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# Can poor consumers pay for energy and water? An affordability analysis for transition countries

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**Abstract**

Low-income households spend a substantial share of their income on utility services such as electricity, heating and water. The difficulty these socially vulnerable consumers have in affording further tariff increases is often used as an argument against tariff reform. However, detailed information on the utility expenditures of different consumer groups and the affordability implications of tariff adjustments is scarce. Much of the available information is based on the analysis of average households. This paper takes a more detailed look at the affordability of electricity, district heating and water for low-income consumers in transition countries. While the available data is incomplete, the paper finds that affordability is a problem for low-income consumers in most countries, in particular in the water sector and in the Commonwealth of Independent States (CIS). The affordability consequences of tariff reform ultimately depend on the speed of tariff adjustments relative to the growth in household income, the level of tariffs needed for cost recovery, the level of effective tariffs at the outset (tariffs adjusted for non-payment) and the demand response to the tariff increase. This paper finds that delaying tariff reform by a few years tends to make little difference to affordability constraints, and may therefore not be an effective way to mitigate the social impact of utility reform.

*Keywords:* affordability, energy, water, tariff reform, social protection, poverty, transition

*JEL Classification Number*: I3, P2, P36, Q4, Q25

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# INTRODUCTION

The affordability of infrastructure services is a key issue in the debate about water, district heating and power sector reform in transition countries.[1] It is also an important aspect of the wider discussion on the social impacts of economic transition. Over the last 15 years, poverty levels in central and eastern Europe and the former Soviet Union have risen dramatically. Depending on the definition used, over 50 per cent of the population are estimated to live in poverty in countries like Moldova and Tajikistan.[2] One aspect of the growing social problems has been the more widespread incidence of energy and water poverty, which manifests itself, for example, in low consumption levels or in poor households finding it difficult to payfor an adequate supply of water, heating and electric power.[3]

There is also a sense that this affordability problem may become worse before it can get better. Improvements in the quality of infrastructure services for both rich and poor consumers – better access, more reliable supply, less wastage – are only possible if the underfunded energy and water industries are put back on a sound financial footing. In practice, this will mean higher end-user prices and bette billing and collection. The current affordability problems have arisen despite often low utility tariffs and a poor payment record. Fixing this situation will mean an increased financial burden for low-income households, in particular if adequate social safety provisions are lacking.

Policy makers are acutely aware of the social consequences of infrastructure reform. However, concern about affordability has perhaps been used too readily as an argument against tariff reform. There are a number of ways through which the social impact of tariff adjustments can be mitigated, chief among them targeted assistance programmes and lifeline tariffs.[4] However, setting up and operating these schemes is challenging. It requires competent institutions and considerable administrative capacity, something that is often lacking in the transition region, particularly in poorer countries – exactly where social protection is needed most. Nevertheless, the tool kit to overcome affordability constraints is available in principle.

Both the development of social assistance programmes and the policy debate on tariff reform is held back, however, by a dearth of good information about household expenditure on infrastructure services. It is surprising how little is known about their affordability, given the political sensitivity of the issue and its prominence in the policy debate. Affordability is generally assessed by estimating the share of infrastructure outlays in total household expenditures. If this fraction (sometimes called the affordability ratio) rises above a certain threshold, affordability is considered to be problematic.

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[1] Unless otherwise defined, the terms "transition countries" and "the region" refer to the 27 countries of central eastern Europe and the Baltics (CEB – the new EU member states), south-eastern Europe (SEE – the three EU candidates and Western Balkans countries) and the Commonwealth of Independent States (CIS).

[2] See EBRD (2004).

[3] Usually, energy poverty is defined as insufficient access to modern energy sources, such as electricity and natural gas. Water poor households are those that do not have access to modern water services. See for example Lampietti and Meyer (2002).

[4] See, for example, Kennedy (2005), EBRD (2004), Velody *et al.* (2003), and Lovei *et al.* (2000).

The question of affordability is usually only discussed in the context of designing social support programmes,[5] or as part of a poverty assessment.[6] Pachauri and Spreng (2003), for instance, developed measures of energy affordability as an indicator of poverty. Similarly, Estache *et al.* (2002) and Foster *et al.* (2000) used affordability indicators to measure energy poverty in Latin America. In each of these papers, affordability is only one of many indicators of energy poverty. Foster *et al.* for instance, also uses measures of basic needs (such as coverage and reliability), monetary indicators (for example, average fuel costs and subsidies per effective unit of energy) and non-monetary indicators. Estache *et al.* distinguish between the affordability of access and the affordability of consumption. This is an important distinction in developing countries, where coverage is low and connection charges can be prohibitively high. It is less relevant for transition countries, where connection rates are generally high. More important is the distinction between the actual ability of poor households to pay their bills and their willingness to pay. The former is studied through an analysis of income and expenditures, while the latter is best assessed through dedicated 'willingness-to-pay' surveys.

One of the most extensive studies on water affordability worldwide is OECD (2003). The study distinguishes between macro-affordability – defined as average national water expenditures divided by average household income – and micro-affordability, which includes estimates that are disaggregated by income group, family type and geographic region. The study confirms the importance of analysing different income groups. It finds that, in general, the share of water charges in household expenditures is inversely related to income. However, the difference in the affordability ratio between the highest and lowest income decile varies considerably from country to country.[7]

Perhaps the most detailed report on electricity affordability to date is IPA Energy (2003). The study contains a series of country analyses and cross-country comparisons for seven south-eastern European countries. Affordability constraints are assessed both for different income deciles and specific vulnerable groups (such as pensioners and recipients of social assistance). Importantly, the study also projects future affordability ratios under basic policy scenarios, taking into account the effect of tariff increases and income growth on electricity demand.[8]

Building on these studies and earlier work by the EBRD,[9] this paper seeks to shed some more light on the under-researched topic of energy and water affordability. The paper uses household survey data to look specifically at low income households and other vulnerable groups. It covers three sectors: electric power, district heating and water. Affordability is assessed both at the prevailing tariff levels and for a future tariff scenario. Most of the analysis is based on actual consumption, but the paper also discusses affordability under standardised consumption levels. The hope is that the analysis will help policy makers to better understand the essence of affordability

[5] See, for example, Lovei *et al.* (2000), Velody *et al.* (2003) and Tabor (2002).
[6] See World Bank (2000, 2001). See also Kennedy (2005) for policy issues.
[7] For example, in Hungary the affordability ratio ranges from 2.5 per cent for the lowest income decile to 1.2 per cent for the highest decile. In Mexico the corresponding figures are 3.8 per cent and 0.7 per cent. In the US they are 0.6 per cent and 0.3 per cent, respectively.
[8] See also Kebede *et al*. (2002)
[9] See EBRD (2001, 2004).

problems, to provide them with additional information about the extent of energy and water poverty and to help them devise appropriate assistance programmes.

The structure of the paper is as follows. Section one summarises the methodology and data used to measure affordability. Section two estimates affordability ratios at the current price and consumption level, focusing on the lowest income decile (that is, the poorest ten per cent of the population). Section three develops scenarios of future affordability by combining a possible tariff reform path with forecasts of income and demand growth. Section four focuses on particular consumer groups known to be economically vulnerable, such as pensioners and the recipients of social benefits. Section five concludes.

# 1. MEASURING AFFORDABILITY

## A definition of affordability

Affordability is relatively easy to understand as a concept, but it is difficult to define precisely. There are a number of related notions. One important distinction is between 'affordable' and 'low-cost'. Utility services may be low-cost, in the sense that a basic, no-frills service is provided cheaply, but this does not mean consumers have enough income to pay for it. Affordability has to do with the ability of certain consumers or consumer groups to pay for a minimum level of service. Ability to pay is also distinct from willingness to pay, which has a clear technical meaning in consumer theory, where it is defined as the amount of income someone is willing to forego to obtain a certain service. Finally, the notion of affordability is closely related to poverty. As outlined above, the affordability of utility services is one of many indicators used to measure poverty.[10]

At its simplest, affordability (or the affordability ratio) is defined as the share of monthly household income that is spent on utility services, such as electricity, district heating and water. Alternatively, and often more accurately, affordability may be expressed as the share of utility payments in total household expenditures. This is the definition used here, although in about half the countries the income-based definition had to be used for data reasons.[11] Using household expenditures rather than income tends to provide more accurate information, as household income data rarely capture all sources of revenue. This is particularly the case in less advanced countries, where informal activity provides a substantial share of household income. In these countries, expenditure is a more reliable indicator of the resources available to households.

