their balance sheets. This is the appropriate time to consider legal unbundling and privatization. At this stage the unbundled entities will attract competition from strategic investors.	✓	Part of ENA's financing under MRH includes commercial debt.
<i>Getting the market structure right</i>		
Market structure suitable for the current stage of economic and political development of the country and the size and features of the power systems should be decided upon for each country.	✓	
For reasonable competition a good rule of thumb may be that no single entity should operate or control more than 20–25 percent of generation or distribution. Thus if the size of the system cannot accommodate four or five generation companies and four or five distribution companies, and if no competition could arise from cross-border demand or supply, then it is time to consider carefully whether unbundling and competition would work in that country.		Armenia's experience suggests so far that unbundling can work with only a single distribution company. This may prove to be more of an issue in Armenia going forward, given RAO UES' recent purchase of ENA and the fact that it also owns generation resources in Armenia and has financial management responsibility for Medzamor.
In the case of small systems (below, say, 3000 MW), which have no ambitions to accede to the European Union, which do not form part of any logical larger international grid, and which have no significant electricity	✓	Armenia could be characterized as a small system but has significant import/export opportunities.

import-export possibilities, be wary of unbundling, as transaction costs may be too high and scope for competition would be severely limited or nonexistent. It is probably better to handle such a small system as a vertically integrated utility and privatize it as it is.		
It is necessary to avoid fragmenting the distribution segment into far too many tiny and nonviable entities (as preferred by many ECA borrowers) because such tiny entities do not attract any serious investors.	✓	The GoA began with 63 distribution companies, and gradually consolidated from 11 to 4 to 2 to 1.
A single buyer model (where the dispatch is on the basis of PPA with generators) is simple and preferred by many countries, but it makes the introduction of competition later very difficult.		Though Armenergo no longer serves as the purchasing agent, the Armenian system is still a single-buyer model in that ENA is now responsible for signing power purchase agreements with generators. This could be an issue for Armenia in the future but generally speaking, market structure choices did not (as it did in Ukraine) hinder power sector reform efforts.
Be wary of the Hungarian type single buyer market model in which the government is able to give private investors in generation and distribution their promised return on equity while holding down retail tariffs and subsidizing the state-owned single buyer through direct and large subsidies from the state budget.	✓	Retail tariffs have not changed since 1999, but the PSRC, and not the GoA, has responsibility for changing them. The state-owned single buyer has been abandoned and therefore no longer can receive any subsidies from the GoA.
It is better to allow the market to take the generation capacity addition decisions than to allow the transmission company or the regulator to make such decisions.	✓	Armenia has not yet needed much new generation capacity, but the regulatory regime has allowed for the entry of a number of new independent power producers, many of them small hydropower plants.
There could be tradeoffs between ease of privatization and introduction of competition. A choice as to which is more important has to be made for each country at the start of the reform process.	✓	Armenia's privatization process, which went through two failed tenders, cannot be called easy. It was, instead, a long learning process that eventually yielded a competitive bid for the distribution company.
<i>Private sector participation</i>		
Privatization should follow reforms, not precede them, and should be undertaken in a transparent manner to maximize the value of the transaction (for example, avoid the kind of problems experienced in Kazakhstan).	✓	Privatization clearly followed extensive reforms in Armenia. Much of the difficult work was done before the private owner commenced operations.

(continued)

Table D.1 (Continued)		
Lesson (from Krishnaswamy and Stuggins study)	Applicable to Armenia?	Comment
IPP contracts with their guaranteed take or pay provisions (insulating the generator from demand risk, dispatch risk, price risk, and exchange rate risk) are a major hindrance for further sector reform involving competition, unless they are structured in ways to make them market friendly.		
In the context of liberalization of the markets, some countries have succeeded in renegotiating these IPP contracts, because of the change in regime and on the basis of the risks being reallocated equitably between the two parties.		
Privatization through transparent international competitive bidding among prequalified investors results in optimal privatization receipts and sustainable privatization deals. Negotiated privatization does not even save time (for example, Estonia) and often leads to unsatisfactory terms.	✓	Though MRH's purchase of ENA arguably had some of the characteristics of a negotiated privatization, (a) it was conducted using all of the international tender documents developed for the previous two privatization attempts, (b) all previously prequalified bidders were invited to participate, and (c) additional safeguards were placed on MRH because of its lack of operating experience and because it was a little-known company.
Issue of shares to employees (10–15 percent) and through local stock exchange (15–20 percent), as is widely practiced in Europe and Central Asia countries, is probably good for the employees morale and for the stock markets, but combined with minority share privatization they tend to give control of the company in unintended ways.		
It is always effective to offer majority shares to attract strategic investors in a manner that enables them to implement prudent investment and operating decisions. In any case the strategic investor must have management control.	✓	MRH owned all of the shares.
Selling all the shares to the strategic investor retaining only a golden share (or some similar device, such as a special shareholder agreement) may be a prudent option.	✓	The GoA retained no golden share, but the terms of the tender forbade sale of more than 25 percent of ENA without prior government approval.

