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Utility Pricing and the Poor

Lessons from Armenia



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ABSTRACT

Increasing cost recovery for utilities is a cornerstone of the Government of Armenia economic reform program. This report assesses the 1999 electricity tariff increase and the potential for future improved water sector cost recovery, with particular attention to questions of service accessibility and affordability for the poor. The burden of energy expenditures is large for most households, particularly for the poor. Electricity makes up the bulk of these expenditures, and a further increase in tariffs, without increasing access to low cost substitutes, would lead to the greatest hardship for the urban poor. Future electricity tariff increases should be closely coordinated with improved price response prediction and credible actions to mitigate the potential impact on the poor and the environment. The water utilities are caught in a low-level equilibrium trap, characterized by decreasing service quality and revenue. The water utilities must break out of this trap by generating more revenues through improved service delivery. A two-stage approach is recommended. In the first stage, revenues should be increased by enforcing payment from the households that currently have reliable service but are not paying their bills. In the second stage, after collection capacity is strengthened, the utility should start a program of tariff adjustments, based on improved service and meter-based billing.

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ABBREVIATIONS

ARD - Armenian Dram (525 ARD = 1US\$)
FSU - Former Soviet Union
GDP – Gross Domestic Product
GoA – Government of Armenia
kWh – Kilowatt hours
LCD – Liters per Capita per Day
LPG – Liquid Propane Gas
N – Number of observations
PCE – Monthly Per Capita Expenditure

EXECUTIVE SUMMARY

Increasing cost recovery for utilities is a cornerstone of the Government of Armenia economic reform program. In the beginning of 1999 the Armenian authorities made decisive moves in several politically sensitive areas, increasing electricity tariffs and reshaping the family benefits system. This report assesses the 1999 electricity tariff increase and the potential for future improved water sector cost recovery, with particular attention to questions of service accessibility and affordability for the poor. The analysis is based on a survey of 2,010 randomly selected households conducted in December 1999 and January 2000. The household surveys were matched with electricity utility billing, payment, and consumption records from January 1, 1998 to December 31, 2000. Caution must be exercised in interpreting findings in this report, as the analysis does not reflect changes in the cost and structure of production that followed the 1999 tariff increase.

The electricity tariff increase and energy policy

Considerable progress has been made in reforming the energy sector since 1995. Electricity supply has become more reliable. Tariffs have been raised, cross-subsidization reduced, and payment discipline improved. Transparency of financial flows has increased and accumulation of quasi-fiscal debts diminished. Also, an energy law has been adopted and an independent Energy Commission established to regulate prices. The Energy Commission is expected to review electricity tariffs and efficiency-enhancing measures every six months to ensure that they are adjusted to fully cover medium-term costs, including depreciation, debt service, and other capital costs. In order to improve the financial sustainability of the utilities, household tariffs are being raised to reflect the high cost of supplying low voltage electricity. As part of this effort, on 1 January 1999 the increasing block tariff was eliminated in favor of a single price of 25 ARD per kWh.

The sampled household's response to this change in the electricity tariff offers important insights into electricity pricing policy and energy sector strategy. For sampled households, electricity consumption records dropped on average 17 percent and reported consumption of such substitutes as wood and natural gas increased. In addition, the collection rates fell 9 percentage points, and arrears increased four-fold. Relative to the non-poor, the poor cut consumption more, the percentage of households with arrears was higher, and the average size of arrears increased more. For the utility, the net result was a revenue increase from these sampled households of about 6 percent.

Elimination of the increasing block tariff was predicted to raise the average price of electricity 30 percent (from 19.2 to 25 ARD per kWh). However, the household survey indicates the new price of 25 ARD per kWh represented an unexpected 47 percent increase (from 17 to 25 ARD per kWh). The difference between the expected and actual tariff increase occurred because the calculation of average price was based on aggregate utility data rather than household level data. Price response prediction can be significantly improved through better methods, data reporting, and sector statistics.

As electricity consumption dropped, reported consumption of wood and natural gas increased. While the inefficient practice of heating with electricity has been reduced, there are potential environmental problems associated with increased wood consumption such as deforestation and increased indoor air pollution. Balancing such concerns signals the need to develop a long-term national heating strategy. This strategy would identify economically efficient and sustainable priority actions to meet basic heating needs.

The utility revenue increase of about 6 percent from sampled households was less than expected. The household revenue increase was limited by a drop in consumption and a simultaneous fall in collection rates and increase in arrears. Improving collection rates, particularly among the population that can afford to pay their electricity bills, is one way to increase utility revenues from households. A complete analysis of the impact of the household tariff increase on the utility revenues and costs requires additional information on other sources of revenue, such as industrial consumers and exports.

The burden of energy expenditures is large for most households, particularly for the poor. Electricity makes up the bulk of these expenditures, and a further increase in tariffs, without access to low cost substitutes, would lead to the greatest hardship for the urban poor. The urban poor spend 16 percent of monthly cash expenditures on electricity and have the least access to wood.

The 1999 tariff increase coincided with the GoA's reshaping and expansion of spending on the family benefits system. This new system was expected to soften the impact of the tariff increase on the 28 percent of households below the poverty line. In addition, a direct income transfer was provided to 8 percent of households expected to have difficulty meeting their electricity payments. Significantly more of the poor (than non-poor) and significantly more of the households regularly consuming in the first two blocks of the 1998 electricity tariff were receiving the income transfer in 1999.

Looking forward, future electricity tariff increases should be closely coordinated with improved price response prediction and credible actions to mitigate the potential impact on the poor and the environment. This includes detailed consumer behavior analysis and timing tariff increases with investments that facilitate access to clean, sustainable, and affordable sources of energy.

Improving water service and water utility revenue

The Armenian water utilities are caught in a low-level equilibrium trap, characterized by decreasing service quality and revenue. Operating expenses have increased, especially due to increasing water losses in aging and poorly maintained distribution systems, and the utilities have been forced to reduce hours of service. In contrast to the electricity utilities, payment discipline and financial accountability have not been consistently improved.

The water utilities must break out of this trap by generating more revenues through improved service delivery. A two-stage approach is recommended. In the first stage, revenues should be increased by enforcing payment from the households that currently have reliable service but are not paying their bills (20 to 25 percent of all households). This strategy will likely

be most effective in rural areas where fewer multi-household dwellings exist and enforcement through service cut-off is more easily implemented.

In the second stage, after collection capacity is strengthened, the utility should start a program of tariff adjustments, based on improved service and meter-based billing. This stage will be supported by critical investments to reduce distribution system losses and costs and improve reliability of supply, expand metering, as well as by improvements in corporate governance of water utilities. On the demand side, reliability is a priority for service improvement, and meter-based billing assures that households will be charged for what they consume. On the supply side, household water meters will facilitate management improvements in the water utilities. Initially, this strategy is likely to be most effective in urban areas—as current satisfaction with service is lowest there, incomes are higher and investments in infrastructure improvements will tend to have the greatest economies of scale.

Because households are reluctant to pay a lump sum for meters, the initial cost of installing water meters should be financed by the water utility and amortized in the price of water. This approach is consistent with the successful introduction of meter-based billing worldwide. Building on experience in the electricity sector, it appears that collection rates may be increased by transferring responsibility for bill collection to a third party not involved in enforcement, such as a bank or post office.

Current water bills are derived from a price of approximately 50 ARD per m³ of water and normative per capita consumption levels of 200 or 250 liters/capita/day (LCD). The analysis indicates that the price of water can be substantially increased if there is an increase in service reliability. If households actually consume at the very low levels reported (approximately 20 LCD); utility revenue would be maximized at approximately 500 ARD per m³. Demand at this price indicates that households agree to an average monthly water expenditure only slightly less than their currently unpaid bills. It remains to be determined, however, if it is possible to deliver reliable water service to households at or below this price.

Given the uncertainty of the consumption estimates, care must be taken in initially setting the meter-based tariff to avoid a significant one-time increase in monthly household water bills. One safeguard would be to accompany an increase in water tariffs with a water conservation awareness program. The program would help households limit water expenditures and encourage better maintenance of household plumbing systems. But from a public health perspective, it may be desirable to keep prices below the estimated revenue maximizing level in order to encourage greater household water consumption. To balance these concerns, one strategy might be to include an affordable fixed tariff to encourage a consumption of the socially optimal level of water plus a marginal tariff to cover water consumption above this level. Further analysis of water consumption preferences should be conducted to validate the water demand model and initiate design of an optimal water tariff.

The proposed shift from the current normative billing scheme to a meter-based billing scheme must be accompanied by regular monitoring and evaluation of household water consumption behavior, carefully analyzed to design an optimal water tariff. This tariff must balance the competing goals of cost recovery and maintaining service delivery to the poor.

The GoA has a window of opportunity to lay another cornerstone in the foundation for sustainable economic growth. Through careful tariff reform and strategic investments in infrastructure, cost-recovery efforts can be maintained, and the impact of these efforts on the poor minimized. Ultimately this will improve living standards for all Armenians.

INTRODUCTION

The Armenian economy suffered a series of devastating shocks in the late 1980s and early 1990s, including a catastrophic earthquake, the breakup of the Former Soviet Union (FSU) and the closure of borders with Turkey and Azerbaijan. At the low point in 1993, gross domestic product (GDP) fell to approximately half its 1990 level, the fiscal deficit rose to almost two-thirds of GDP and inflation reached 10,000 percent a year.

How is the economy today?

Today, the economy has stabilized and appears to be on the path of sustainable growth. Since 1994 real GDP has increased 5 percent per year, and the fiscal deficit has been reduced. Since 1998 inflation has stabilized around 1 to 2 percent a year, the result of very strict monetary policy and a decrease in the budget deficit achieved through a series of revenue enhancing and expenditure reducing measures by the Government of Armenia (GoA).

Despite progress in cutting the budget, subsidies and lending to utilities have both increased substantially in the last few years. In 1998 and 1999, total subsidies and lending for the sector was about 2 percent of GDP. This reflects an effort by the GoA to support budget dependent utilities (drinking water, irrigation and district heating) through explicit direct transfers rather than subsidies.

Why did the utilities collapse?

Like many other FSU countries, the utility sector in Armenia developed in a central planning framework characterized by massive price distortions and direct state control over resource allocation decisions. The transition to market prices coupled with border closures crippled the utilities because of their heavy dependence on energy imports.

As energy prices in Armenia were brought in line with world prices in the mid-1990s, the cost of delivering electricity, central heating and water skyrocketed. The situation was exacerbated by delays in adjusting consumer prices to reflect hyperinflation and failures to cover internal costs such as current maintenance and capital repayment.² With the shutdown of the nuclear power plant and weekly interruptions in natural gas supply, the collapse of the utilities was imminent.

Residential consumers bore the brunt of the utility crisis. From 1992 to 1995 most of the population received only 2 to 4 hours electricity a day, central heating and natural gas supply were virtually terminated, and the supply of drinking water substantially decreased in areas that required pumping. Partially in response to unreliable supply, consumer payment for services in 1994 fell to only 10 percent of billings for both electricity and drinking water further threatening sustainability of these services.

² External costs were financed through accumulation of arrears, barter trading, and official transfers.

How have the utilities fared since the crisis?

Recognizing the need for a reliable utility sector to achieve sustainable development, the GoA embarked on a series of economic reforms aimed at putting the energy sector back on its feet. The key elements of this program included targeted investments, the elimination of subsidies, improvements in cost recovery and the passage of a comprehensive energy law. The net result has been a dramatic improvement in the supply of electricity. Most households now receive service 24 hours a day, and outages are shorter and less frequent.

The rapid progress in the energy sector must be juxtaposed against the slow progress in the water sector. Why have reforms been slower in one sector than the other? There are several reasons. First, water is vital, so enforcing payment discipline and disconnecting non-paying consumers from their water supply is even more politically charged than it is with electricity. Second, the marginal cost of rehabilitating water networks is significantly higher than it is for electricity networks. Third, the marginal cost of operating the network is lower than electricity because water is virtually free. Fourth, a water sector reform program was initiated only in the late 1990s.