Utility expenditures can either be defined as actual payments or billed amounts. In transition countries, the difference can be substantial. The payment record of households in transition countries is uneven, and many utilities only collect a fraction of payments due. In what follows, estimates of current affordability ratios will use both actual payments (partial collection) and billed amounts (full collection), while estimates of future affordability will assume full payment. To the extent possible, expenditure estimates cover both fixed and consumption-related costs. However, they do not include the upfront costs of hooking up to the network. Our emphasis is on the affordability of consumption, rather than the affordability of access. This is the more relevant issue in transition countries, where network access is generally high. Affordability is therefore determined, among other factors, by the income of households, the level of household consumption, tariff policy, subsidy schemes and the level of payment collection.

## Affordability benchmarks

To assess whether affordability is problematic, a threshold needs to be defined to determine what constitutes an acceptable level of utility expenditure. Setting this benchmark inevitably requires some value judgement. The benchmark is difficult to

[10] See Foster *et al.* (2000) and Foster (2000).

[11] The income-based deciles were used for the following countries: Belarus, Croatia, FYR Macedonia, Georgia, Estonia, Lithuania, Serbia and Montenegro, Slovak Republic, Slovenia, Turkmenistan, Ukraine and Uzbekistan. The affordability estimates for these countries are likely to overstate actual affordability constraints.

determine also because affordability depends on overall expenditure. For example, spending a large amount of money on electric power may be less problematic if electricity is also used for heating (and the heating bill is therefore low) or if a household lives rent-free (as is often the case in transition countries).[12] The wider context is particularly important for district heating. In many countries households use a range of methods for space heating, including electricity, district heating, gas, kerosene, coal and wood.[13] Under these circumstances it may be difficult to determine the total heating bill. Ideally expenditures on utility services should be reviewed as a bundle.

Bearing these complications in mind, many governments and international financial institutions have developed *ad hoc* rules on what constitutes an acceptable level of utility expenditures. They are summarised in Table 1. Although there is no universal benchmark, the table suggests that an acceptable threshold may be around 25 per cent of household expenditures for electricity, heating and water. That is, affordability becomes problematic if these utility bills account for more than 25 per cent of total outgoings on average over a year (expenditure may fluctuate seasonally). To measure affordability in individual sectors, we assume the following indicative benchmarks:

- electricity: 10 per cent of household expenditures
- heating: 10 per cent of household expenditures
- water and waste water: 5 per cent of household expenditures.

**Table 1: Benchmarks used in measuring affordability (in per cent of total household income/expenditure)**

| Source | Electricity | Heating | Water | All utility bills |
|---|---|---|---|---|
| World Bank (2002) | 10-15 | | 3-5 | |
| WHO (2004) | 10 | | | |
| IPA Energy (2003) | 10 | 20 | | |
| UN/ECE [1] | | 15 | | |
| UK government[2] | | 10 | 3 | |
| US government[3] | | 6 | 2.5 | |
| Asian Development Bank | | | 5 | |
| Ukraine government[4] | | | | 20 |

[1] Available online at http://www.unece.org/env/europe/reps.pdf.
[2] The UK government set 3 per cent as a burden threshold for the lowest income decile (see http://www.sustainable-development.gov.uk/sustainable/quality04/maind/04j06.htm and http://www.scotland.gov.uk/library5/environment/sfps.pdf).
[3] The US Environmental Protection Agency (http://www.epa.gov).
[4] Figures reported as in Lovei (2000).

[12] Household survey data show that low-income households spend most of their income on food, housing and utilities.
[13] See Lampietti and Meyer (2002) and Gochenaur (2001) for an overview of the heating sectors in transition countries.

## Data

The main data needed for affordability analysis are expenditures (or, if not available, income data) for different groups of households (for example, income deciles), as well as their energy and water payments. Much of this information can be obtained from household surveys. However, we also used data from national authorities, including the ministries of social protection (data on vulnerable groups) and regulatory agencies (data on tariffs, consumption and collection rates).[14]

Household surveys have been carried out in all transition countries, and they provide a rich source of information on household behaviour. The most common types of available surveys are household budget surveys and, more recently, living standard measurement surveys (LSMS).[15] The LSMS are particularly useful as they are specifically designed to measure poverty. However, household surveys differ in scope, size and quality, and this makes household data difficult to compare across countries and regions. Such comparisons should therefore be made with caution. Another complication is that household surveys in low-income countries tend to focus on urban areas and may not fully represent the situation of the rural population.

There are also some issues associated with energy and water expenditure data. Because this data are self-reported, there can be inaccuracies (for example, due to seasonal fluctuations in demand) and discrepancies with the statistics of the supplying utilities.[16] Moreover, most household surveys ask about actual payments, rather than billed amounts, and they do not report collection rates. Where arrears are included in the data, it can become difficult to distinguish between actual and historic consumption. In some surveys utility expenditures were reported in aggregate, and it was necessary to construct separate data for electricity, heating and water through extrapolation. Where data on the utility expenditure of low income groups were not available, we used standardised consumption figures as a proxy. Given the robustness of household expenditure data, the quality of data is generally best for electricity and worst for district heating.

[14] The collection rate is defined as the ratio of total payments to total billing.

[15] Household budget surveys are usually limited to households living in private residences only (see Kordos, 2003). LSMS include data on consumption, income, expenditures and socio-economic characteristics (see Grosh and Glewwe, 1995, Deaton and Grosh, 2000, and Ravallion, 1998). See also www.worldbank.org/lsms.

[16] See Lampietti (2004) for electricity issues.

# 2. CURRENT AFFORDABILITY

The starting point of the analysis is affordability at the present time, that is, the share of expenditure currently devoted to electric power, water and district heating. Although household surveys provide reasonably accurate data on utility expenditures it was necessary to extrapolate some observations, for example, to obtain estimates on income groups by deciles or to break down utility payments by type of service.

The analysis is based on actual utility payments, and this has a number of implications. First, it means that affordability estimates will be affected by the degree of non-payment. Some households may spend little on utility services simply because they do not pay their bills. Second, the estimates will reflect the often still low tariffs charged, particularly for water and district heating in the CIS and less advanced SEE countries. Because of these inaccuracies, estimates of current affordability understate the true scale of energy and water poverty. Tariffs tend to be lowest and the payment discipline worst in low income countries. As a consequence, affordability issues will often be least visible in the countries with the highest incidence of poverty.

The analysis should, however, reflect the mitigating effect of social support programmes. Tariff-based social support measures, such as lifeline tariffs, will be reflected in the expenditure estimate, while offsetting social payments, such as those made under fuel poverty programmes, are, at least in principle, captured in the estimate of household income or expenditure.

**Affordability analysis by sector**

Utility expenditures in transition countries show some unexpected patterns. Households in high latitude locations would normally be expected to spend more money on space heating than on either water or electric power. In transition countries this is not the case, even though in many of them the heating season can last for up to six months. The households of the region currently spend more on electricity than on either district heating or water. Average utility expenditures are also surprisingly low.

In most transition countries, average electricity payments do not account for more than 5-6 per cent of total expenditures (see Table 2). In no country do district heating bills account for more than 8 per cent of total expenditures. Water expenditure accounts for less than 3 per cent of the total in all but three countries (Hungary, Romania and Russia), suggesting that tariffs have not been adjusted in many of the poorer and less advanced countries. Averaged across the region, the typical household spends around 3-4 per cent of its income on electricity, 2 per cent on district heating and 1-2 per cent on water and waste water.

However, there are some regional differences (see Table 2). Consumers in south eastern Europe (SEE), for example, spend on average more than twice as much on electric power as households in the Commonwealth of Independent States (CIS) and one-third more than households in central Europe and the Baltic states (CEB). At the same time SEE and CIS consumers spend considerably less on district heating. The average district heating bill in SEE and the CIS accounts for about 1.5 per cent of household expenditures, compared to almost 4 per cent in CEB. In the water sector, there is less variation. Consumers in all three sub-regions set aside between 1 and 2 per cent of total expenditures for water and waste water.