<p>The privatization agreement may also contain a prohibition for the resale of assets to anyone with qualifications inferior to those of the original investor.</p>	✓	<p>The GoA's approval of RAO UES' 2005 purchase of ENA was made conditional on RAO UES meeting the original prequalification criteria.</p>
<p>It is more difficult to sell generating units that need to function as merchant plants in a competitive market than those that can function as a part of a vertically integrated operation can supply to their own distribution utility, or can have bilateral contracts with distribution utilities and large industries.</p>		
<p>Saddling generation units with the ownership of coal or lignite mines makes privatization difficult.</p>		
<p>It is good practice to sort out labor agreements (employment levels, severance compensation, funds for assisting separated labor), issues related to associated coal or lignite mines, and discontinuation of fuel allocation practices before starting privatization. Poland and Hungary provide different examples for this purpose.</p>		
<p>While privatizing distribution utilities, issues relating to the right of way vis-à-vis the facilities located in state or municipal lands and issues relating to the quenching of any legal rights the municipalities may have in relation to distribution business and related power facilities should be sorted out in the pre-privatization phase. Special legislation appears to be necessary for this in most European and Central Asia countries.</p>	✓	
<p>It is good practice to prepare and include in the privatization documents comprehensive inventory of assets being sold (for example, "include all relevant feeders and not let the new owner to fight for every feeder with some reseller"), debt inventories and debt restructuring plans, and clearly laid out tariff policies.</p>	✓	<p>This was completed before the final sale to MRH.</p>
<p>To reduce the regulatory risks, it would be useful to examine whether detailed tariff principles and the actual formulae could be built into the privatization contract. Most regulatory bodies are new and are subject to political pressures and may take a few years to settle down to the routine of independent regulation.</p>	✓	<p>AERC (now PSRC), the regulator in Armenia, had five years of experience regulating the electricity sector in Armenia, and had already developed strong independence from the GoA.</p>