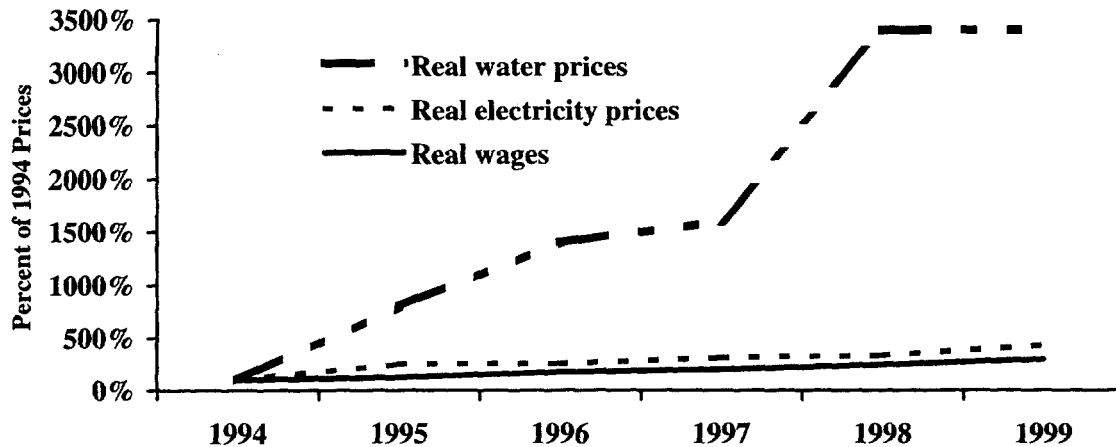
How have the people fared?

The combination of natural disaster, transition and war has taken a heavy toll on the living standards of Armenians. Despite increasing every year since 1994, real wages are only 12 percent of what they were in 1990. Recent data indicate that wages are lowest in education and agriculture (10,500 and 12,000 ARD a month) and highest in financial services (58,000 ARD a month).³

Given this situation, the potential impact of the water and electricity sector reform program on living standards would appear to be of concern. From 1994 to 1999, real electricity prices have outpaced increases in real wages (Figure 1). Not only did the growth in electricity prices outpace that of official wages, but there was also a substantial increase in collection rates, further increasing the burden of payments. At the same time, water sector tariff reform has resulted in a rapid increase in real water prices. However, few households currently pay their water bills. However, official wages are only one source of income. There is a large and active informal economy and many households receive substantial private transfers from abroad, tempering the impact of utility price increases.

³ Socio-economic situation of the Republic of Armenia, 1999 January-December. Monthly Statistical Analytical Report 2000, Department of Statistics, Yerevan.

Figure 1. The burden of utility price increases in Armenia



Source: Authors' estimates.

The challenge ahead

Increasing cost recovery of utilities is a cornerstone of the GoA's economic reform program. The World Bank has supported this effort through a series of direct investments to improve energy and water supply. They have also conditioned loans and credits on the GoA's passage of tariff increases, improved collections and strengthening of governance and regulation in the sector. But higher utility tariffs continue to meet with political resistance. The GoA is concerned that continued cost-recovery efforts might hurt consumers, particularly the poor. Despite substantial increases in real wages over the last few years, an already difficult situation is likely to be exacerbated as collection rates are increased and tariffs are brought to cost recovery levels in multiple sectors.

The challenge the GoA faces is to maintain cost recovery while minimizing the impact of these efforts on the poor. Recently, the strategy has been to couple tariff increases with generalized social transfers targeted at low-income households. For example, on 1 January 1999, the Energy Regulatory Commission eliminated the increasing block tariff in favor of a single uniform tariff. The poorest households are compensated for the elimination of the lifeline tariff with a direct cash payment through the social protection system.

The task at hand is twofold. First, collection rates from households that are willing and able to pay for improved service delivery, but are not paying because of the non-excludable characteristics of the network, must be improved. Second, if the poor are unable to maintain (or gain) access to the public service network and per unit costs of substitute services are higher than those from the network, then social policy must effectively protect the poor from tariff increases. Ultimately, this document is a contribution to devising a socially equitable and politically feasible strategy that will enable the GoA to continue to restore viability to the electricity and water sectors by providing a better understanding of the relationship between living standards and utility tariff increases.

IDENTIFYING THE POOR AND THEIR PRIORITIES

A central aim of this study is to understand cost-recovery efforts in the water and electricity sectors affect the poor. This chapter has two sections. The first section describes the welfare measure used to identify the poor and its characteristics. The second section explores household development priorities.

What is the preferred welfare measure?

The quantitative household survey collected data on several potential welfare measures, including income, consumption and expenditure (Table 1).⁴ As is typical in these surveys, reported income is lower than reported expenditure. Mean per capita monthly income is 7,000 to 8,000 ARD, expenditure 7,000 to 10,000 ARD. The bottom third of the welfare distribution receives about 15 percent of resources. These results are broadly consistent with those from the 1996 household budget survey, when median monthly per capita expenditure for all households (both rural and urban) was 7,700 ARD.⁵

Table 1. Alternative welfare measures (per capita)

Quantile share of welfare distribution	Aggregate income		Aggregate expenditure		Reported expenditure	
	Urban	Rural	Urban	Rural	Urban	Rural
Bottom third	9%	11%	19%	15%	16%	14%
Middle third	26%	28%	30%	28%	42%	34%
Top third	65%	61%	51%	56%	42%	52%
Gini coefficient	0.45	0.39	0.25	0.32	0.32	0.34
Mean (ARD/month)	7,714	8,660	10,621	6,808	10,403	6,963
Median (ARD/month)	5,707	7,115	9,499	5,695	8,783	6,000

Source: 1999–2000 survey.

Inequality, as measured by the Gini coefficient, ranges from 0.25 to 0.45, depending on the measure. This is well below the 1996 Gini, which was between 0.44 and 0.65. But due to differences in the sample design and aggregation methods, it is not possible to say if inequality in Armenia has increased or decreased since 1996.

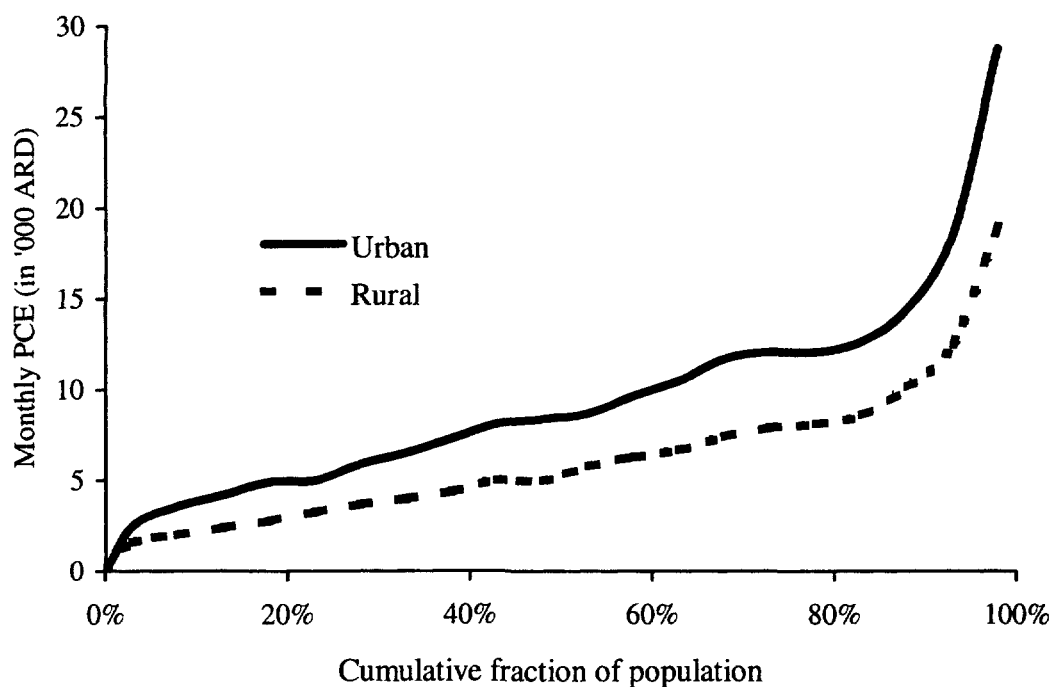
In this study, reported *monthly* per capita expenditure (PCE) is the preferred welfare measure and therefore used to identify the poor and non-poor. While it is not the most theoretically desirable welfare measure, it is more reliable than income and less subject to measurement error than aggregate expenditure. Because it measures cash expenditure only, it is expected to differ systematically between rural and urban areas (Figure 2).⁶

⁴ Annex 2-1 provides an overview of the data cleaning procedure.

⁵ Adjusted for inflation using the CPI.

⁶ Rural households grow 60 percent of the food they consume, whereas urban households grow only 25 percent.

Figure 2. Welfare distributions for rural and urban households



Source: 1999–2000 survey.

Poverty lines are drawn so that rural households with PCEs less than 4,100 ARD and urban households with less than 6,700 ARD are defined as poor.⁷ This choice is generally consistent with the 1996 line, which was just over 5,000 Dram per capita for the entire population.⁸ In 1996 about 24 percent of rural and 30 percent of urban households were identified as very poor. In the analysis that follows about 33 percent of rural and urban households are poor. The poverty profile using these poverty lines is broadly consistent with those from previous surveys (Box 1).

⁷ These are relative poverty lines defining the poor as the lower third of households in the distribution of PCE.

⁸ Adjusted for inflation using the CPI.

Box 1. How does the survey compare with earlier poverty profiles?

1993–1994 survey. Poverty was not significantly correlated with age, gender, unemployment, family size or stock of consumer goods. Factors strongly correlated with poverty included, lack of extended family support, private remittances and informal earnings. Also, location was one of the strongest poverty correlates. In rural areas, those who do not own good quality agricultural land were most vulnerable to poverty.

1996 survey. The main poverty correlates were location, land ownership, education, employment and dependency ratios. More specifically, 58 percent of urban households were poor, compared with 48 percent of rural households. In rural areas, 70 percent of landless households were poor. Wide variation in poverty also existed across and within Marz. While the less educated were worse off, this relationship was weak. As might be expected, the unemployed were worse off, as were households with high dependency ratios, especially when dependents were young, children, invalids or disabled elderly.

1999–2000 survey. As with the 1996 results, the poverty profile for this survey suggests that household size, employment, and education are all highly correlated with welfare.⁹ Larger households, especially those with more dependents, are worse off,¹⁰ and households with at least one wage earner are better off. Education is positively correlated with welfare in urban areas. Poverty remains highly location-specific, with urban households in most but not all Marz outside Yerevan tending to be worse off. Urban homeowners and households with significant assets such as cars were much less likely to be poor. Households with vulnerable groups such as the disabled and pensioners were not consistently worse off, but rural households with a disabled member were more likely to be poor.

Source: World Bank (1996) "Armenia, Confronting Poverty Issues," Report No. 15693-AM. June 10, Washington, D.C.; 1999–2000 survey.

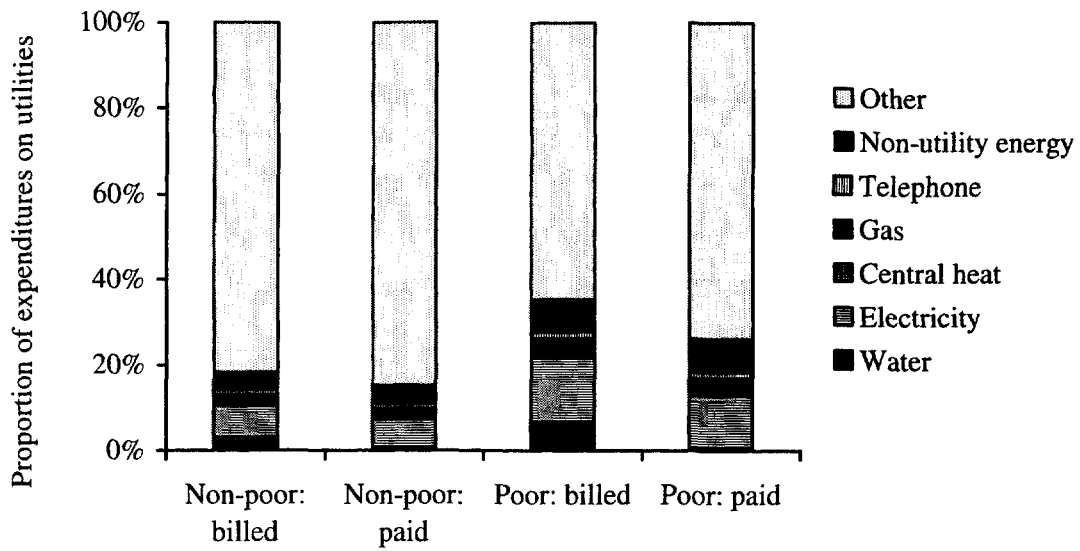
How much money are people spending on utilities?