**Table 2: Current affordability of utility services, average household (in per cent of total household expenditure)**

| | Electricity | Heating | Water |
|---|---|---|---|
| Czech Republic | 4.2 | 3.4 | 1.2 |
| Estonia | 3.2 | 5.4 | 1.0 |
| Hungary | 5.3 | 1.9 | 4.1 |
| Latvia | 2.2 | 3.2 | 0.8 |
| Lithuania | 2.8 | 3.7 | 1.1 |
| Poland | 4.5 | 2.7 | 2.0 |
| Slovak Republic | 3.5 | 7.9 | 1.3 |
| Slovenia | 4.5 | 1.2 | 1.3 |
| *Central eastern Europe and the Baltic states* | *3.8* | *3.7* | *1.6* |
| Albania | 4.2 | na | 0.8 |
| Bosnia and Herzegovina | 5.4 | 0.6 | 1.1 |
| Bulgaria | 7.3 | 1.2 | 2.5 |
| Croatia | 3.9 | 0.4 | 1.3 |
| FYR Macedonia | 5.3 | 0.1 | 1.2 |
| Romania | 4.8 | 2.5 | 3.1 |
| Serbia and Montenegro | 5.5 | 4.6 | 0.7 |
| *South-eastern Europe* | *5.2* | *1.6* | *1.5* |
| Armenia | 6.2 | 0.1 | 0.5 |
| Azerbaijan | 1.8 | 0.9 | 0.9 |
| Belarus | 2.2 | 2.4 | 0.7 |
| Georgia | 2.8 | na | 0.2 |
| Kazakhstan | 1.7 | 2.1 | 1.4 |
| Kyrgyz Republic | 2.2 | 4.9 | 0.9 |
| Moldova | 3.5 | 1.2 | 0.4 |
| Russia | 1.6 | 2.1 | 3.5 |
| Tajikistan | 1.4 | 0.3 | 1.4 |
| Turkmenistan | 0.1 | 0.0 | 0.0 |
| Ukraine | 2.1 | 2.4 | 1.2 |
| Uzbekistan | 1.7 | 0.3 | 0.5 |
| *Commonwealth of Independent States* | *2.3* | *1.4* | *1.0* |

Note: Affordability estimates are unweighted averages. Data on district heating were not available for Albania and Georgia, where heating networks are not functioning.

Source: Authors' own calculations based on household survey data.

A number of factors can explain these differences. A first explanation has to do with the level of tariffs. One reason why electricity costs are higher than either heating or water expenditures is the higher *effective* tariffs (that is, tariffs adjusted for collection rates).[17] Power prices tend to be much closer to cost recovery levels than water and, to a lesser extent, district heating tariffs.[18] Collection rates in the power sector are also

[17] Effective tariffs may not be uniform, as collection rates are likely to vary across income deciles. However, data on collection rates by income deciles are not available.

[18] For estimates of effective tariffs in the electricity sector see the country assessments in EBRD (2003) and (2004). See also Kennedy and Besant-Jones (2004).

generally much higher than for either water or district heating. As a consequence of these higher effective tariffs, household expenditures on electricity are more substantial, even if actual consumption levels are modest. Electricity expenditures themselves tend to be higher in those countries where tariff reform has advanced most. Higher effective tariffs are also partly responsible for the comparatively high heating bills in CEB. Equally, in the water sector average affordability ratios are higher in countries where water prices are closer to cost recovery levels.

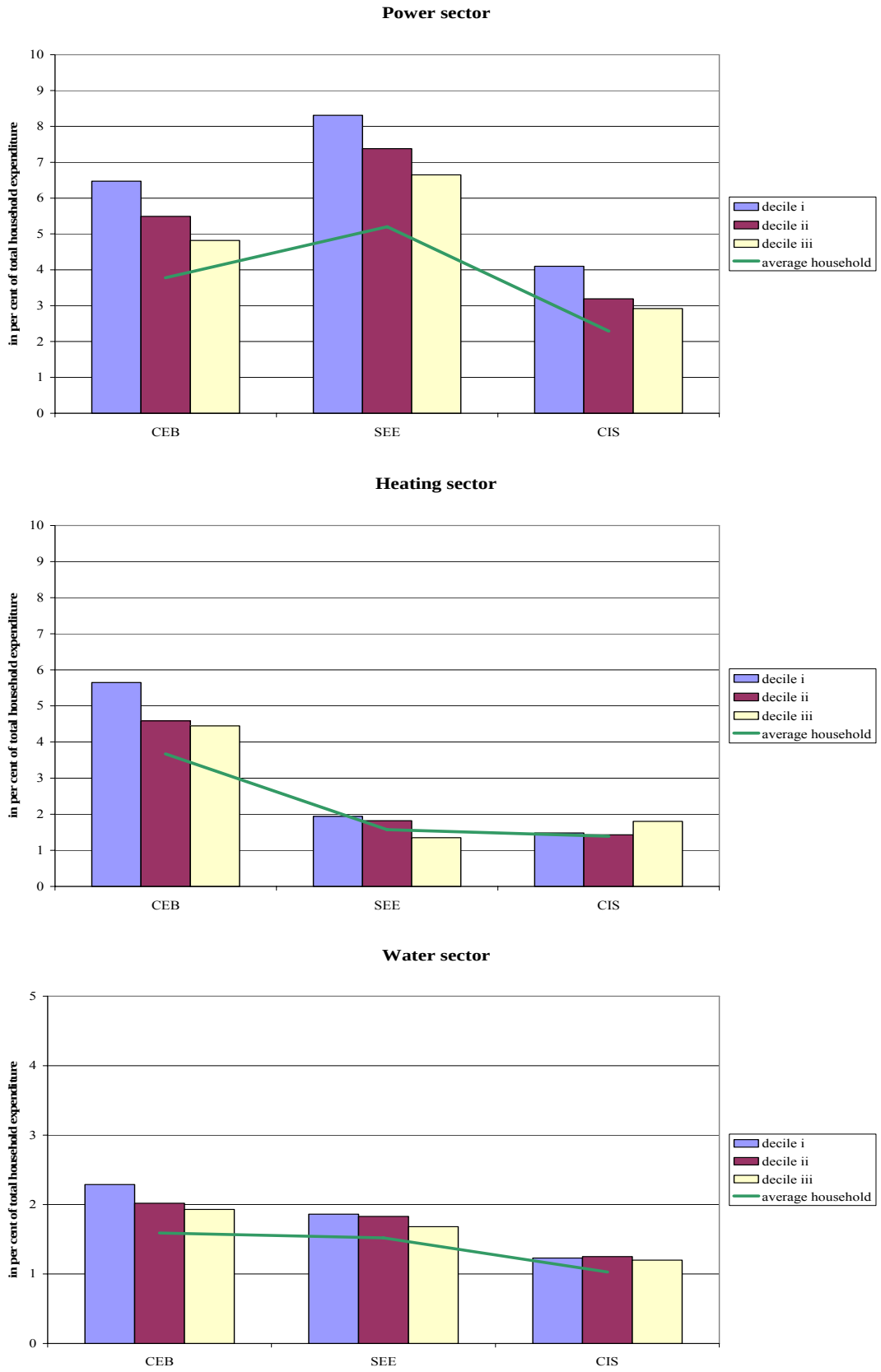
A second explanation has to do with consumption patterns. Consumption levels vary widely, partly as a function of tariffs, but also due to differences in income and the quality of supply. In the power sector, average household consumption in SEE countries, for instance, is approximately twice the level found in CEB and three times that in the CIS. In some CIS countries (for example, Georgia and Moldova) the average electricity consumption of households can be as low as 50-70 kWh per month, while in countries like Croatia and FYR Macedonia monthly consumption may exceed 400 kWh per month.[19] Some of these differences may be a result of substitution effects between district heating and electricity. Many households use electricity as their primary or secondary heating source either because it is cheaper or more reliable than district heating. The data show that households with low district heating expenditures tend to have higher electricity bills. This is for example the case in Albania, Armenia and FYR Macedonia, three countries that have a low level of connection to district heating and poorly functioning networks where they exist. Because of this substitution effect, there is much less variance in the combined expenditure for electricity and district heating than in either of these expenditure categories individually.

There are also strong substitution effects with other sources of heat, such as natural gas, wood and coal. By focusing on district heating and electric power, this analysis does not include these alternative fuels and therefore underestimates the total amount of money spent on heating. Remote regions, for example, are generally not connected to a district heating system and households tend to heat with wood or coal. Similarly, more affluent households usually prefer to install their own boilers rather than connect to the district heating network. The data show that for low-income urban households, which predominantly consume district heating, district heating expenditure is in fact much higher than in rural areas with district heating systems put in place.

Difference in water consumption mainly has to do with price effects, the impact of metering (which is still rare in the CIS) and the level of water losses. Thus, the richer countries of CEB record the lowest average water use, largely because water tariffs are higher and consumers are billed according to their metered consumption. On average, consumers in SEE and the CIS consume at least 20 per cent more water than CEB households.

[19] The consumption data were usually derived indirectly from household expenditure and tariff data. As such, they may be less reliable than direct measurements by electricity companies and regulatory agencies. They provide a lower bound estimate of consumption if they assume full collection.

## Chart 1: Affordability in 2003, by sectors




Note: Affordability estimates are unweighted averages.

Source: Authors' own calculations based on household survey data.