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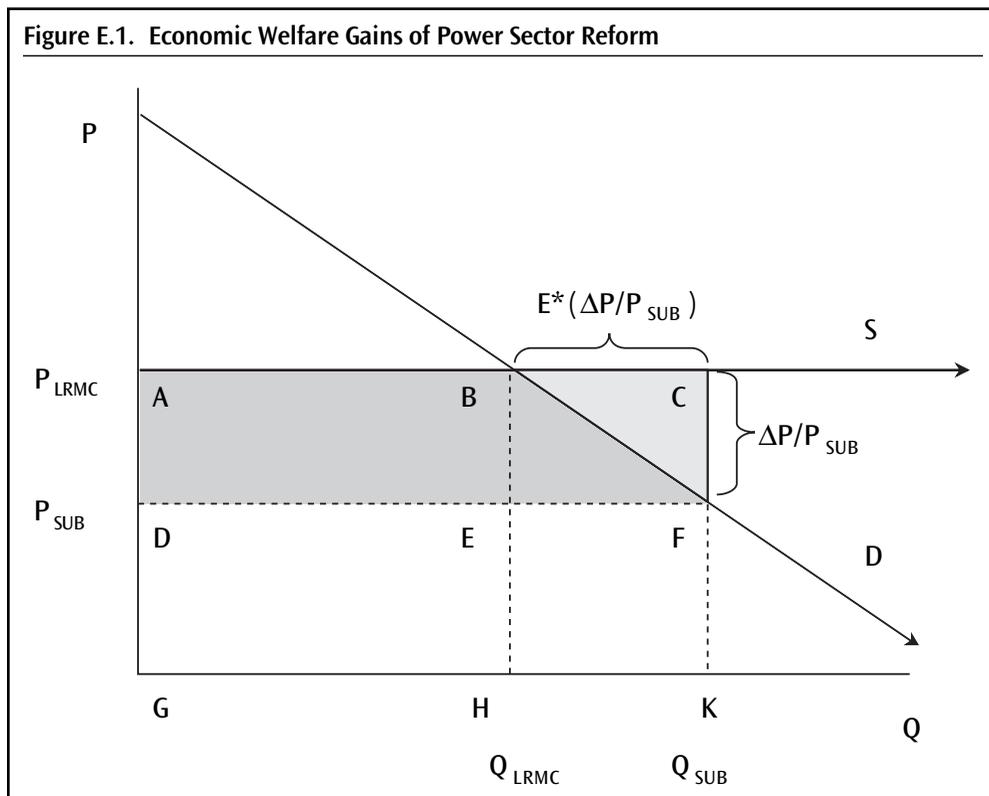
Lesson (from Krishnaswamy and Stuggins study)	Applicable to Armenia?	Comment
Establishment of an independent regulatory body with adequate financial and personnel resources and the issuance of clear and fair tariff guidelines and methodologies improve the prospects of privatization (example of Ukraine in the last round of distribution privatization).	✓	As mentioned above, this was done well in advance of privatization in Armenia.
Provision for international arbitration makes it easier to attract strategic investors (for example, Turkey). Recourse to an Appellate Tribunal has also been found to be helpful in many Latin American countries, India, and the United States.	✓	
The concept of strategic investors (mostly from West Europe or North America) being selected on the basis of competitive bidding was working well until recently. Increasingly, tenders issued do not elicit any response (for example, Georgia, Armenia, Czech Republic, and several other countries). Diversification appears to be necessary, and efforts have to be made to look for investors also from Australia, Japan, Latin America, and Asia. Local and regional entrepreneurs (and financial investors from any part of the world) with proven resources and with firm technical collaboration or joint venture agreements with strategic investors are resources that should also be mobilized. Competitive bidding is still the preferred approach.	✓	MRH was an unconventional financial bidder that broke from what the GoA (initially) and its donors considered to be a strategic investor.
Be wary of dishonest and collusive equity for debt swaps and asset stripping as was practiced in Ukraine.		Some of Armenia's generating plants were sold under such terms to Russian companies but asset stripping as was seen in Ukraine has not been a problem in Armenia, possibly because the owners are able to operate the plants profitably by selling power to the grid.
In the context of lack of interest on the part of the strategic investors, it appears worthwhile to encourage franchising and second-best solutions, such as concessions, leasing, and management contracts, as interim solutions.	✓	Before MRH expressed interest (and after the second failed privatization effort) Armenia had resolved to seek a management contractor if it remained unable to find a buyer

The best insurance against the present lack of investor interest is to focus on continued commercialization (if necessary, for example, using concession/leasing arrangements, management contracts, inter utility cooperation), improve corporate governance, and take the utility up to the stage of its being able to provide the equity from the internally generated cash for the investment needs and being able to access the debt market on the basis of its credit rating (for example, Lithuania).	✓	Much of the most difficult commercialization work was already completed in Armenia before MRH's purchase of ENA.
<i>Social safety-net issues</i>		
Privatization plans should include comprehensive measures to deal with the problems of redundant labor and managers, their relocation, training, and redeployment.		
The indiscriminate privileged tariff discount system used in most former Soviet Union countries must be fully eliminated.	✓	Privileged tariffs were eliminated in favor of the Poverty Family Benefit Program.
Tariff increases and reduction of cross subsidies should be gradual and phased and not be at a pace excessively faster than the pace of income growth.	✓	Tariffs were increased gradually between 1995 and 1999 and have remained constant since then.
The target poverty group to be protected against rising tariffs for electricity and other forms of energy should be carefully determined on the basis of household income and expenditure surveys.	✓	As mentioned above, the Poverty Family Benefit Program provides cash transfers to poor households identified through a multivariate means testing program. Additional one-off payments were made through this program in 1999 and 2000 in an effort to offset the 1999 electricity tariff increase mandated by the AERC and the removal of the lowest block (lifeline) tariff.
Direct income supplements to the target poverty households through social security system should be provided without distorting the tariffs of utilities.	✓	The Poverty Family Benefit Program accomplishes this, as benefits are delivered through direct cash transfer rather than any concessional tariffs for poor consumers.
Pending the implementation of such a social safety net, suboptimal solutions, such as lifeline tariffs, and energy vouchers, could be considered and implemented respecting the property rights of the utility operators.		The Poverty Family Benefit Program program has prevailed over these options.