The challenge is in trying to increase cost recovery in the utility sector in a socially equitable manner. Current expenditures on such utilities as telephone, gas, central heat, electricity and water are 18 percent for poor and 11 percent for non-poor of average household monthly expenditures. If households were actually paying the full amount they are being billed for these services, this would rise by about 9 percent for the poor and 3 percent for the non-poor, thus consuming a larger share of the poor's budget (Figure 3).

⁹ These trends are confirmed in the multivariate analysis presented in Annex 2-3

¹⁰ As with the 1996 survey results, there do not appear to be significant economies of scale in household consumption—see Annex 2-2.

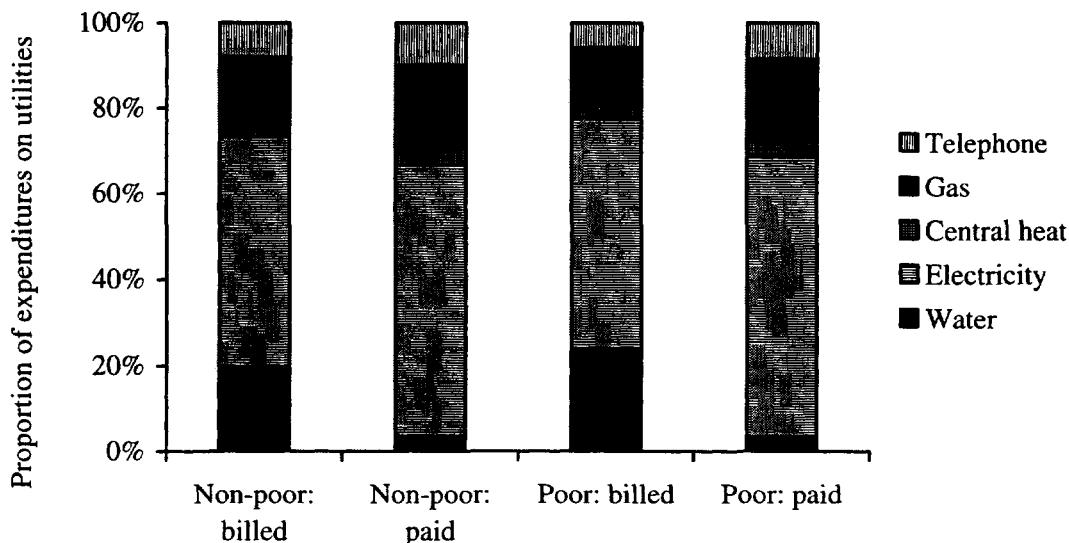
Figure 3. Overall household expenditure basket



Source: 1999–2000 survey.

At current levels, approximately 68 percent of total utility expenditures are on water and electricity. If consumers were to pay these bills in full, about 75 percent of total utility expenditures would be on water and electricity (Figure 4).

Figure 4. Utility expenditure basket



Source: 1999–2000 survey.

What are people’s development priorities?

Before exploring the specific concerns of poor and non-poor households related to water and electricity, it is important to first consider how these concerns fit into overall development priorities. How important are utility services compared with other needs? Respondents were asked to rank their development priorities.¹¹ The most important: unemployment, social protection and preventive healthcare. These are followed by utility or infrastructure issues such as water supply, electricity and housing maintenance (Table 2).

¹¹ The exact wording of the question is as follows. Suppose that the Government of Armenia had enough money to help with one of the following problems: Unemployment, preventive health care, primary education, water supply, electricity, roads, public transportation, telephone, new housing, housing maintenance, solid waste collection, sewerage and wastewater, water level in lake Sevan, social protection programs and other. Which of these problems is the most important to solve first? Which of these problems is the most important to solve second? Which of these problems is the most important to solve third?

Table 2. Development priorities

Development priority	1 st most	2 nd most	3 rd most	Total ¹²
	important	important	important	
Unemployment	59%	12%	7%	26%
Social protection	14%	18%	27%	20%
Preventive healthcare	9%	25%	15%	16%
Water supply	6%	9%	9%	8%
Electricity	2%	7%	7%	5%
New housing	2%	5%	5%	4%
Other	8%	23%	32%	21%
Total	100%	100%	100%	100%
N	2,010	2,010	2,010	6,030

Source: 1999–2000 survey.

Aside from a few minor exceptions, the ranking of priorities remains remarkably consistent if responses are subdivided by location (rural, urban and Marz), or respondent's education, age or gender. Consistent with Armenia's being a relatively homogenous society, this implies that a national development strategy addressing these priority areas will serve the majority of the population well.

Do the poor have the same priorities as the non-poor?

A higher percentage of poor than non-poor reported social protection as an important priority. But there is almost no difference in the emphasis they place on infrastructure issues such as water supply and electricity (Table 3).

Table 3. Development priorities by welfare

Development priority	1 st most important		2 nd most important		3 rd most important	
	Poor	Non-poor	Poor	Non-poor	Poor	Non-poor
Unemployment	60%	58%	14%	11%	7%	7%
Social protection	17%	13%	23%	16%	28%	26%
Preventive healthcare	8%	10%	20%	27%	16%	14%
Water supply	6%	6%	11%	9%	10%	8%
Electricity	2%	2%	9%	7%	7%	6%
New housing	3%	2%	7%	4%	7%	4%
Other	5%	9%	16%	26%	25%	35%
Total	100%	100%	100%	100%	100%	100%
N	608	1,402	608	1,402	608	1,402

Source: 1999–2000 survey.

There are no large differences between rural and urban priorities. Again, unemployment, social protection and preventive health care are the top priorities. Urban respondents place a slightly higher emphasis on unemployment and rural respondents on social protection.

¹² "Total" here refers to frequency with which a particular priority was mentioned either as a first, second or third priority.

Dividing priorities by Marz reveals some interesting differences. For example in Gegharkunik, a mountainous Marz around Lake Sevan, roads follow unemployment and social protection as top priorities. In Lory, where many households depend on public taps for water, water supply ranks above preventive health care. In Shirak, in the earthquake zone, housing maintenance follows unemployment and social protection.

After macro-economic issues such as employment and social-protection, water and electricity are consistently at the top of the list of people's development priorities, suggesting that this analysis is quite timely.

HOUSEHOLD ENERGY CONSUMPTION

This chapter presents a snapshot of household energy consumption patterns and the impact of the electricity tariff increase. Energy accounts for between 16 and 30 percent of monthly household cash expenditure. The most common sources of energy are electricity, wood and natural gas. The burden of rising electricity prices appears to be highest among the urban poor, because they have the least access to low-cost substitutes, such as wood.

What happened?

In the late 1980s the price of residential electricity was very low, eliminating incentives to save energy and creating a mentality among the population that electricity should be provided virtually free to the people. In the early 1990s electricity generation plummeted. At the low point in 1993 electricity was typically supplied to households for only 2 to 4 hours a day. Payments from residential consumers dropped to 10 percent, further compounding price distortions and perceptions.

Considerable progress has been made in reforming the energy sector since 1995. Electricity supply has become more reliable. Payment discipline has improved. And tariffs have been raised. Also, an energy law has been adopted, and an independent commission established to regulate prices. The GoA and the energy commission will continue to review electricity tariffs and efficiency-enhancing measures every six months and—if possible, tariffs will be adjusted to cover depreciation, inflation, exchange rate changes and capital costs.

As part of the effort to increase cost recovery, the increasing block tariff in place in 1998 was eliminated in favor of a single price in 1999. To soften the impact, a direct cash transfer of 1,450 ARD was provided to approximately 30 percent of households (230,000 households) eligible for the family benefit, plus an additional 9 percent (70,000 households) expected to have difficulty meeting their electricity payments.

Household energy consumption patterns

Households consume energy for lighting, heating, water heating and cooking. For lighting, 100 percent rely on electricity. For heating and cooking, they consume wood, electricity and both central gas and liquid propane gas (LPG). Much less common are dung, kerosene and diesel.

Large amounts of energy are consumed for heating, particularly in the colder winter months. Fifty-three percent use wood, 17 percent electricity (Table 4). Other important sources of energy for heating include natural gas and central heat. Rural households depend more on wood for heating than urban households do, and the urban poor depend significantly more on wood (56 percent) and less on electricity (14 percent) for heating than the urban non-poor (42 percent and 29 percent respectively).

Energy is also consumed for heating water and cooking. For heating water, 44 percent use wood, 35 percent electricity and 14 percent natural gas. Again, the *urban poor* depend significantly more on wood and significantly less on electricity than the urban non-poor. For

cooking, 37 percent use wood, 29 percent electricity and 26 percent natural gas. Natural gas is favored for cooking by non-poor in both rural and urban areas.

Table 4. Household energy consumption patterns

Primary source for:	Heating		Heating water		Cooking	
	Poor	Non-poor	Poor	Non-poor	Poor	Non-poor
Electricity	10%	20%	31%	37%	28%	29%
Central heat	7%	9%	–	–	–	–
Central gas	8%	11%	11%	13%	13%	16%
LPG	<1%	<1%	1%	1%	8%	13%
Wood	59%	50%	47%	43%	41%	35%
Dung	6%	5%	6%	5%	6%	4%
Other	9%	5%	4%	2%	5%	2%
Total	100%	100%	100%	100%	100%	100%
N	625	1,385	625	1,385	625	1,385

Source: 1999–2000 survey.

The poor consume 20 to 30 percent less of each type of energy than the non-poor. Conditional on positive consumption of a given type of energy, median household consumption of electricity was 1,275 kWh, LPG 60 kg, wood 5 m³ and dung 5 m³.¹³ Again, there are significant rural and urban differences, with rural households consuming less electricity and natural gas, and more wood and dung, than urban households.

Data on the price of substitutes was also collected as part of the survey (Table 5). While electricity and natural gas prices are constant at 25 ARD per kWh and 51 ARD per m³, there is some variation in the prices of LPG and wood. The price of LPG is between 300 and 400 ARD per kilogram, highest in urban Lory Marz and lowest in rural Ararat Marz. The price of wood ranged from a low of 4,000 ARD per m³ in densely forested Lory Marz to a high of 8,000 ARD per m³ in Yerevan.

Table 5. Prices of LPG and wood in December 1999

	LPG (ARD per kg)		Wood (ARD per m ³)	
	Urban	Rural	Urban	Rural
Yerevan	322		8,104	
Gegarkunik	332	341	6,246	6,721
Lory	370	334	4,288	4,092
Ararat	329	318	7,971	7,816
Shirak	328	350	6,568	7,409

Source: 1999–2000 survey.

The burden of energy expenditures is very large, particularly for the poor. They are close to 30 percent of PCE for the poor and 18 percent for the non-poor (Table 6).¹⁴ Electricity makes

¹³ Wood consumption is substantially lower than reported in the qualitative portion of the survey, where households said they consumed 20 to 30 m³ per year.

¹⁴ This result must be treated with caution because the mean is influenced by a number of high consumption and low expenditure values.

up the bulk of energy expenditures for all households and the burden of raising prices would appear to be highest among the urban poor, with 16 percent of their expenditures going for electricity alone. The rural poor spend equivalent amounts on wood and electricity.

Table 6. Energy expenditures¹⁵ (percent of monthly expenditures)

	Rural		Urban	
	Poor	Non-poor	Poor	Non-poor
Electricity	13%	7%	16%	9%
Natural Gas	6%	4%	3%	2%
Wood	13%	8%	5%	2%
Other	1%	1%	2%	1%
Total	34%	21%	27%	16%
N	177	402	380	793

Source: 1999–2000 survey.