## Affordability by income group

More interesting than average affordability – and of more concern – are the affordability ratios of low-income groups. As we have seen in the previous section, at current effective tariffs the affordability of utility services does not seem to be an issue for the average household. If affordability is a problem, it will be for low-income consumers.[20] Across the region, the poorer households spend considerably more on electricity, heating and water than average consumers (see Chart 1). However, at current tariffs and collection rates utility payments are surprisingly low even for households in the lowest three income deciles. The affordability constraint is tightest for the poorest 10 per cent of households. Table 3 shows that for the lowest income decile the affordability thresholds defined in section one are surpassed in a number of sectors and countries.

As an average across the region, the poorest 10 per cent of the population spend around 6 per cent of their income on electricity. Affordability issues are most pressing in SEE, where the poorest households often spend more than twice as much on electric power as their peers in CEB and the CIS. Compared to CEB, income levels in SEE are still very low, especially in the Western Balkans (Albania, Bosnia and Herzegovina, FYR Macedonia, and Serbia and Montenegro). At the same time, effective power tariffs tend to be higher than in most of the CIS. The combination of low income and high effective tariffs makes affordability a particular problem for SEE households. However, affordability is also an issue in some of the poorest CIS countries, such as Armenia, Georgia and Moldova.[21] In Croatia, the Slovak Republic and Slovenia, the tight affordability constraint is primarily a consequence of aggressive tariff reforms. In all three countries, tariffs have almost reached cost-recovery levels.

The affordability of district heating is more difficult to assess, given the high level of substitution between alternative fuels. Not surprisingly, the affordability numbers are highest in countries where there is good access to district heating for low-income households. According to Table 3, affordability seems to be most problematic in Estonia, Serbia and Montenegro and the Slovak Republic. These are the only countries where district heating payments by the lowest income decile exceed the 10 per cent threshold. Estonia and the Slovak Republic have both relatively high heat prices and a good payment discipline. The two countries also have a relatively uneven distribution of income, with a significant gap between the lowest income decile and average households. In Serbia and Montenegro, heating tariffs are lower and the payment record of poorer consumers is patchy, but the level of poverty is much higher.[22]

Water affordability is most problematic in Hungary, Russia and the Slovak Republic. In Russia, the key reasons are inefficient consumption and widespread poverty. In

[20] Household surveys usually report ten equally divided groups of income or expenditure deciles. In this analysis, we focus on the three bottom deciles, which represent the poorest 30 per cent of the population.

[21] One should recall that the Georgia estimate shows power expenditures in per cent of household income, rather than total household expenditures. Given the substantial amount of informal income earned in Georgia, the figures in Table 2 and 3 significantly overestimate the affordability ratio.

[22] District heating collection rates ranged from 70-75 per cent in 2001-04 on average. They tend to be lower for low income households.

Hungary and the Slovak Republic, affordability ratios are close to the threshold as a consequence of aggressive tariff reform.

**Table 3: Current affordability of utility services, bottom decile (in per cent of total household expenditure)**

| | Electricity | Heating | Water |
|---|---|---|---|
| Czech Republic | 5.5 | 3.3 | 1.5 |
| Estonia | 8.2 | 15.4 | 2.4 |
| Hungary | 6.3 | 1.3 | 4.0 |
| Latvia | 2.2 | 2.8 | 0.9 |
| Lithuania | 3.1 | 0.7 | 0.7 |
| Poland | 5.7 | 1.2 | 1.8 |
| Slovak Republic | 11.4 | 18.6 | 4.3 |
| Slovenia | 9.4 | 1.9 | 2.6 |
| *Central eastern Europe and the Baltic states* | *6.5* | *5.7* | *2.3* |
| Albania | 6.0 | na | 1.6 |
| Bosnia and Herzegovina | 8.4 | 0.3 | 0.7 |
| Bulgaria | 8.5 | 0.4 | 2.7 |
| Croatia | 10.9 | 0.6 | 2.3 |
| FYR Macedonia | 13.1 | 0.0 | 2.9 |
| Romania | 4.1 | 0.3 | 0.7 |
| Serbia and Montenegro | 7.2 | 10.0 | 2.1 |
| *South-eastern Europe* | *8.3* | *1.9* | *1.9* |
| Armenia | 6.1 | 0.0 | 0.1 |
| Azerbaijan | 2.4 | 0.0 | 1.1 |
| Belarus | 3.9 | 4.7 | 1.2 |
| Georgia | 14.1 | na | 0.6 |
| Kazakhstan | 2.7 | 0.5 | 1.0 |
| Kyrgyz Republic | 2.8 | 8.8 | 1.2 |
| Moldova | 5.0 | 0.4 | 0.3 |
| Russia | 2.1 | 2.3 | 4.5 |
| Tajikistan | 2.5 | 0.3 | 3.5 |
| Turkmenistan | 0.3 | 0.1 | 0.0 |
| Ukraine | 2.6 | 0.4 | 0.6 |
| Uzbekistan | 4.6 | 0.2 | 0.6 |
| *Commonwealth of Independent States* | *4.1* | *1.5* | *1.2* |

Note: Affordability estimates are unweighted averages. Data on district heating were not available for Albania and Georgia, where heating networks are not functioning.

Source: Authors' own calculations based on household survey data.

## Affordability and non-payment

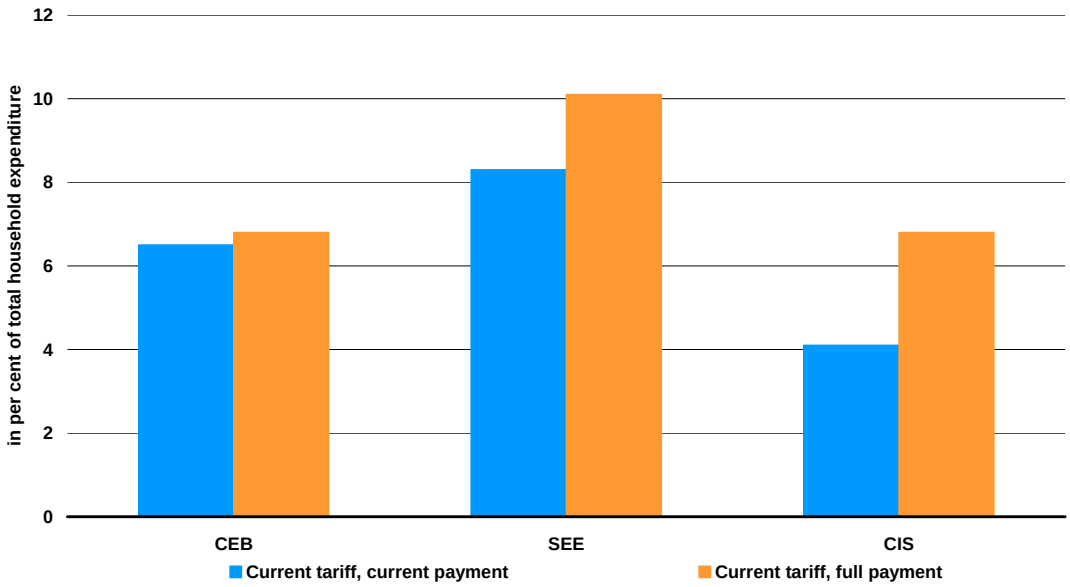
We have argued above that one of the reasons why affordability ratios are often acceptable under current conditions is the high level of non-payment. To substantiate this assertion we now take a more detailed look at the link between affordability and non-payment in one particular sector, electric power.

Electric power was chosen because it is the only sector for which systematic information on collection rates is currently available. However, the sketchy evidence obtainable for other sectors suggests that non-payment is an equally, if not more important issue for district heating and water. In Tajikistan, for example, the payment rate of residential water consumers is a mere 10-15 per cent. For both water and district heating, problems of non-payment are often linked to poor service quality and the absence of meters.

In the power sector the main non-payers are found in the corporate and municipal sectors, particularly among state-owned enterprises. However, residential users also have a relatively poor payment record. Payment discipline has improved over recent years, and many countries (for example, Hungary, Poland and Latvia) now have collection rates of close to 100 per cent. However, in other countries residential collection rates are still low.[23]

There is a direct, linear relationship between collection rates and affordability: a one per cent increase in payment will increase the affordability ratio by one per cent as well. Moving from the current payment record to full payment would therefore considerably alter affordability ratios for low income households, as Chart 2 shows. The difference is particularly significant for the CIS, where affordability ratios under full payment are over 60 per cent higher than with current collection rates.

**Chart 2: Affordability and payment discipline, power sector, 2003**




Source: Authors' own calculations based on household survey data.

[23] See, for example, EBRD (2004). The data tables at the back of that report contain estimates of the average (residential and non-residential) collection rates for 27 transition countires.

# 3. FUTURE AFFORDABILITY

From a policy point of view, the affordability of future tariff increases is more relevant than the affordability of current consumption. Residential tariffs in transition countries have risen sharply over the last few years, but tariff reform remains one of the most important regulatory challenges.[24] Regulators and policy makers need to know what the social impact of these reforms will be, and by implication what amount of social protection will be needed. Simulations of the affordability impact of future tariff adjustments can provide important information in this respect.