Estimating the Welfare Benefits of Power Sector Reform in Armenia

Figure E.1 shows hypothetical short-run demand and supply curves for electricity in Armenia. The pre-reform effective electricity price is shown at P_{SUB} with electricity consumption at Q_{SUB} . The post-reform price is shown as P_{LRMC} , with consumption at Q_{LRMC} . The demand curve is assumed to be downward sloping. The supply curve is flat to reflect the fact that, during the period of the reforms (but after the 1992–94 energy crisis), the electricity companies supplied as much as was demanded during any given year at whatever prices were set for them by the GoA or AERC (now PSRC). This assumption held true during the course of Armenia’s power sector reforms (but again, after the 1992–94 energy crisis), given the country’s persistent capacity surplus.

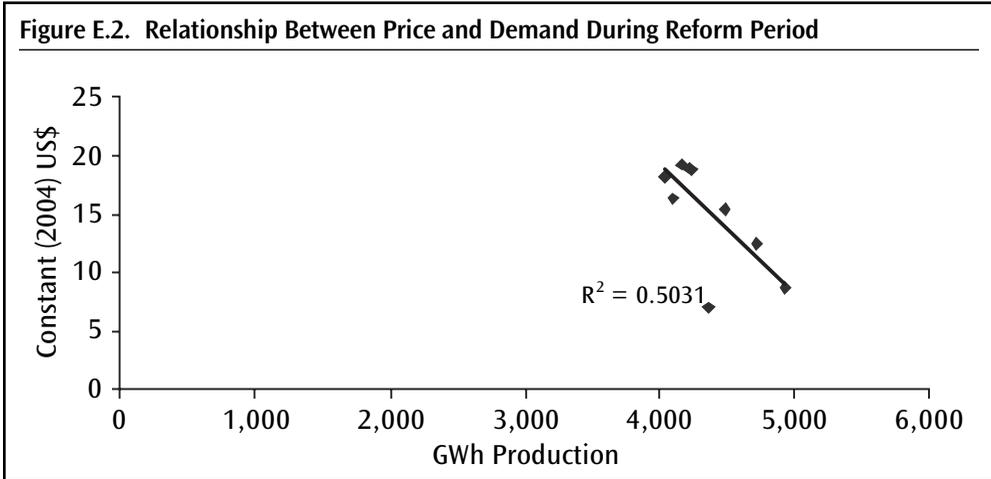
The economic gains from power sector reform can be expressed in terms of fiscal subsidies and deadweight loss. By ensuring that customers pay for all power consumed at full cost, the GoA restores the price of electricity from P_{SUB} to P_{LRMC} . This price increase causes total consumption (sales + theft) to decrease along the demand curve, from Q_{SUB} to Q_{LRMC} . Before the subsidy is removed, the total economic cost of electricity production is represented by the area under rectangle ACKG, with revenues at only DFKG. Some of this production cost is borne by the GoA through explicit and implicit fiscal subsidies, and some is borne by the Armenian economy as a whole, as inefficient utilization of resources. Without this subsidy, revenues are equal to the amount represented by the area under rectangle ABHG. By removing its fiscal support to the power sector, the GoA recovers an amount equal to the shaded area under ABFD. The area under rectangle BCFE is the deadweight loss recovered by the Armenian economy as a result of the power sector reforms. Before reform, some of that inefficient consumption (triangle BFE) was financed by the GoA, through explicit or implicit subsidies. Another portion of that consumption (triangle BCF) was financed by the economy



as a whole through spending on electricity of funds that would have been more efficiently spent elsewhere.