Kaiser (1999) reports that in 1997 an average of 9–10 percent of household income was spent on *electricity* during the winter and summer. In Western countries, electricity expenditures typically range from 3 to 7 percent of total income (Kaiser 1999). This is also broadly consistent with data from 1996, which suggests that the cost of *electricity* exceeded 10 percent of an urban household's expenditures for the average *very poor* family and less than 3 percent for a non-poor family.¹⁶

Note that expenditures on wood and dung may not fully reflect consumption, particularly for the poor. The reason is that households often collect part or all the wood they use for heating and cooking. Sixteen percent of households cut their own wood, with this activity concentrated, as expected, in the densely forested Lori Marz. The poor spend approximately 20 days a year on this activity and the non-poor 12 days.

How reliable is electricity service?

The reliability of electricity supply has steadily increased since 1994, when service was available for a few hours a day. In 1996 slightly less than 90 percent of households reported expenditures on electricity. Today, 98 percent of households report having electricity and paying for it, with the remaining 2 percent reporting that their service was cut off due to non-payment.

In addition to better coverage, the electricity service has become more reliable. The qualitative study indicated that electricity was available 24 hours a day in all locations and that there were no electricity failures. Seventy percent of respondents report no break in service in the last year. Of the 30 percent that did have a break, the median duration was 3 days and the mean 14 days. These figures are slightly higher for the poor (4 days and 17 days) than for the non-poor (3 days and 12 days).

¹⁵ Households with *positive* expenditures for at least one source of the three sources of energy reported in the table.

¹⁶ World Bank. 1996. "Improving Social Assistance in Armenia". The poverty lines are set differently and expenditures are measured differently, so they are not directly comparable.

Respondents are satisfied with the electricity service maintenance. Eighty-six percent believe that a utility employee performs maintenance activities. But the qualitative consumer satisfaction survey indicated that respondents were not sure whom they should contact if they had problems with their electricity service. Friends or relatives often make informal repairs in the household. A higher percentage of the poor report making repairs themselves (13 percent) than the non-poor (7 percent).

The quality of service was rated as average or better than average 95 percent of the time. But some aspects of electricity quality can still be improved. Twenty-two percent of respondents report having lost an appliance in the last year due to a surge in electricity.

What are the payment and collection mechanisms?

Armenia has made considerable progress in improving electricity collection rates since 1994. Electricity is metered in all households. In 85 percent of households meters are read once a month. In the remaining 15 percent, meters are read an average of twice a month. The poor are much more likely to have their meter read twice a month (22 percent) than the non-poor (12 percent).

Depending on location, payment may be through the local bank, the post office or local fee collectors. Eighty-seven percent of respondents pay their electricity bill at the post office, about 7 percent at the bank. The remaining 6 percent pay fee collectors working for the utility, with the latter common only in rural areas.

How do people cope with rising energy prices?

With energy expenditures accounting for 15–30 percent of PCE, many households have a very difficult time paying their bills. The qualitative research suggests that one coping mechanism is to pay only a fraction of the bill, maintaining service while accumulating arrears. Another coping strategy is to monitor consumption closely and then impose austerity measures when the budget is reached.

Most households pay part of their electricity bill each month. A common explanation for non-payment that emerged from the qualitative analysis is that the GoA owes them salary arrears, pension arrears or the savings that disappeared from their bank accounts at the end of 1993. Furthermore, public sector employees often stated that until wages are increased they will not pay their utility bills. The issue of arrears is explored in greater detail below.

When questioned directly, about 45 percent of households said that they avoid having their electricity service cut off by paying some fraction of their bill. The remaining 55 percent reported that they must pay their entire bill to avoid service cut-off. When asked what will happen if they do not pay any fraction of their bill, 88 percent responded that service will be cut off.

How do people reduce consumption of electricity in the face of rising prices? Ninety percent of the poor and 86 percent of the non-poor said they were always careful to turn out the lights when leaving a room. Seventy-three percent of the poor and 61 percent of the non-poor said

they always made an effort to wear more clothing to reduce the amount of electrical heating they consume.

On alternatives, 80 percent of all households and, in particular, 95 percent of the rural poor report that they have substituted away from electricity. More than 60 percent report that the primary substitute is wood, and about 24 percent gas (Table 7). The stated increased reliance on wood is particularly acute among the urban poor. The primary use of substitutes is for heating and cooking. When asked directly if they made an effort to reduce their reliance on electricity over the past 12 months, about 65 percent of poor and 54 percent of the non-poor said they had, with the effort highest among the rural poor (71 percent).

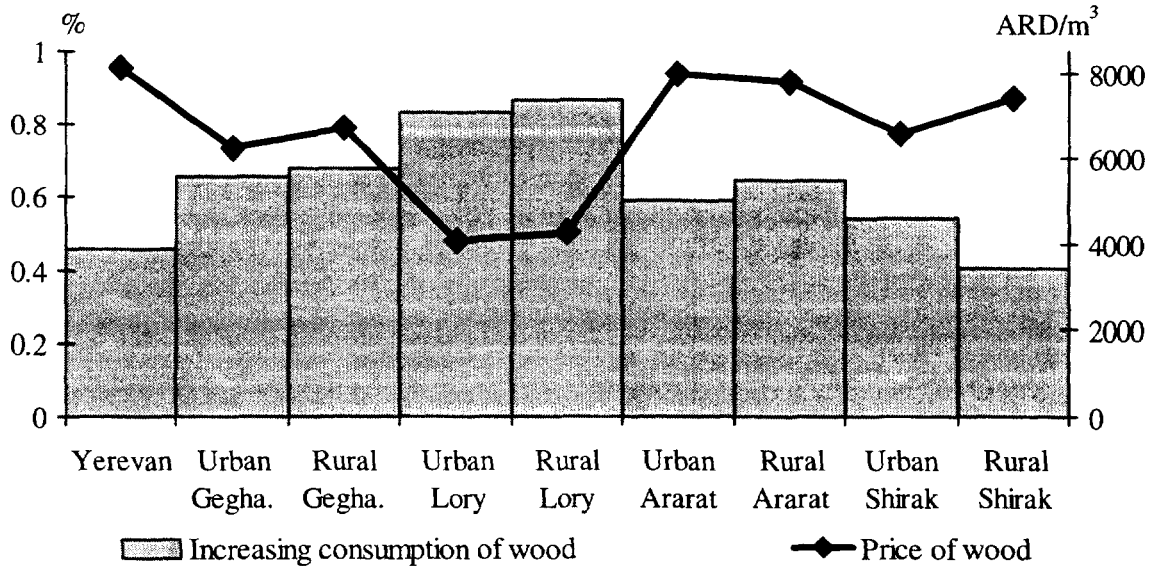
Table 7. Stated sources of energy used to reduce reliance on electricity

	Rural		Urban	
	Poor	Non-Poor	Poor	Non-Poor
Wood	63%	68%	68%	57%
Natural gas	14%	16%	17%	35%
Kerosene	1%	1%	7%	6%
Dung	18%	14%	1%	1%
Other	3%	0%	7%	7%
Total	100%	100%	100%	100%
N	93	204	181	316

Source: 1999–2000 survey.

Increases in wood consumption appear closely correlated with the price of wood, with the highest stated increases in wood consumption in Lory Marz, where the prices of wood are lowest (Figure 5). The lowest stated increase in consumption occurred in Yerevan, where the price of wood is highest. Again, this suggests that the burden of rising electricity prices is likely to be highest for poor urban households because they face the highest priced substitutes for electricity.

Figure 5. Increasing wood consumption and price in 1999



Source: 1999–2000 survey.

How much was the price of electricity increased?

On 1 January 1999 a new electricity tariff or rate structure came into effect. The existing increasing block tariff (1st block 0–100 kWh = 15 ARD/kWh, 2nd block 100–250 kWh = 20 ARD/kWh, and 3rd block >250 kWh = 25 ARD/kWh) was eliminated in favor of a uniform price of 25 ARD per kWh. In 1998 before tariff restructuring, electrical utility billing records for the survey sample indicate that a typical household faced an effective average price of approximately 17 ARD per kWh.¹⁷ So the 1999 tariff change can be seen as a 47 percent increase in price.

The rest of this section examines the impact of the new electricity tariff on household consumption and payment behavior. The analysis is based on a subset of 1,514 households from the survey sample for which complete utility records are available from March 1998 through December 1999.¹⁸ The proportion of poor and non-poor households in this subset is equal to the proportion in the overall sample, 485 and 1,029 poor and non-poor households respectively. Unless otherwise noted, this discussion focuses on comparing household consumption and

¹⁷ Note that for 1998, the Government reported the effective average household tariff was 19.2 ARD/kWh or 20 ARD/kWh adjusting for technical/commercial losses retroactively reflected in consumption figures. These calculations are based on dividing aggregated or total bills by total consumption for all households consuming electricity in 1998. Calculating an effective average tariff in this manner using the billing record also results in a figure of 19.2 ARD/kWh. However, a more appropriate measure of the effective average price actually faced by individual households can only be calculated using individual household consumption and billing records. Taking the average of the effective price faced by each individual household during 1998 using available monthly billing records results in the 17 ARD/kWh effective price quoted here.

¹⁸ Unfortunately only complete billing records for households in Yerevan are available from the utility for months before March 1998.

payment behavior between 1998 and 1999 using March-November billing, payment and consumption data.¹⁹

What was the overall impact of the price increase?

Total household electricity consumption dropped 17 percent—from 2.2 million kWh in March-November 1998 to 1.8 million kWh during the same months of 1999 (Table 8). Despite this drop in consumption, the new tariff resulted in a 16 percent increase in total billings. But utility revenues from the households increased only 6 percent, as household payments failed to keep pace with billings. Calculated collection rates—the ratio of total payments to total billings—fell 9 percentage points, from 97 percent in 1998 to 88 percent in 1999 (Figure 6).

Table 8. Aggregate impact of electricity tariff change *

Household	1998	1999	Change between 1998 and 1999	
			Units	Percent
Consumption—million kWh (a)	2.22	1.83	-0.38	-17%
Billings—million ARD (b)	39.57	45.79	6.22	16%
Payments—million ARD (c)	38.22	40.33	2.11	6%
Collection rate—percent (c/b)	97%	88%		-9 pp.**

* For sample households only

** Percentage points

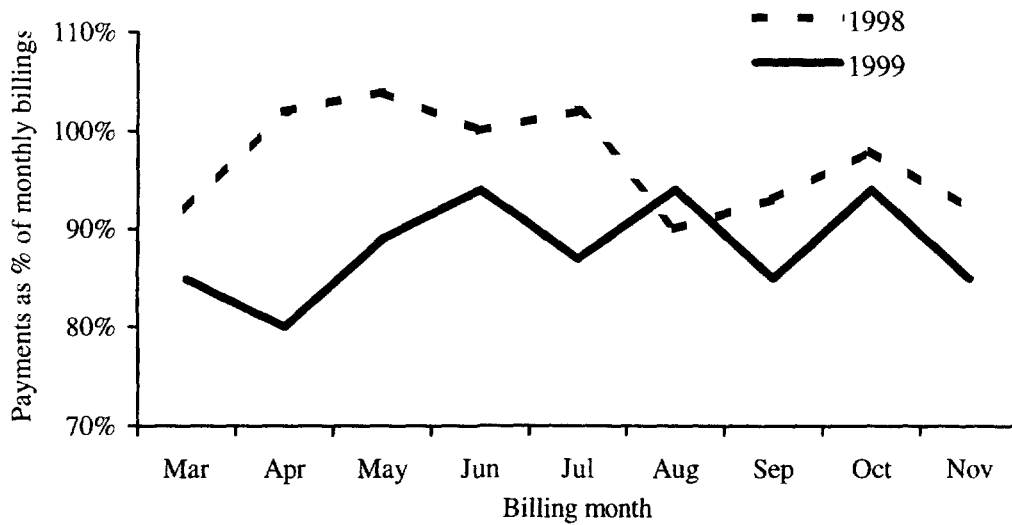
Source: 1999–2000 survey.

The GoA reports collection rates for 1998 and 1999 as 86 percent and 79 percent. Both the collection rate and the change in the collection rate calculated in this analysis are higher than the reported figures. There are three possible explanations for this. First, the analysis does not include data from the months with the highest incidence and level of arrears—January, February and December—thus resulting in a potential overestimation of collection rates.²⁰ Second, the reported figures include technical and commercial losses as well as nonresidential consumption and payment data not included in household billing data used in this analysis. Third, the reported figures are based on national data, whereas the analysis presented here is based on a sample from five Marz. The sampled Marz may have systematically higher collection rates than the rest of the country.