**Some further assumptions**

Estimating future affordability requires some further information. In particular, assumptions have to be made about future income growth, including those for low-income households. A better understanding is also needed of the future demand for utility services. Once these factors are known, various tariff scenarios can be superimposed on these income and comsumption paths to determine what percentage of household expenditures residential users will devote to utility payments in the future.

Income and expenditure forecasts can be derived from an internal EBRD forecast of medium-term growth and inflation.[25] For simplicity it was assumed that total household income will rise in proportion to GDP for all income groups equally. This is a crude, but not unreasonable, assumption. On the one hand, one would expect the income of poor households to grow faster as part of a catch-up effect. On the other hand, there is evidence that over the past decade income differentials have actually increased. That is, incomes from poor households have grown at below average rates.

Power, heating and water demand were modelled as a Cobb-Douglas function of price and income and were calibrated on current affordability data.[26] The income and price elasticities of demand are thus the key parameters in the demand function. Estimates for the two parameters are available from a number of studies (see Annex 1), but the range of results is quite wide.[27] While estimates vary for a number of reasons, a key distinction is between short-run and long-run price elasticities. Estimates of the latter tend to be higher, as households are more sensitive to price signals in the longer term, when more response options are available.[28] Substitution effects are particularly important in the case of heating, where the availability of several substitute fuels makes it easy to switch, and in the case of electricity, which is used for a number of

[24] See EBRD (2004).

[25] For example, real GDP growth of CEB countries (on average) is projected to be around 4.6 per cent in the medium term.

[26] Cobb-Douglas is an often-used function of the form $D=(a)P^{\varepsilon p}*I^{\varepsilon i}$, where D denotes demand, a - constant, P - price, I - income; $\varepsilon_p$ and $\varepsilon_i$ denote the price and income elasticity of demand, respectively.

[27] For a literature review, see Kamerschen and Porter (2004), Halvorsen and Larsen (2001) and Doorman (2003). In the energy sector, contemporary studies take into account a number of factors, such as the weather, real-time market prices and expected prices. Most studies use a static model, but dynamic models have also been advocated (see Dinar and Subramanian, 1997; Dalhuisen *et al*., 2001, and Lampietti *et al.* 2001).

[28] For example, in the short term the only response to an electricity price increase may be to curtail consumption (for example, switching off the lights). In the long term, consumers may switch from electric heating and cooking to natural gas or invest in more energy efficient appliances.

different purposes, such as lighting, cooking and heating. Substitution effects are particularly important in the case of heating, where the studies suggest a price elasticity of -0.4 for power and -0.2 for district heating and water.[29] The income elasticity was assumed to be 0.3 for all three services.[30]

**Affordability assuming full cost recovery by 2007**

To illustrate the impact of tariff adjustments on future affordability, a hypothetical scenario is adopted under which all utility prices are raised steadily to reach full cost recovery levels by 2007. After 2007, tariffs (in local currency terms) rise in line with local currency inflation.[31] For the purpose of this paper, we assumed the full economic cost of a kilowatt hour (kWh) of electricity to be US¢ 8 in CEB and SEE and US¢ 6 in the more energy-rich CIS. The full cost recovery level for district heating is assumed to be 4 US¢/kWh for CEB and SEE and 3 US¢/kWh for CIS countries. The indicative cost recovery level for water was set at US$ 1.40 per cubic metre ($m^3$) of piped water for CEB and SEE countries and US$ 1.00/$m^3$ in the CIS.[32] Actual cost recovery levels are obviously situation-specific and vary between countries and municipalities. These values should therefore be used with caution and taken as indicative estimates only.

Chart 3 and Table 4 show the development of affordability ratios under these assumptions. Both Chart 3 and Table 4 focus on the lowest income decile.

In general, the affordability paths are hump-shaped. The initial price hikes imposed under the proposed tariff scenario are much higher than the assumed level of income growth. Consequently, the fraction of expenditures devoted to utility payments increases until tariffs reach cost recovery levels in 2007. After 2007, the analysis assumes real prices remain constant, which results in lowering affordability ratios because of expected positive income growth.

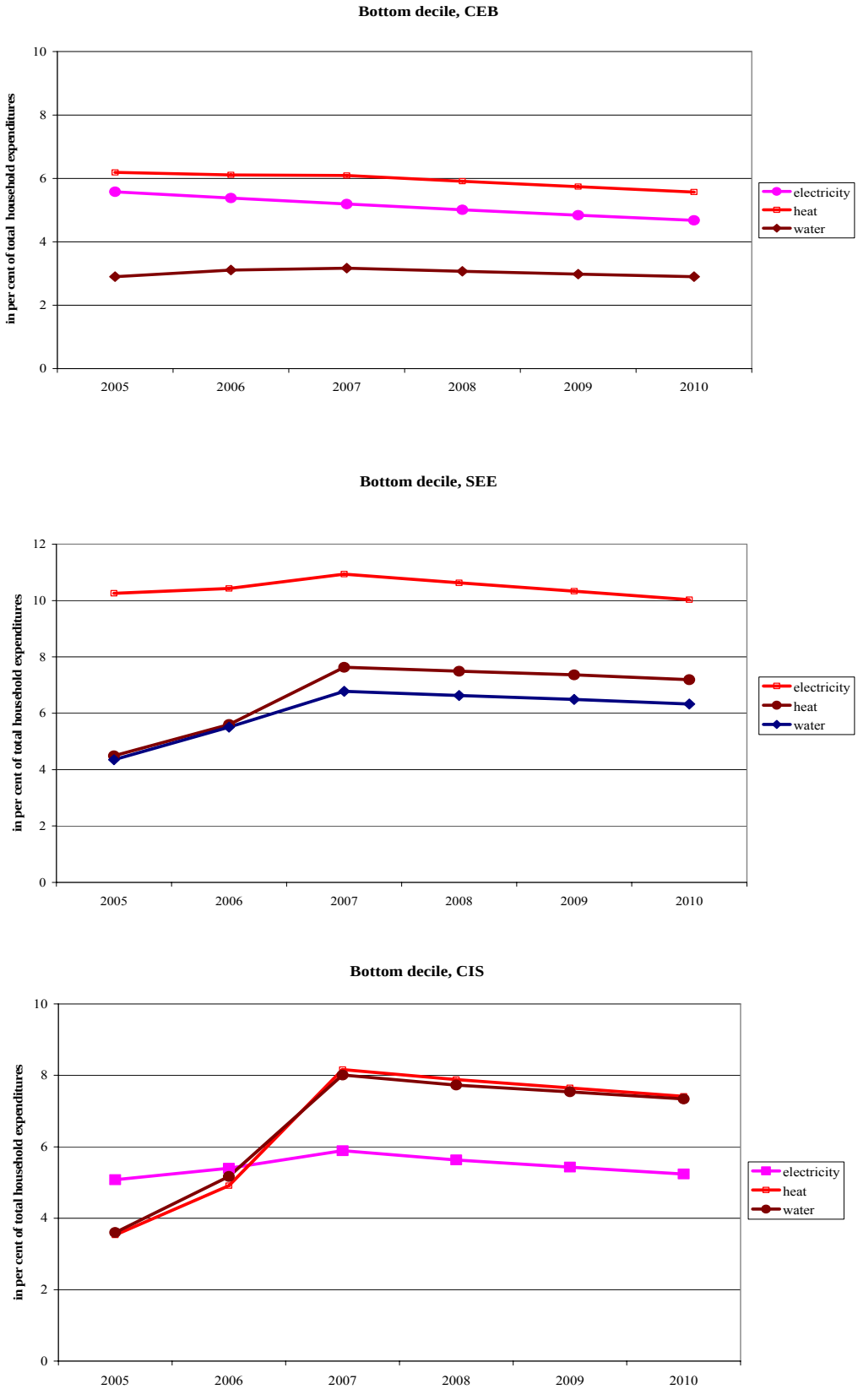
[29] Utilities consumption is modelled to be price elastic over time. Every one per cent increase in electricity tariffs will result in a 0.4 per cent reduction in electricity consumption. On the other hand, every one per cent increase in heat and water tariffs will result in a 0.2 per cent reduction in heat and water consumption.

[30] In the calculation of future affordability, the changes in household income over time were taken into account. Every one per cent increase in household income will result in 0.3 per cent increase in electricity, heat and water consumption.

[31] In such case, fluctuations in exchange rates with the US$ are taken into account.

[32] All figures are assumed to be in 2007 dollars. In CEB and SEE countries where district heating is charged per $m^2$, the per kWh charges are assumed to be equivalent to US$ 1.60. In CIS countries it is US$ 1.20 per $m^2$.