The economic benefit attributable to power sector reform therefore depends on the magnitude of the effective price increase, the slope of the demand curve, and its inverse, the price elasticity of demand. The first two variables can be treated as known: price and quantity consumed at the end of the reform process under consideration (2004).⁴⁸ Price elasticity of demand is not known, and is much more difficult to estimate. Electricity demand is typically inelastic (between 0 and -1), but depends on the availability of substitute fuel sources, the portion of customer income represented by electricity purchases, and the time customers have available to adjust to price changes. Elasticity also changes along a demand curve, and varies across income levels. At lower levels of consumption (and higher prices), price elasticity of demand tends to be lower than at higher levels of consumption (and lower prices). Estimates of price elasticity typically run between -0.25 and -0.75 . Some recent estimates of elasticity in the CIS do exist: a 2002 study in the Kyrgyz Republic found elasticity ranging

48. Though some power sector reforms began in 1994, here we treat 1995 as the first year of the reform and use effective prices from that year. Though some elements of the reform program did begin in 1994 (remetering and first reform of tariffs), the majority of the reform measures were launched in 1995. Moreover, Armenia was still emerging from severe inflation in 1994, and Medzamor had not yet returned to operation, suggesting structural differences from the 1995–2004 period that may have made for a different relationship between price and quantity.



between -1.11 (for houses without electric heat) and -0.47 (for apartment buildings with electric heat).⁴⁹ A 2004 study in Azerbaijan found a price elasticity of demand of -0.20 .⁵⁰

The relationship between the effective electricity price and quantity demanded in Armenia also suggest fairly inelastic demand. Electricity demand has decreased only very slightly along with the effective price increases. Ten years of annual time-series data will obviously not yield a reliable estimate of price elasticity, but can provide some idea of how electricity demand has responded to changes in price. A simple OLS estimate shows an elasticity of -0.32 . From 1995 to 2004, a 10 percent increase in effective electricity price therefore appears to have been accompanied by 3.2 percent decrease in consumption in Armenia. Figure E.2 shows the results of the OLS estimate.

The value of deadweight loss and fiscal subsidy can be calculated using an assumed value for price elasticity of demand, and the known value of the price change. Figure E.1 shows that the area of triangle BCF can be calculated as half the area of BCFE, where BCFE is equal to the product of $\Delta Q/Q$, $\Delta P/P$, and revenue before removal of the subsidy (DFKG). Some simple algebra allows for the expression of $\Delta Q/Q$ as the product of price elasticity of demand and $\Delta P/P$ ($\Delta Q/Q = E^* \Delta P/P$). Using the (real) AMD 11.71/kWh price change between 1995 and 2004, an assumed price elasticity of -0.32 , and post-reform revenue of AMD 79.49 billion (expressed in terms of constant 2004 AMD; equivalent to US\$ 149.02 million), deadweight loss (BCFE) can be found to equal to AMD 9.85 billion (US\$ 18.46 million). Using this value, the total amount of fiscal subsidy to the power sector, the area under ABFD, can be found to equal AMD 54.55 billion (US\$ 102.25 million).⁵¹ The total value of deadweight loss not financed by the GoA (the area under triangle BCF) is equal to AMD 4.92 billion (US\$ 9.23 million). The removal of the fiscal deficit attributable to power sector reform (the transfer in welfare from consumers to the GoA, ABED) is equal to AMD 49.62 billion (US\$93.02 million).

49. World Bank. 2002. *Social Impact of Electricity Sector Reform in the Kyrgyz Republic: Households, Electricity Sector, Budget*. Washington, D.C.

50. World Bank. 2004. *Azerbaijan—Raising Rates: Short-Term Implications of Residential Electricity Tariff Rebalancing*. Washington, D.C. This estimate was based, in part, on surveys of electricity consumption in four CIS capitals, including Baku, Yerevan, Tbilisi, and Chisinau.

51. This can also be characterized as the amount transferred from consumer to producer surplus.

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THE WORLD BANK
1818 H Street, NW
Washington, DC 20433 USA
Telephone: 202 473-1000
Internet: www.worldbank.org
E-mail: feedback@worldbank.org

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