¹⁹ Note: December billing and consumption data is excluded as payment information for that month in 1999 (i.e., January 2000 payments) is unavailable.

²⁰ For example, the collection rate for 1999 calculated over bills for January-November is only 85 percent.

Figure 6. Monthly collection rates



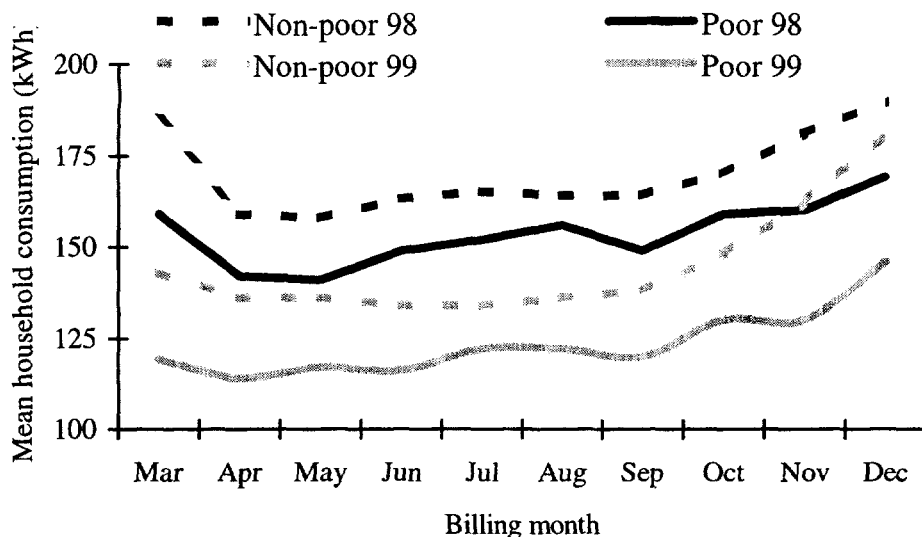
Source: 1999–2000 survey.

Did consumption fall more among the poor?

Average household consumption by the non-poor decreased by 16 percent from 178 kWh a month during March–November 1998 to 141 kWh a month during these months in 1999.²¹ Meanwhile, poor households responded more strongly to the price change, decreasing average consumption by 20 percent from 152 kWh a month in 1998 to 121 kWh a month in 1999 (Figure 7). Consumption decreased significantly more among rural households (26 percent) than urban (13 percent).

²¹ The drop in consumption does not appear to be caused by climatic variations as temperatures during the major heating months in the period of analysis were actually lower in 1999 than in 1998.

Figure 7. Household electricity consumption 1998 and 1999

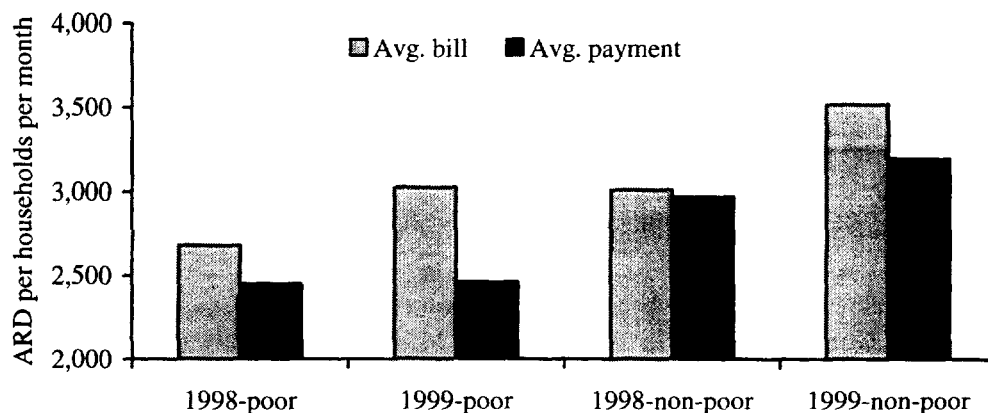


Source: 1999–2000 survey.

How did bill amounts and payments change?

For non-poor households, although average consumption fell 16 percent, average monthly bills under the new tariff increased 17 percent—from 3,010 ARD in 1998 to 3,520 ARD in 1999. But these households increased their average monthly payments to the utility by only 7.5 percent—from 2,970 ARD to 3,190 ARD. Despite a 20 percent reduction in average consumption by the poor, their average bills increased by 13 percent—from 2,680 ARD in 1998 to 3,020 ARD in 1999. Average payments by the poor remained about the same at approximately 2,450 ARD per month (Figure 8). The observation that average expenditures by poor households were more or less constant before and after the price change suggests that the poor cannot or will not spend more than they currently do on electricity.

Figure 8. Average monthly bills and payments

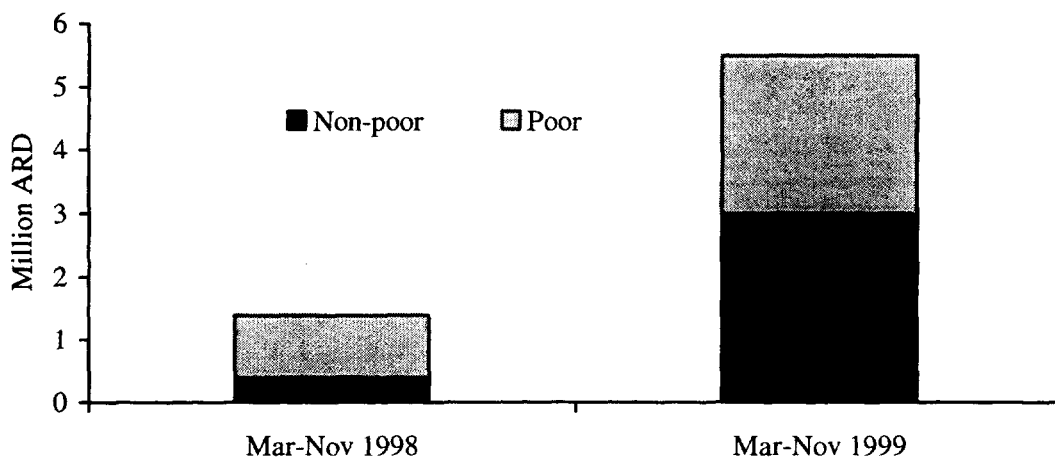


Source: 1999–2000 survey.

How did the gap between bills and payments change?

The gap between billings and payment, or arrears, increased significantly for both the poor and the non-poor between 1998 and 1999. Over the March–November period, total arrears increased four-fold—from 1.4 million ARD in 1998 to 5.5 million ARD in 1999 (Figure 9). In 1998 the non-poor accounted for less than a quarter of arrears even though they constitute two-thirds of the sample population. In 1999 arrears of the non-poor grew dramatically and accounted for over half of the total.

Figure 9. Total arrears or unpaid balances



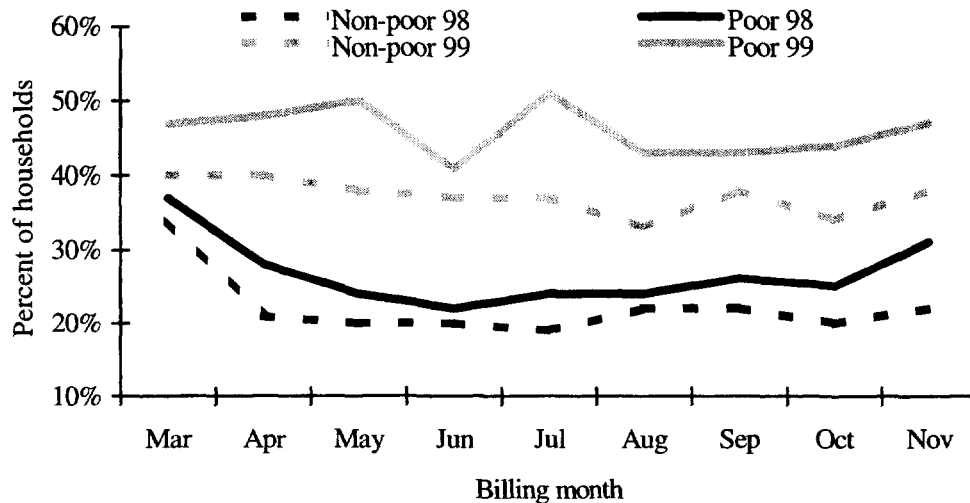
Source: 1999–2000 survey.

Two factors contributed to this. First, the *number* of households not paying their bill in full each month increased. Before the tariff increase in 1998, on average, fewer than a quarter of

households did not clear their bills in a particular month. In 1999, on average, more than a third of households did not clear their bills in a particular month. Second, the average monthly *size* of arrears or the unpaid balance per household also increased—by 13 percent.

Among the non-poor, the percentage of households carrying arrears increased from 22 percent to 37 percent while that of poor households carrying arrears increased from 27 percent to 46 percent (Figure 10), increases of 15 and 19 percentage points respectively. The increase in the size of arrears was larger among the poor than among the non-poor, 15 and 10 percent respectively.

Figure 10. Households with arrears²²

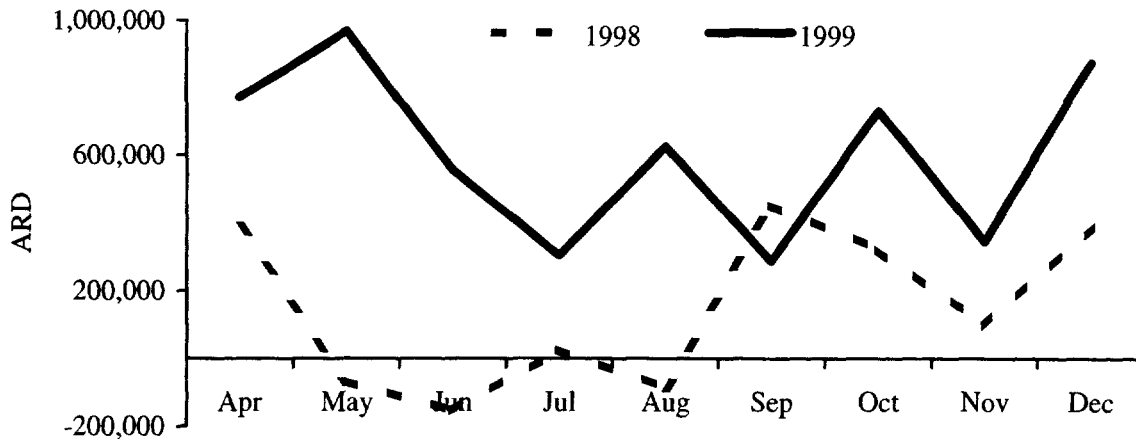


Source: 1999–2000 survey.

Monthly billing and payment trends in 1998 and 1999 reveal that consumption and thus billings are significantly higher in winter (Figure 11). Households appear to have the most difficulty paying these higher bills and tend to accrue arrears during these months. In 1998 households paid off their winter arrears over May through August. In 1999, however, households were unable to do so—in fact, they tended to accrue additional arrears accumulating significant debt to the utility over the year.

²² A household is considered in arrears if the difference between the payment and the bill is greater than 5 percent of the bill.

Figure 11. Monthly arrears owed to the utility



Source: 1999–2000 survey.

What was the impact and effectiveness of cash transfers?

Two actions were undertaken an effort to minimize the impact of the 1999 tariff increase on the poor. First, a newly designed family benefit targeted at 28 percent of households below the poverty line was introduced in 1999. Second, an additional 9 percent of households not eligible for the family benefit, but expected to have difficulty paying their electricity bills, were to receive 1,450 ARD per month.

The data indicate that the correct percentage of households in the sample received the cash transfer. About 28 percent of households reported receiving the family benefit or a closely related benefit from the government in 1999. The mean monthly amount received was 9,480 ARD per household or 2,500 ARD per capita.

In addition, about 8 percent received a special cash benefit or other electricity privilege of some kind in 1999.²³ Almost all households receiving the latter benefit report receiving 1,400 or 1,450 ARD per month. But they reported receiving it only an average of 6 times during the year. Thus, the average amount of special cash benefit received was 9,470 ARD per household per year, less than the targeted amount of 17,400 ARD per year if households had received it for 12 months. But even the limited amount provided represents a significant cash transfer—almost 5 months of these households' average 1999 electricity bills.