## Chart 3: Affordability over time, at full cost recovery in 2007




Source: Authors' own calculations based on household survey data.

As shown above, the main exceptions to this general pattern are the countries of CEB. For most of them, income growth is expected to outpace the increase in utility prices, and affordability ratios are expected to decrease steadily in most sectors. Following extensive tariff adjustments over recent years, the price increases still needed to reach cost recovery in CEB are relatively modest. This more than offsets the fact that household income is assumed to grow more slowly than in either SEE or the CIS.

The steepest increases in affordability ratios are observed in the water sector, where prices are generally furthest away from cost recovery and larger adjustments are needed. Compared to electricity, we also expect to see a more modest demand response: the price elasticity of water demand is lower than that one for electric power. However, this demand effect is much less important than the impact of different tariff paths.

For a number of countries, the proposed tariff scenarios would violate the affordability constraint postulated in section one. Households in the lowest income decile – and sometimes even households in decile II and decile III – would have to pay more for power, water and heating than the 10 per cent (for power and heating) and 5 per cent (for water) of household expenditure proposed in section one.

In the power sector, affordability ratios would approach or exceed the critical threshold in most of SEE and some of the less advanced CIS countries, in particular those countries where income growth is projected to grow at lower rates.

In the case of district heating, it should be noted that poor households in several countries do not have access to district heating or that the quality of service is extremely low.[33] In countries with broad access to functioning district heating systems, affordability problems would become as severe as in the water sector.

Affordability is even more problematic in the water sector, where it would affect the majority of CIS and SEE countries. In the CIS, where the steepest tariff increases would be necessary, affordability ratios could exceed 10 per cent of total income on average – twice the proposed threshold. Particularly affected would be Russia, Tajikistan and Uzbekistan as well as FYR Macedonia, Romania and Serbia and Montenegro in the SEE. The lower affordability concerns in Armenia, Moldova, Ukraine and Turkmenistan, on the other hand, probably reflect low consumption, poor collection rates for utility services and perhaps inaccuracies in household expenditure data.

[33] In a number of SEE and CIS countries the percentage of households connected to district heating is as low as 10-15 per cent. See World Energy Council (2003).

**Table 4: Affordability at cost recovery in 2007, bottom decile (in per cent of total household expenditure)**

| | 2007 | | | 2010 | | |
|---|---|---|---|---|---|---|
| | **Electricity** | **Heating** | **Water** | **Electricity** | **Heating** | **Water** |
| Czech Republic | 3.9 | 3.2 | 1.2 | 3.5 | 2.9 | 1.1 |
| Estonia | 6.0 | 11.3 | 3.1 | 5.3 | 10.3 | 2.8 |
| Hungary | 5.6 | 2.3 | 4.5 | 5.0 | 2.1 | 4.1 |
| Latvia | 2.4 | 3.9 | 2.3 | 2.2 | 3.5 | 2.1 |
| Lithuania | 3.2 | 4.3 | 1.3 | 2.9 | 3.9 | 1.2 |
| Poland | 5.6 | 5.1 | 4.6 | 5.0 | 4.6 | 4.1 |
| Slovak Republic | 7.0 | 16.5 | 5.0 | 6.4 | 15.4 | 4.7 |
| Slovenia | 7.7 | 2.1 | 3.3 | 7.1 | 2.0 | 3.2 |
| *Central eastern Europe and the Baltic states* | *5.2* | *6.1* | *3.2* | *4.7* | *5.6* | *2.9* |
| Albania | 6.9 | na | 4.3 | 6.3 | na | 4.0 |
| Bosnia and Herzegovina | 9.7 | 1.9 | 4.6 | 8.8 | 1.8 | 4.3 |
| Bulgaria | 9.8 | 2.1 | 4.7 | 9.0 | 2.0 | 4.3 |
| Croatia | 11.2 | 2.1 | 4.5 | 10.4 | 2.0 | 4.3 |
| FYR Macedonia | 17.2 | 0.6 | 11.2 | 15.7 | 0.5 | 10.4 |
| Romania | 6.0 | 5.0 | 9.8 | 5.5 | 4.6 | 9.1 |
| Serbia and Montenegro | 15.8 | 34.1 | 8.4 | 14.5 | 32.3 | 7.9 |
| *South-eastern Europe* | *10.9* | *7.6* | *6.8* | *10.0* | *7.2* | *6.3* |
| Armenia | 8.5 | 0.3 | 4.0 | 7.8 | 0.3 | 3.7 |
| Azerbaijan | 2.7 | 13.8 | 8.5 | 2.1 | 11.3 | 6.9 |
| Belarus | 3.8 | 8.7 | 6.4 | 3.5 | 8.4 | 6.2 |
| Georgia | 15.5 | na | 8.7 | 13.3 | na | 7.7 |
| Kazakhstan | 4.4 | 7.9 | 9.0 | 3.8 | 7.1 | 8.1 |
| Kyrgyz Republic | 5.9 | 15.2 | 8.9 | 5.4 | 14.3 | 8.4 |
| Moldova | 5.1 | 2.2 | 1.6 | 4.6 | 2.1 | 1.5 |
| Russia | 3.3 | 10.7 | 10.5 | 2.9 | 9.8 | 9.6 |
| Tajikistan | 8.9 | 3.0 | 14.6 | 7.8 | 2.8 | 13.2 |
| Turkmenistan | 0.9 | 16.6 | 1.5 | 0.8 | 15.0 | 1.4 |
| Ukraine | 2.8 | 8.9 | 3.8 | 2.4 | 8.1 | 3.4 |
| Uzbekistan | 9.0 | 2.4 | 18.6 | 8.3 | 2.3 | 17.8 |
| *Commonwealth of Independent States* | *5.9* | *8.2* | *8.0* | *5.2* | *7.4* | *7.3* |

Notes: Affordability estimates are unweighted averages.

Source: Authors' own calculations based on household survey data.

**Sensitivity analysis**

Estimates of future affordability depend on the assumptions made about future income and demand. To determine the sensitivity of estimates with respect to these parameters we recalculated the affordability ratios under two alternative scenarios.

The pessimistic scenario assumes a lower level of real income growth based on the pessimistic case of the EBRD macroeconomic scenarios and a lower price elasticity of -0.1 for all services. The income elasticity was left unchanged. The result of these changes are higher affordability ratios than in the base case.

The optimistic scenario assumes higher real income growth using the optimistic case of the EBRD macroeconomic scenarios. It again assumes a constant income elasticity of 0.3, but a higher price elasticity of -1.0 for power and -0.5 for heating and water. Taken together this implies a lower level of consumption, other things being equal, and a reduction in affordability ratios.

Table 5 compares the two sensitivity scenarios with the base case, assuming again that tariffs would reach cost recovery in 2007 under the same constant rate. The table shows that compared to the base scenario, the affordability ratios are about 30 per cent higher, on average, in the pessimistic case. They could be substantially lowered in the optimistic scenario, mostly as a consequence of particularly favourable macroeconomic scenarios for some countries. While this suggests that the estimates are sensitive to changes in the underlying assumptions, the broader picture does not change. In the pessimistic case, the number of countries for which the overall affordability threshold of 25 per cent would be surpassed increases from seven to fourteen. In the optimistic case only two countries would be close to the threshold.

The estimates appear to be most sensitive to assumptions about income growth. However, particularly in those countries where large tariff increases are envisaged, a strong demand response to these adjustments would contribute significantly to the mitigation of affordability concerns. Low levels of end-user efficiency suggest that the potential for such a response is there, although support programmes (such as subsidy mechanisms and information campaigns) may be needed to trigger the necessary adjustments.

Future affordability ratios also depend on the assumed tariff policies. For many countries and sectors, the goal of full cost recovery by 2007 may be ambitious and quite difficult to implement politically. Countries like FYR Macedonia, Serbia and Montenegro and some CIS countries which could have severe affordability problems in 2007, may need longer periods of time to achieve full cost recovery, at least for heating and water. As an alternative tariff scenario, we therefore considered a tariff path where full cost recovery is not introduced until 2010, keeping all other assumptions as in the base case. Table 6 shows the difference in affordability ratios compared to the base case in Table 4. Delaying cost recovery by three years would substantially ease affordability constraints only in some of the faster-growing countries of the CIS. In CEB and SEE it would make little difference. This suggests that delaying tariff adjustments may not be an effective way of mitigating the social impact of tariff reform.

**Table 5: Affordability of all utility services, with different demand and income parameters (in per cent of total household expenditure)**

| | 2007 | | | 2010 | | |
|---|---|---|---|---|---|---|
| | **Pessimistic** | **Base** | **Optimistic** | **Pessimistic** | **Base** | **Optimistic** |
| Czech Republic | 8.9 | 8.2 | 7.7 | 8.4 | 7.4 | 5.9 |
| Estonia | 20.7 | 20.4 | 16.6 | 18.6 | 18.4 | 13.9 |
| Hungary | 12.7 | 12.4 | 11.4 | 11.9 | 11.2 | 10.0 |
| Latvia | 9.6 | 8.7 | 6.8 | 9.1 | 7.8 | 5.7 |
| Lithuania | 9.6 | 8.9 | 8.0 | 8.8 | 8.0 | 6.6 |
| Poland | 16.4 | 15.3 | 11.9 | 14.7 | 13.6 | 10.2 |
| Slovak Republic | 29.3 | 28.6 | 24.8 | 28.6 | 26.5 | 21.2 |
| Slovenia | 14.2 | 13.1 | 10.8 | 13.6 | 12.2 | 9.7 |
| *Central eastern Europe and the Baltic states* | *15.1* | *14.4* | *12.2* | *14.2* | *13.1* | *10.4* |
| Albania[1] | 18.7 | 11.2 | 7.1 | 18.2 | 10.3 | 6.0 |
| Bosnia and Herzegovina | 28.6 | 16.2 | 12.0 | 30.7 | 14.9 | 10.1 |
| Bulgaria | 19.0 | 16.6 | 13.5 | 19.8 | 15.3 | 11.8 |
| Croatia | 21.0 | 17.8 | 14.8 | 21.5 | 16.7 | 8.3 |
| FYR Macedonia | 39.5 | 29.0 | 20.6 | 40.6 | 26.7 | 17.6 |
| Romania | 31.4 | 20.7 | 13.6 | 31.7 | 19.1 | 12.2 |
| Serbia and Montenegro | 72.0 | 58.3 | 31.1 | 73.9 | 54.7 | 26.6 |
| *South-eastern Europe* | *32.9* | *24.3* | *16.1* | *33.8* | *22.5* | *13.2* |
| Armenia | 17.7 | 12.7 | 11.5 | 17.7 | 11.8 | 9.5 |
| Azerbaijan | 48.7 | 24.9 | 9.4 | 49.7 | 20.4 | 6.3 |
| Belarus | 30.6 | 18.8 | 13.0 | 31.9 | 18.1 | 0.1 |
| Georgia[1] | 43.8 | 24.2 | 16.8 | 43.9 | 21.1 | 13.6 |
| Kazakhstan | 30.3 | 21.3 | 13.3 | 28.2 | 19.1 | 11.4 |
| Kyrgyz Republic | 45.5 | 29.9 | 15.0 | 45.6 | 28.2 | 13.4 |
| Moldova | 12.1 | 9.0 | 6.7 | 12.6 | 8.2 | 5.0 |
| Russia | 26.4 | 24.5 | 15.5 | 27.3 | 22.3 | 12.5 |
| Tajikistan | 64.0 | 26.6 | 8.9 | 68.8 | 23.8 | 7.2 |
| Turkmenistan | 39.1 | 19.1 | 0.3 | 40.3 | 17.2 | 0.2 |
| Ukraine | 20.9 | 15.5 | 7.1 | 20.8 | 14.0 | 5.7 |
| Uzbekistan | 30.6 | 30.0 | 9.1 | 31.7 | 28.4 | 7.6 |
| *Commonwealth of Independent States* | *34.1* | *22.1* | *10.6* | *34.9* | *20.0* | *8.6* |

[1] Excluding district heating.

Note: Affordability estimates are unweighted averages.

Source: Authors' own calculations based on household survey data, EBRD

**Table 6: Affordability at full cost recovery in 2010, bottom decile (in per cent of total household expenditure)**

| | 2007 | | | 2010 | | |
|---|---|---|---|---|---|---|
| | **Electricity** | **Heating** | **Water** | **Electricity** | **Heating** | **Water** |
| Czech Republic | 3.9 | 3.2 | 1.2 | 3.5 | 2.9 | 1.1 |
| Estonia | 6.0 | 11.4 | 2.8 | 5.3 | 10.3 | 2.8 |
| Hungary | 5.6 | 2.2 | 4.5 | 5.0 | 2.1 | 4.1 |
| Latvia | 2.4 | 3.8 | 2.1 | 2.2 | 3.5 | 2.1 |
| Lithuania | 3.2 | 4.3 | 1.3 | 2.9 | 3.9 | 1.2 |
| Poland | 5.6 | 3.6 | 4.3 | 5.0 | 4.6 | 4.1 |
| Slovak Republic | 7.0 | 16.5 | 3.4 | 6.4 | 15.4 | 4.7 |
| Slovenia | 7.7 | 2.1 | 3.3 | 7.1 | 2.0 | 3.2 |
| *Central eastern Europe and the Baltic states* | *5.2* | *5.9* | *2.9* | *4.7* | *5.6* | *2.9* |
| Albania | 6.0 | na | 2.1 | 6.3 | na | 4.0 |
| Bosnia and Herzegovina | 9.2 | 1.2 | 2.5 | 8.8 | 1.8 | 4.3 |
| Bulgaria | 9.1 | 1.6 | 3.8 | 9.0 | 2.0 | 4.3 |
| Croatia | 10.9 | 1.4 | 3.7 | 10.4 | 2.0 | 4.3 |
| FYR Macedonia | 16.6 | 0.3 | 6.8 | 15.7 | 0.5 | 10.4 |
| Romania | 5.7 | 3.6 | 5.4 | 5.5 | 4.6 | 9.0 |
| Serbia and Montenegro | 12.1 | 14.8 | 6.1 | 14.5 | 32.3 | 7.9 |
| *South-eastern Europe* | *9.9* | *3.8* | *4.4* | *10.0* | *7.2* | *6.3* |
| Armenia | 8.5 | 0.2 | 2.4 | 7.8 | 0.3 | 3.7 |
| Azerbaijan | 1.8 | 3.0 | 2.1 | 2.1 | 11.3 | 6.9 |
| Belarus | 3.2 | 4.3 | 2.4 | 3.5 | 8.4 | 6.2 |
| Georgia | 13.7 | na | 2.0 | 13.3 | na | 7.7 |
| Kazakhstan | 3.4 | 4.5 | 3.8 | 3.8 | 7.1 | 8.1 |
| Kyrgyz Republic | 3.7 | 9.3 | 6.9 | 5.4 | 14.3 | 8.4 |
| Moldova | 5.1 | 1.9 | 1.2 | 4.6 | 2.1 | 1.5 |
| Russia | 2.8 | 5.4 | 6.2 | 2.9 | 9.8 | 8.4 |
| Tajikistan | 3.4 | 0.9 | 9.9 | 7.8 | 2.8 | 13.2 |
| Turkmenistan | 0.4 | 1.0 | 0.1 | 0.8 | 15.0 | 1.4 |
| Ukraine | 2.8 | 8.9 | 3.8 | 2.4 | 8.1 | 3.4 |
| Uzbekistan | 5.2 | 2.4 | 6.7 | 8.3 | 2.3 | 1.8 |
| *Commonwealth of Independent States* | *4.5* | *3.8* | *3.9* | *5.2* | *7.4* | *7.2* |

Notes: Affordability estimates are unweighted averages. Costs in US cents are given in 2007 dollar values.

Source: Authors' own calculations based on household survey data.

# 4. FOCUS ON VULNERABLE GROUPS

An alternative way of looking at affordability is to study specific groups of vulnerable consumers, rather than income deciles. Many of the households included in the bottom income deciles are in fact pensioners, the unemployed and people living on various kinds of social benefits. However, since these groups are of particular concern on social policy grounds it may be instructive to focus on them in some more detail.[34]

Relatively little is known about the consumption patterns of socially vulnerable groups. Instead of using actual consumption, this section therefore assesses the cost and affordability of a standardised level of consumption. This level can be thought of as an entitlement – the minimum level of utility services a person should have access to. The notion is often used in the context of assessing energy and water poverty, which uses subsistence energy consumption as a proxy.

Standardised entitlements have several analytical advantages: they are less data-intensive and thus easier to estimate, they facilitate the comparison of affordability across countries and they correct anomalies in consumption patterns. However, the definition of minimum consumption levels often varies depending on differences in climate, living standards and the socio-economic environment. The standard consumption levels used here are approximately 600 kWh/year for electricity, 1,500 kWh/year for district heat and 22 $m^3$/year for water. While these values are based on typical values found in the literature, they should be seen as indicative only.[35] For example, it has been argued that households in transition countries should have higher consumption levels because of the harsh climate in some regions and the exceptionally high supply and end-user inefficiencies.