²³ Five percent of households specified that they received the special cash benefit while 3 percent said they received a reduction in their bill or a voucher (usually for 600 kWh) to help defray their electrical bill. Only 10 percent of households receiving the special cash benefit, 9 of the 2010 sampled, claimed to be receiving both the family benefit and the special cash benefit.

Were cash transfers well targeted?

Without information on the formula used to determine which households were targeted to receive the cash transfers,²⁴ it is not possible to determine targeting success. But it is possible to examine whether poor households *and* households regularly consuming in the lower blocks of the 1998 tariff structure reported receiving the transfer (Table 9). Poor households were more than twice as likely to receive the cash transfer than non-poor households. And households regularly consuming electricity in the first two blocks of the 1998 tariff were significantly more likely to receive the cash transfers.

Table 9. Targeting of electricity cash transfers (1,514 household sub-sample)

	Household welfare		Monthly electricity consumption, 1998 ²⁵	
	Poor	Non-poor	<250 kWh	>250 kWh
Mean consumption (kWh)	152	167	105	203
Households receiving cash transfer	55%	23%	36%	25%
<250 kWh (1998 consumption)	56%	47%		
N	485	1,029	753	761

Source: 1999–2000 survey.

Did cash transfers help soften the impact?

Households receiving the cash transfer cut their consumption after the price increase by about 20 percent, similar to poor households overall. Their average bills rose by a 15 percent, again similar to poor households overall. But unlike poor households whose average payments were unchanged between 1998 and 1999, households receiving cash transfers increased average monthly payments to the utility by 4 percent. Although it is difficult to determine if the cash transfers offset the adverse impact of the tariff increase, it may well have prevented an even greater drop in consumption and increase in arrears among the recipients. It is also possible that these cash transfers may work even better if targeted households receive them every month.

Conclusions and lessons

Recognizing the need for a reliable utility sector to achieve sustainable development, the GoA embarked on a series of economic reforms aimed at putting the energy sector back on its feet. Considerable progress has been made in reforming the energy sector since 1995. Electricity supply has become more reliable. Tariffs have been raised, cross-subsidization reduced, and payment discipline improved. Transparency of financial flows has increased and accumulation of quasi-fiscal debts diminished. Also, an energy law has been adopted and an independent Energy Commission established to regulate prices. The Energy Commission is expected to review electricity tariffs and efficiency-enhancing measures every six months to ensure that they are adjusted to fully cover medium-term costs, including depreciation, debt service, and other capital

²⁴ An important future step will be to analyze this information and compare it with this report's findings.

²⁵ <250 kWh implies consumption in every month of record in 1998 was within the first two tariff blocks. >250 kWh implies that consumption in at least one month was greater than 250 kWh.

costs. In order to improve the financial sustainability of the utilities, household tariffs are being raised to reflect the high cost of supplying low voltage electricity. As part of this effort, on 1 January 1999 the increasing block tariff was eliminated in favor of a single price of 25 ARD per kWh.

The household response to this change in the electricity tariff offers important insights into electricity pricing policy and energy sector strategy. For households, electricity consumption dropped on average 17 percent and reported consumption of such substitutes as wood and natural gas increased. In addition, household collection rates fell 9 percentage points, and arrears increased four-fold. Relative to the non-poor, the poor cut consumption more, the percentage of households with arrears was higher, and the average size of arrears increased more. For the utility, the net result was a revenue increase from these sampled households of about 6 percent.

Elimination of the increasing block tariff was predicted to raise the average price of electricity 30 percent (from 19.2 to 25 ARD per kWh). However, the household survey indicates the new price of 25 ARD per kWh represented an unexpected 47 percent increase (from 17 to 25 ARD per kWh). The difference between the expected and actual tariff increase occurred because the calculation of average price was based on aggregate utility data rather than household level data. Price response prediction can be significantly improved through better methods, data reporting, and sector statistics.

As electricity consumption dropped, reported consumption of wood and natural gas increased. While the inefficient practice of heating with electricity has been reduced, this must be balanced against potential environmental problems associated with increased wood consumption such as deforestation and increased indoor air pollution. Balancing such concerns signals the need to develop a long-term national heating strategy. This strategy would identify economically efficient and sustainable priority actions to meet basic heating needs.

The utility revenue increase of about 6 percent from sampled households was less than expected. The household revenue increase was limited by a drop in consumption and a simultaneous fall in collection rates and increase in arrears. Improving collection rates, particularly among the population that can afford to pay their electricity bills, is one way to increase utility revenues from households. A complete analysis of the impact of the household tariff increase on the utility revenues and costs requires additional information on other sources of revenue, such as industrial consumers and exports.

The burden of energy expenditures is large for most households, particularly for the poor. Electricity makes up the bulk of these expenditures, and a further increase in tariffs, without access to low cost substitutes, would lead to the greatest hardship for the urban poor. The urban poor spend 16 percent of monthly cash expenditures on electricity and have the least access to wood.

The 1999 tariff increase coincided with the GoA's reshaping and expansion of spending on the family benefits system. This new system was expected to soften the impact of the tariff increase on the 28 percent of households below the poverty line. In addition, a direct income transfer was provided to 8 percent of households expected to have difficulty meeting their electricity payments. Significantly more of the poor (than non-poor) and significantly more of the

households regularly consuming in the first two blocks of the 1998 electricity tariff were receiving the income transfer in 1999.

Looking forward, future electricity tariff increases should be closely coordinated with improved price response prediction and credible actions to mitigate the potential impact on the poor and the environment. This includes detailed consumer behavior analysis and timing tariff increases with investments that facilitate access to clean, sustainable, and affordable sources of energy.

HOUSEHOLD WATER CONSUMPTION

Although connections to piped utility water are very common among Armenian households, service is often unreliable, so households spend considerable time transporting, pumping and storing water. Under the current water supply and billing system, the water utility expects non-poor households to pay approximately 3 percent and poor households about 8 percent of their respective current monthly expenditure for an average of 9 hours of water service a day. But these bills are almost never paid, except when households are threatened with the elimination of service. Respondents indicated that they are not paying the full water bill because they believe that they are being charged for more water than they consume.

While respondents may not pay their water bills, the data suggest that households are willing to pay for improved water service, particularly if service reliability is increased. Demand for improved service goes from elastic to inelastic at about 500 ARD per m³ (\$1 per m³). At this price respondents' state that they would consume on average only 20 LCD from the improved system, resulting in monthly water bills that would be slightly lower than the currently unpaid bills. This self-estimate of water consumption is very low, and households' connected to the improved system are expected to consume more water as system service is improved.

What led to the current situation?

As with electricity, domestic water prices were traditionally set very low and system maintenance was not closely linked to revenue from households, and service improvements were driven primarily by supply side concerns. Revenue was primarily generated from higher priced industrial consumption. This changed dramatically in the late 1980s, leading to a significant shift in the utilities' consumer base. Industrial water consumption dropped by about 50 percent, and domestic consumption increased from approximately 60 percent to over 90 percent of utility production in just a few years.

At the same time the GoA initiated major changes in the water tariff structure, dramatically increasing prices for domestic consumers. For example, from 1995 to 1999 in Yerevan, real domestic tariffs increased almost 100 percent while the non-domestic tariff actually decreased 36 percent. Not only have the water utilities become much more financially dependent on revenue from domestic consumers, but also non-payment (or free-riding) has become a major problem. Bill payment enforcement is almost nonexistent because system characteristics make it difficult to deny access to individual households and because consumption is not metered.

The Armenian water utilities are caught in a low-level equilibrium trap, characterized by decreasing service quality and falling revenue. Operating expenses have increased, especially due to increasing water losses in aging and poorly maintained distribution systems, which drive up pumping costs. Unable to cover operating expenses, the water utilities have been forced to reduce hours of service. Meanwhile revenue continues to fall as households refuse to pay their bills partly because of the decreasing service quality. Thus lacking revenue to properly maintain system infrastructure, operating expenses continue to increase and service quality suffers.

The challenge is for the water utilities to break out of this trap by employing strategies that generate more revenue and improve service to both the poor and non-poor. This chapter

considers how implementation of such a strategy might be guided by expressed public opinion on current service and willingness to pay for service improvements.

How satisfactory is the current level of service?

Forty percent of respondents report general dissatisfaction with their water service. As a group, the rural poor report the highest dissatisfaction (50 percent). Dissatisfaction is particularly high among households relying on public street taps as their primary water source.²⁶

The top priority for water service improvement for all households is more hours of service (Table 10). System maintenance, presumably related to reliability,²⁷ is also a priority, especially among rural households. Many rural households place a high priority on increased access to a central water system. While respondents indicate support for improvements that require a capital investment, they did not indicate support for increased prices that could generate the revenue needed to pay for these improvements. Indeed, 20 to 30 percent of households consider reducing current prices a priority, and fewer than 10 percent consider meter installation a priority. Determining how to pay for the desired improvements is a critical task facing the utilities.

Table 10. Top priorities for water service improvement

Priorities	Urban		Rural	
	Poor	Non-poor	Poor	Non-poor
Improve water quality	7%	8%	9%	7%
Reduce health risks	7%	4%	5%	3%
More hours of service	34%	35%	23%	25%
Reduce the price	34%	22%	21%	19%
Install meters	6%	10%	2%	4%
Improve maintenance	5%	10%	20%	19%
Improve water pressure	3%	4%	1%	2%
Central system for all	1%	1%	14%	10%
Don't know	3%	6%	5%	11%
Total	100%	100%	100%	100%
N	428	922	197	463

Source: 1999–2000 survey.

Who has access to running water at home?

The vast majority of households have access to running water in their homes (Table 11). The rural poor have significantly less access to running water in their homes compared to the rural non-poor and to urban households.²⁸ Twenty-five percent of the rural poor rely on shared home taps or public street taps as their primary water source.

²⁶ Most of these respondents are poor rural households

²⁷ Household's ranking this as a top priority reported longer periods without water in the last year.

²⁸ These results are consistent with the Household Budget Survey (HBS) carried out in Nov-Dec 1996.

Table 11. Poverty and primary water source

Primary water source	Urban		Rural	
	Poor	Non-poor	Poor	Non-poor
Exclusive home tap	98%	99%	75%	86%
Shared home tap	1%	1%	5%	2%
Public tap	1%	1%	20%	11%
Other sources ²⁹	>1%	0%	>1%	>1%
Total	100%	100%	100%	100%
N	428	922	197	463

Source: 1999–2000 survey.

Is access the same for all?

While most households have access to home taps, there is much variation in the service they receive. Both the focus group and the survey respondents indicated that their water service is unreliable. Survey respondents reported two measures of service reliability: (1) the number of *hours* that water is typically available from their tap each day, and (2) the longest number of *days* that water was unavailable from their tap during the last year.

For hours of service, only 25 percent of households indicate that water is available from their taps 24 hours a day. Average daily hours of service are higher in rural areas (14 hours) than in urban areas (8 hours). For households with less than 16 hours of service a day (70 percent), water was typically available for a few hours in the morning and in the evening.

About 50 percent of households indicated water was available from their taps every day during the past year. The other 50 percent indicated that water was unavailable for an average of 40 days. About 12 percent were without water for three months or more—with breaks in service being particularly acute for the rural poor.

In addition to tap water often being unavailable, 20 percent of households consider their water pressure unsatisfactory. Dissatisfaction was most severe in the upper stories of multi-story buildings (10 percent on floors 1 and 2 but 30 percent on higher floors). Again, the rural poor are the least satisfied with their water pressure.

Focus group participants complained about network maintenance—a major factor affecting water reliability—and did not feel there is a clear distinction between where responsibility for network maintenance ends and household responsibility begins. Uncertainty over maintenance responsibility is highest in urban areas, where only 75 percent of respondents knew who performs repairs on the system. By contrast, in rural areas 90 percent of households knew who performed these repairs.³⁰

²⁹ Other sources: own system maintained by the household, or natural sources such as wells, river or lake water.

³⁰ In both urban and rural areas of those households that did know, over 70 percent of respondents indicate that an individual from the water utility, municipality, private contractor repairs water lines and taps in the street. The remaining households say a household member performs these tasks.

How is water quality perceived?

Focus groups indicated some problems with high sediment and chlorine levels—and perceived threats to children’s health due to contamination by wastewater. The survey results indicate that more than 60 percent of respondents regard water to be of high quality and safe enough to drink without treatment. Water quality appears to be higher in rural areas, where more than 70 percent of households considered their water to be of good quality and safe, compared with 50 percent in urban areas.

There is little variation in perceived quality between the urban poor and non-poor, but the rural poor perceived quality to be lower than the rural non-poor (Table 12). This is consistent with the pattern of the lowest level of satisfaction with service being found among the rural poor.

Table 12. Perceptions of water quality (cell percent)

Water quality	Urban		Rural	
	Poor	Non-poor	Poor	Non-poor
Bad or very bad	15%	19%	14%	7%
N	(427)	(921)	(197)	(463)
Unsafe or very unsafe	36%	37%	16%	16%
N	(414)	(882)	(191)	(449)
Objects found in water*	26%	21%	18%	11%
N	(423)	(918)	(196)	(460)

*Frequently or very frequently.

Source: 1999–2000 survey.

Allowing water pressure to fall in the distribution system often degrades water quality. So it is not surprising that water quality tended to be lower among households with fewer hours of service. Households ranking water quality as very bad had only about 5 hours of service a day, while households ranking water quality as very good had water for an average of 13 hours a day, a relationship particularly strong in urban areas.

How are households coping with service problems?

Households use a variety of mechanisms to cope with service reliability, pressure and quality problems, including storage, pumping, alternative sources and treatment.

Storage. As expected, as hours of service decrease households with private taps are more likely to store water. In urban areas, where water is available for only about 8 hours a day, 80 percent of households store water. In rural areas, where water is typically available for 14 hours a day, only 50 percent of households store water. Generally households store an average of 20 LCD, about 80 percent of daily reported consumption. About 8 percent of households invested in storage systems in the last two years with a median investment of 1,330 ARD. The poor invested less in storage than the non-poor did.

Pumping. About 20 percent of urban and 7 percent of rural households use motorized pumps to address problems with pressure. Over 40 percent of households report using a pump in mountainous Gegharkunik. Fewer poor than non-poor report using pumps. Fourteen percent of

households using pumps report paying a fee of about 50 ARD per capita per month for its operation.³¹

Alternative sources. When storage or pumping is not adequate to handle supply problems, households are forced to find and use alternative sources of water—such as street taps or natural sources. Roughly half of residents using home taps needed to find alternative sources of supply in the last year (Table 13). Urban households generally rely on street taps or neighbors. Rural households commonly rely on street taps, neighbors and natural sources.

Table 13. Source of water when home tap is not running

	Urban		Rural	
	Poor	Non-poor	Poor	Non-poor
Street tap	76%	69%	35%	42%
Neighbors	21%	29%	35%	23%
Well/spring/river/lake	3%	1%	25%	30%
Other ³²	>1%	1%	4%	5%
Total	100%	100%	100%	100%
N	196	483	88	204

Source: 1999–2000 survey.

Households generally do not pay for water from these sources, except when using water vendors. The price of vended water ranges from 10 to 25 ARD (about 0.02–0.05 US\$) per 10 liters. Vendors are very uncommon, however (only 9 households used them). So, although the monetary cost of alternative sources is not high, the combination of finding, carrying and storing water can involve considerable time and effort. When the need arises, about one-person hour per day is spent finding, carrying and storing water, time that could be spent on other important tasks.³³ The burden of spending time collecting water is most likely to be highest among the rural poor and women. The rural poor report the longest periods without water service. In more than 60 percent of households, water collection is the responsibility of adult females.

Treatment. Twenty-six percent of households in urban areas and 18 percent in rural areas treat their water before drinking it. Of those treating their water, 63 percent use boiling as their primary treatment method, 33 percent allow particles to settle out and 4 percent use filtering. There is no major difference in the incidence or way the poor and non-poor treat their water, suggesting an even distribution of this burden across all types of households. Furthermore, urban households with fewer hours of service treat their water more frequently—probably due to greater contamination in low-pressure water systems. So, not only does low service reliability result in more time and effort collecting and storing water, but it also results in more time spent treating water.

³¹ The cost of electricity for pump operation was not reported.

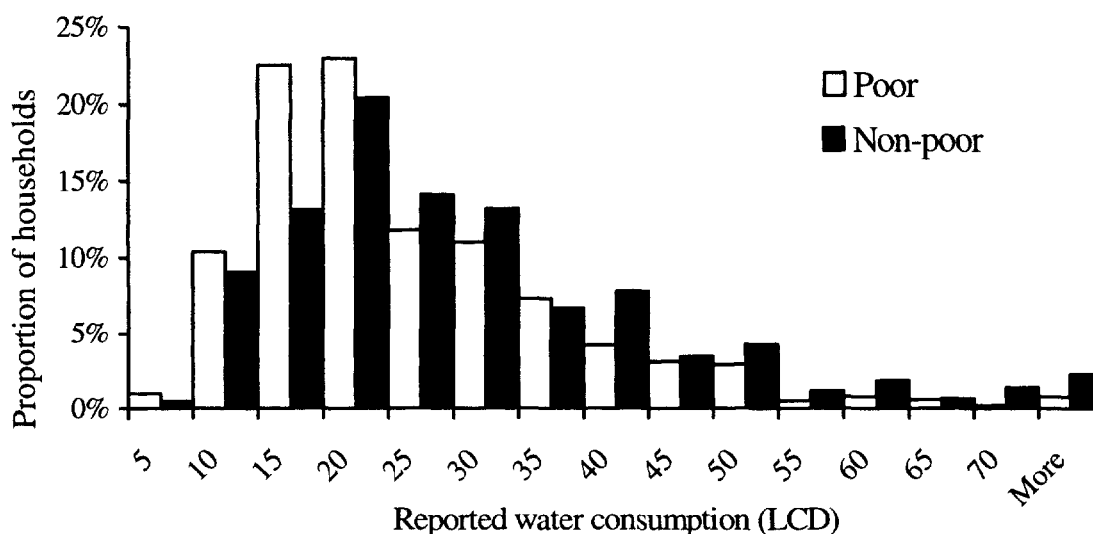
³² Other alternative water sources include: water vendors, own pump or other village.

³³ Households utilizing street taps as their primary source reported spending about the same amount of time carrying water, however presumably on a more regular basis.

How much water do people think they consume?

Fewer than 1 percent of households have water meters, making it difficult to collect reliable data on their consumption. Therefore, respondents were asked to estimate their household consumption in units of 10-liter buckets, the most common water handling device.³⁴ Note that self-reported water consumption is likely to be underestimated for three reasons. First, respondents typically underestimate household consumption from a running tap. Second, they generally do not include leakage or other wastage in their estimates. Third, the survey was conducted in mid-winter when consumption is likely lower than during the hot, dry summer. Median self-reported water consumption is 23 LCD³⁵ with poor households tending to report lower consumption especially in urban areas (Figure 12). Annex 4-2 provides a detailed analysis of the validity of this result.

Figure 12. Self-reported water consumption



Source: 1999–2000 survey.

Self-reported consumption is likely to be *much lower* than actual consumption for some groups of households, especially those with running water 24 hours a day. Households that must carry their water from public taps are expected to provide the most accurate estimates of their consumption. Median self-reported consumption for the former is 20 LCD and 22 LCD for the latter, suggesting a significant underestimation of consumption by households with reliable tap water.

³⁴ Households were asked how many buckets they typically consume *each day* and what additional amount of water they use *each week* for activities like clothes washing, etc. Ninety-seven percent of respondents felt able to provide an estimate. Forty-nine of the 59 households unable to estimate their consumption had water available from their taps 24 hours per day and did not store water.

³⁵ In a careful study of water consumption patterns in Yerevan in 1998 [“Water Consumption and Population Willingness to Pay Survey”, Municipal Development Project, Sasoun Tsurouian (March 1998)], mean consumption rates were estimated to be 115 LCD not including wastage.

While actual consumption may be underestimated, the important point here is that the average household *thinks* it consumes 23 LCD. A common justification that focus group participants put forth for not paying their water bills was that they do not think they receive the water they are supposed to, which is between 200 to 250 LCD depending on location.

Who pays for water?

The majority of focus group participants said they do not pay their water bills. This is consistent with survey results, which indicate that *the typical household has not paid its water bill for 14 months*. Only 17 percent of households billed for water report having no outstanding arrears. Households in rural Shirak and Lory paid most frequently, and the average time in arrears was lower in rural areas (Table 14).

Table 14. Average time in arrears (months)

Marz	Urban		Rural	
	Poor	Non-poor	Poor	Non-poor
Yerevan	19	16	–	–
Gegharkunik	18	9	20	16
Lory	17	11	10	7
Ararat	14	14	16	11
Shirak	9	7	6	6
Overall	15	14	12	10
N	374	788	156	335

Source: 1999–2000 survey.

This high level of arrears is not surprising given the low payment enforcement. Only 33 percent of households report any enforcement (Table 15). Three percent indicate that their service or service to their building will be cut off if they do not pay their bill. Thirty percent indicate that they are either threatened or fined if they do not pay their bill. Bill collection mechanisms differ significantly among other urban and rural households. Most urban households are supposed to pay their water bill to a condominium committee or Zhek, most rural households to a local government official.

Table 15. Bill collection enforcement

Enforcement	Urban	Rural	Overall
Nothing	71%	59%	67%
Fined	28%	35%	30%
Cutoff	2%	5%	3%
Total	100%	100%	100%
N	1,306	577	1,883

Source: 1999–2000 survey.

Consistent patterns emerge from an analysis of arrears and enforcement.

- Higher service reliability is correlated with lower arrears.

- More enforcement is correlated with lower arrears, particularly among rural households.
- Higher income households have lower arrears.
- Households receiving family benefits do not have significantly lower arrears (see annex 4-3).

While enforcement is not widespread, it does appear to be effective, especially when threats of service cutoff are credible. In addition, wealthier households and those receiving more hours of service a day are more likely to pay their bills. This suggests that a dual approach combining improvements in service reliability with enforcement would likely be most successful in reducing arrears.

How much are people expected to pay?

Few households pay their water bills.³⁶ The survey results indicate that current water tariff range from 200 to 400 ARD per capita per month (Table 16). Tariffs are significantly higher in urban areas, especially Yerevan, where the average tariff is 420 ARD per capita per month.³⁷ If fully enforced, these tariffs would represent approximately 1,300 drams per month per household or 5 percent of current monthly household expenditures. The burden of these tariffs would be *almost three times* higher for the poor (8 percent of monthly expenditure) as the non-poor (3 percent of monthly expenditure). Thirteen percent of households are paying their water bill regularly (every month), an average of only 300 ARD per capita, about 3 percent of monthly household expenditures for the non-poor and 7 percent for the poor.

Table 16. Average water tariffs (ARD per capita per month)

Marz	Urban	Rural
Yerevan	420	–
Gegharkunik	360	320
Lory	290	230
Ararat	330	260
Shirak	320	310
Overall	370	270
N	1,083	441

Source: 1999–2000 survey.

How much are people willing to pay?

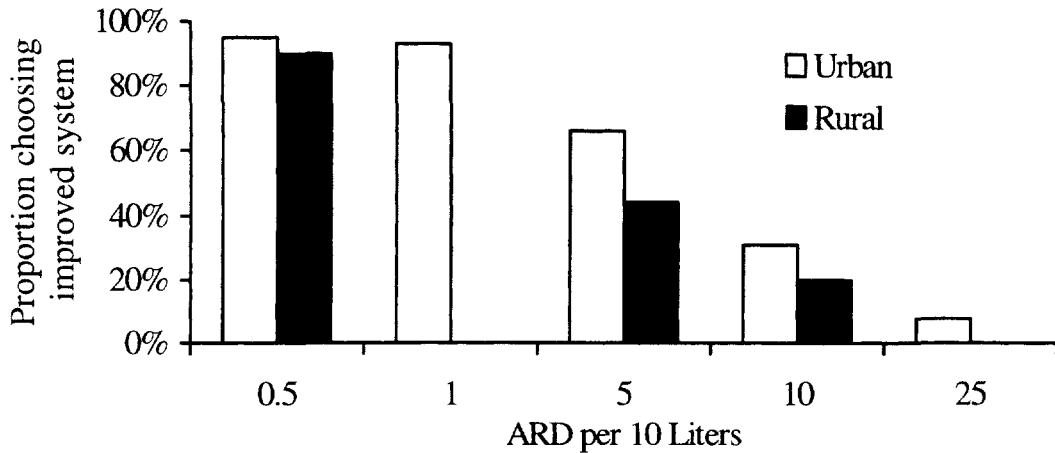
The relationship between cost recovery and household water consumption can be informed by studying demand for better water service. Since the majority of households do not pay their bills, this section analyzes survey respondents' stated preference between their current system and a hypothetical improved system. The improved system described to respondents

³⁶ Only seven of the 102 households using a public tap regularly pay for that service. These fees averaged 85 Dram/capita/month.

³⁷ These differences follow from localized variation in per volume water rates applied to the standard per capita daily allotment of 250 LCD in Yerevan and 200 LCD outside.

would provide a reliable (24 hour a day), high-quality, metered water connection in their home.³⁸ The water meter would be installed by the water utility free of any direct charge to the customer. Bills could be paid anytime during the month at a bank or the post office. As expected, as the price of water from the improved system goes up, the percentage of respondents choosing to connect goes down (Figure 13). Almost all respondents choose the improved system at a price of 0.5 ARD per 10 liters, and almost none choose it at 25 ARD per 10 liters. Also, rural households are significantly less likely than urban households to select the improved system at each price.

Figure 13. Preferences for an improved water system³⁹



Source: 1999–2000 survey.

Respondents that did not select the improved system were asked why. The data indicate that at 5 ARD per 10 liters (or about \$1 per m³) the price suddenly becomes the most important consideration in selecting the improved system (Table 17). Respondents who did not choose the improved system at these lower prices were either already satisfied with their service or did not want to have their consumption metered (Annex 4-5).

³⁸ See annex 4-4 for a detailed description of the attributes of the improved system as they were described to the respondent.

³⁹ Rural households only received three of the 5 prices as part of the survey design

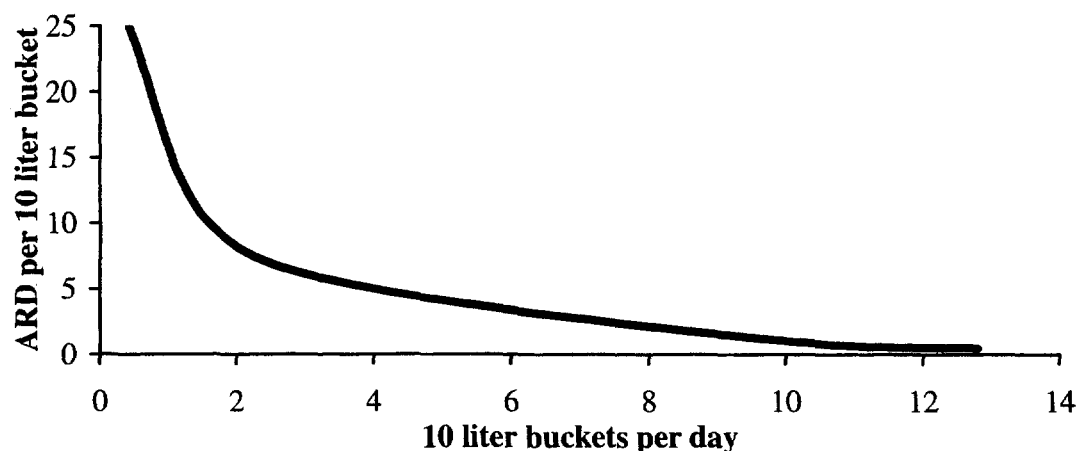
Table 17. Main reason for not selecting the improved system

Reason	Price (ARD per 10 liters)					Overall
	0.5	1	5	10	25	
Too expensive	0%	0%	54%	70%	88%	66%
No improvement in service	0%	11%	12%	15%	6%	11%
Satisfied with current quality	39%	32%	16%	8%	2%	11%
Do not want meter	42%	39%	9%	5%	3%	8%
Money not to improved system	5%	14%	8%	3%	0%	4%
Price not stable	13%	4%	0%	0%	0%	1%
Overall	100%	100%	100%	100%	100%	100%
N	38	28	243	368	248	925

Source: 1999–2000 survey.

Households selecting the improved system were also asked how much water their household would consume from the system in a day. Averaging this result over all households⁴⁰ indicates that at 0.5 ARD per 10 liters *daily household* consumption from the improved system will be about 130 liters and at 5 ARD it will be 40 liters (Figure 14). Again, there appears to be a significant increase in the quantity of water that would be consumed at prices below about 5 ARD per 10 liters (\$1 per m³).

Figure 14. Household demand for water from improved system



Source: 1999–2000 survey.

One important question when considering how to improve cost recovery and maintain service delivery to the poor is whether they respond differently from the non-poor to such policy variables as the price of water. For example, if the tariff was increased by 10 percent and you could enforce payment, would this have a differential impact on consumption of the poor and the non-poor?

⁴⁰ Those households preferring their current system are considered as consuming nothing from the improved system. These zeros are averaged along with the quantities quoted by those households preferring the improved system to arrive at overall average demand.

The data collected in the survey were used to model household responses to changes in price if the improved system were in place (Annex 4-5). The multivariate model greatly increases our confidence in the data because it suggests that households responded to the choice questions exactly as economic theory predicts they would. The quantity consumed is negatively correlated with price and positively correlated with income and household size. Moreover, the quantity a household would consume from the improved system decreases as the quality of the household's current water service increases.

The model suggests that above 5 ARD per 10 liters, the poor are significantly more sensitive to the price of the improved system than the non-poor (Table 18).⁴¹ At 1 ARD per 10 liters, a 10 percent increase in price to 1.10 ARD per 10 liters, would lead to about a 2 percent reduction in consumption for all households. Meanwhile at 10 ARD per 10 liters, a 10 percent increase to 11 ARD per 10 liters would lead to a 23 percent reduction in consumption by the poor and only an 18 percent reduction by the non-poor.

Table 18. Impact of price changes on consumption from improved system

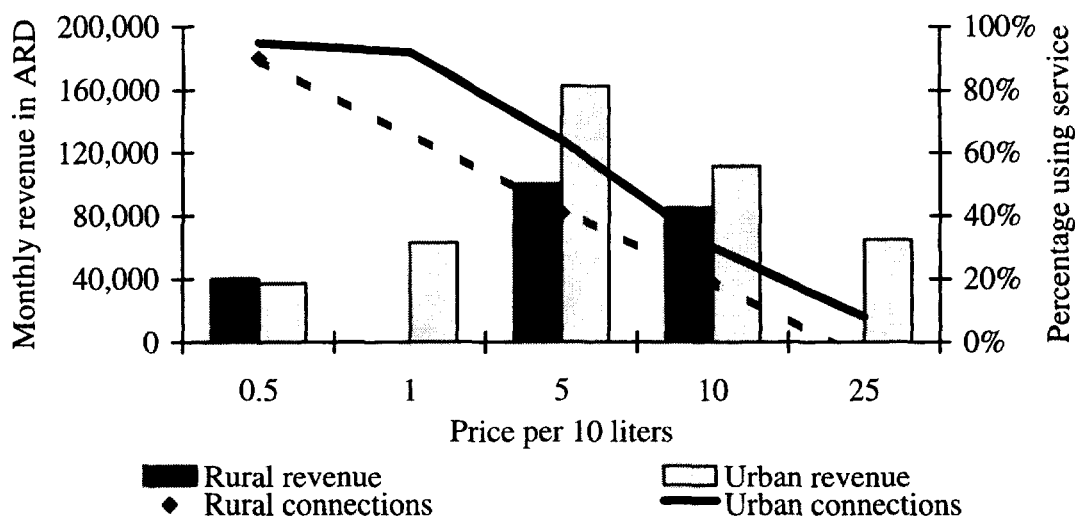
10 percent change in price	Percentage change in quantity consumed	
	Poor	Non-poor
0.50 to 0.55 ARD/10 liters	-1.2%	-0.9%
1.00 to 1.10 ARD/10 liters	-2.4%	-1.8%
5.00 to 5.50 ARD/10 liters	-11.6%	-8.9%
10.0 to 11.0 ARD/10 liters	-22.9%	-17.5%
25.0 to 27.5 ARD/10 liters	-54.4%	-41.6%

Source: 1999–2000 survey.

The data from the survey can also be used to simulate the tradeoffs between cost recovery for the utility and the choices households make about using the improved service. Consider two *hypothetical* 200-household communities, one rural and one urban, with the same underlying characteristics as the survey sample and assume that there are no arrears (Figure 15). Modeling consumer response at the prices used in the survey questionnaire, revenue is maximized at a price of 5 ARD per 10 liters with about 100,000 ARD a month collected from the rural community and about 160 thousand ARD a month from the urban community. But at this price only about 40 percent of households in the rural community and 65 percent in the urban community would purchase water from the improved system. At prices above 5 ARD, total revenue from the improved system and the number of households using the system both decrease. At prices below 5 ARD, the number of households benefiting from the improved system increases but revenue decreases.

⁴¹ Because price enters in linear form price elasticity of demand is not constant over the function.

Figure 15. Revenues and connection rates in 200-household hypothetical communities



Source: 1999–2000 survey.

Conclusions

The Armenian water utilities are caught in a low-level equilibrium trap, characterized by decreasing service quality and revenue. Operating expenses have increased, especially due to increasing water losses in aging and poorly maintained distribution systems, and the utilities have been forced to reduce hours of service.

The water utilities must break out of this trap by generating more revenue through improved service delivery. A two-stage approach is recommended. In the first stage, revenue should be increased by enforcing payment from the households that currently have reliable service but are not paying their bills (20 to 25 percent of all households). This strategy will likely be most effective in rural areas where fewer multi-household dwellings exist and enforcement through service cut-off is more easily implemented.

In the second stage, the utility should capture demand for improved service by increasing reliability and going to meter-based billing. On the demand side, reliability is a priority for service improvement, and meter-based billing assures that households will be charged for what they consume. On the supply side, household water meters will facilitate management by the water utility. Initially, this strategy is likely to be most effective in urban areas—as current satisfaction with service is lowest there, incomes are higher and investments in infrastructure improvements will tend to have the greatest economies of scale.

Because households are reluctant to pay a lump sum for meters, the initial cost of installing water meters should be financed by the water utility and amortized in the price of water. This approach is consistent with the successful introduction of meter-based billing. Building on experience in the electricity sector, it appears that collection rates may be increased by transferring responsibility for bill collection to a third party not involved in enforcement, such as a bank or post office.

Current water bills are derived from a price of approximately 50 ARD per m³ of water and normative per capita consumption levels of 200 or 250 liters/capita/day, LCD. The analysis indicates that the price of water can be substantially increased if there is an increase in service reliability. If households actually consume at the very low levels reported (approximately 20 LCD) utility revenue would be maximized at approximately 500 ARD per m³. Demand at this price indicates that households agree to an average monthly water expenditure only slightly less than their currently unpaid bills. It remains to be determined, however, if it is possible to deliver reliable water service to households at or below this price.

Given the uncertainty of the consumption projected by households, care must be taken in setting the meter-based price to avoid a significant increase in monthly household water bills. One safeguard would be to accompany an increase in water tariffs with a water conservation awareness program. The program would help households limit water expenditures and encourage better maintenance of household plumbing systems. But from a public health perspective, it may be desirable to keep prices below the estimated revenue maximizing level in order to encourage greater household water consumption. To satisfy these conflicting concerns, one strategy might be to include an affordable fixed tariff to encourage a consumption of the socially optimal level of water plus a marginal tariff to cover water consumption above this level.

The proposed shift from the current normative billing scheme to a meter-based billing scheme must be accompanied by regular monitoring and evaluation of household water consumption behavior, and carefully analyzed to design an optimal water tariff. Experience from the electricity sector indicates that care must be taken in designing such a tariff to avoid undesirable impacts on consumption patterns and revenue generation.

A proposed next step in future research is to combine the stated preference data on water consumption with revealed preference data from metering studies to validate the demand model and initiate design of an optimal water tariff.

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