Although many household groups are considered to be socially vulnerable, the analysis focuses on pensioners and social benefit recipients. Unlike unemployment benefits – which in most countries are designed to provide a partial and temporary income only – pensions and social benefits are more likely to constitute the lion's share of income for their recipients.

Table 7 shows how much of that income would have to be spent to secure a minimum level of electricity, heating and water.[36] The table suggests that even at current tariff levels (but assuming full payment) paying for utility services is problematic for many vulnerable consumers. Pensioners in Georgia and Moldova, in particular, seem to experience severe affordability problems. The high affordability ratios in these two countries reflect a combination of low income and (relatively) high tariffs. Together with Tajikistan and Uzbekistan, Georgia and Moldova have the lowest pension levels in the region, but unlike Tajikistan and Uzbekistan they have already made progress in tariff reform, at least in the power sector.[37]

Social beneficiaries tend to be worse off than pensioners. In most countries, social benefits are considerably lower than pension levels and they tend to be supplemented by informal income and other temporary forms of social support. In Armenia, Azerbaijan, the Czech Republic, Georgia, Moldova, Romania and Uzbekistan the affordability ratios for total electricity, district heating and water expenditures are above the 25 per cent threshold defined in section

[34] In affordability analysis we use average pensions and social benefits as the only source of income for vulnerable groups. One should not underestimate the importance of informal income given the size of pervasive informal sector in transition countries (see Schneider, 2002 and Lacko, 2000).

[35] We used middle-income countries as a benchmark and assumed an approximate apartment size of 50$m^2$. See Foster (2000) for different methods to estimate energy poverty lines; see WHO (2004), OECD (2003) and Eurelectric (2004) for other measures.

[36] This does not take into account seasonal variations, which are particularly important for heating.

[37] In addition, there is a data issue. The Georgian estimate is based on minimum pension levels, rather than the average pensions used for the other countries.

one. Should tariffs rise to cost recovery levels, the affordability threshold for total utility expenditures would be surpassed in practically all CIS countries.

The estimates of Table 7 are higher than the affordability ratios of Table 4 for two reasons. The first is that vulnerable groups tend to have lower incomes even than the typical households in the lowest income decile. They also rely more heavily on informal sources of income, which are not taken into account in our estimates, particularly in the CIS region.[38] The second reason is that the estimates are based on consumption entitlements rather than actual consumption. Some low income households consume less than the minimum entitlement, particularly in the CIS. From a purely economic point of view, this is the rational response of utility-maximising households to a particularly tight budget constraint. However, from a social point of view it is a sign of pervasive energy and water poverty. Energy poverty is particularly acute in less advanced CIS countries. Vulnerable groups do not have access to the socially acceptable mimimum level of consumption for these essential services. In the case of electricity and district heating, low consumption often means the use of alternative forms of energy, such as wood and dirty fuels, many of which are associated with severe health effects from indoor air pollution.

Even though the quality of estimates is limited, Table 7 seems to confirm that socially vulnerable groups are particularly exposed to tariff adjustments and that better social support schemes will be needed to protect them from the negative impacts of tariff reform. In principle at least, these consumers should be easier to reach through social programmes than other affected groups since they are already registered benefit recipients. In practice, however, there is little evidence that existing support programmes have successfully targeted the most vulnerable groups (see Kennedy, 2005).

[38] According to the estimates on the shadow economy labour force, countries like Georgia, Moldova and Ukraine have around 50 per cent of the labour force working in the informal sector (see Schneider, 2002 and Lacko, 2000).

**Table 7: Affordability of vulnerable groups in 2003, all utility services, by minimum consumption entitlements (in per cent of total household expenditure)**

| | Pensioners | Social beneficiaries |
|---|---|---|
| Czech Republic | 5.6 | 45.6 |
| Estonia | 6.3 | 10.8 |
| Hungary | 4.9 | 10.3 |
| Latvia | 7.3 | 12.8 |
| Lithuania | 10.2 | 14.7 |
| Poland | 4.0 | na |
| Slovak Republic | 9.7 | na |
| Slovenia | 5.8 | 13.2 |
| *Central eastern Europe and the Baltic states* | *6.7* | *17.9* |
| Albania | 3.8 | 10.9 |
| Bosnia and Herzegovina | 6.0 | 6.6 |
| Bulgaria | 6.6 | 13.1 |
| Croatia | 3.9 | 12.4 |
| FYR Macedonia | 6.9 | 13.3 |
| Romania | 8.7 | 25.7 |
| Serbia and Montenegro | 4.4 | 7.2 |
| *South-eastern Europe* | *5.7* | *12.7* |
| Armenia | 19.1 | 40.6 |
| Azerbaijan | 6.6 | 26.8 |
| Belarus | 4.9 | na |
| Georgia | 30.3 | 30.3 |
| Kazakhstan | 5.3 | 22.8 |
| Kyrgyz Republic | 12.8 | 22.9 |
| Moldova | 37.7 | 40.4 |
| Russia | 3.4 | 12.5 |
| Tajikistan | 9.9 | 22.7 |
| Turkmenistan | 0.3 | 0.9 |
| Ukraine | 7.1 | 9.3 |
| Uzbekistan | 17.5 | 61.4 |
| *Commonwealth of Independent States* | *12.9* | *26.4* |

Notes: Affordability estimates are unweighted averages. Affordability excludes water for the following countries: Belarus, Georgia, the Kyrgyz Republic, Russia and Tajikistan due to incompatibility of data. District heating data are excluded for Albania and Georgia, where heating networks are not functioning.

Source: Authors' own calculations based on household survey data, EBRD survey of national authorities.

# 5. CONCLUSION

In this paper we have looked at household expenditures for electricity, district heating and water services in central eastern Europe and the Commonwealth of Independent States. The aim was to understand better to what extent low income households can afford these services. The last 15 years have seen a marked increase in poverty levels in transition countries. Difficulties with the affordability of modern sources of energy and clean water is only one manifestation of this trend.

The paper found that on average households are able to pay their utility bills without problems. The water, heating and electricity expenditures of an average household currently account for no more than 4-10 per cent of total outgoings. However, for low-income households the affordability ratios are much higher. In Croatia, FYR Macedonia, Georgia and the Slovak Republic, for instance the poorest 10 per cent of households spend more than 10 per cent of their income on electric power alone.

While there are important data limitations, these estimates suggest that affordability is indeed a problem in some countries and for some consumer groups. This is a concern not least because in many countries problems have arisen despite low effective tariffs. In much of the region, water, district heating and electricity tariffs are still unsustainably low, and the payment record is patchy. Effective tariffs will have to be adjusted if services are to be improved and financial sustainability restored.

Given the urgency of these adjustments, affordability problems are likely to get worse before they get better. The paper confirmed that for many tariff scenarios the trajectory of future affordability ratios is hump-shaped. In the short term, the tariff increases needed for financial sustainability are steeper than the rate of income growth; affordability ratios will increase. They will only level off once cost recovery has been reached.

One possible response to these trends would be to pace tariff adjustments so that they do not exceed the rate of income growth. In that case, affordability ratios would remain more or less stable over time.[39] However, this may not necessarily be the best policy. It would mean a delay in much-needed sector rehabilitation without leading to a significant reduction in affordability ratios. The delay in rehabilitation would also affect poor consumers, which often suffer disproportionately from the poor service quality.[40] Furthermore, unreliable services (electric power in particular) impose a large burden on local businesses. Postponing reforms under these circumstances would slow down the output growth needed to lift low-income consumers out of poverty.

A more promising approach may be to complement tariff reform with targeted measures to mitigate its social consequences. Several such schemes are used in practice. Perhaps the most common instrument to protect low-income consumers is block or lifeline tariffs. Under a block tariff system services up to a certain threshold are provided at a low or no cost. Consumption beyond this point is charged at full cost. In this way all consumers have access to a minimum level of service, but there is a price signal to large users about the true cost of the service. An alternative solution are targeted assistance programmes, that is, means-tested cash payments or transfers to vulnerable consumer groups, typically to cover minimum consumption levels. Less common are end-user efficiency programmes, which alleviate affordability problems by reducing the level of consumption needed to reach the desired service standard.

The institutional, organisational and practical constraints for implementing these solutions are considerable, and, the experience in transition countries so far has been mixed (see Kennedy,

[39] The exact change in the affordability ratio will depend on the relative magnitude of the price and income effects on demand.

[40] As observed by OECD (1999) higher quality water and services can lead to increased household consumption, despite the higher price levels.

2005). Block tariffs, for example, require that household consumption is metered, something that is not always cost-effective for poor consumers, especially in the water and district heating sector. Means-tested assistance programmes put high demands on the ability to identify and reach vulnerable households. This capacity is often lacking, particularly in rural areas. Social programmes also depend on a reliable funding source, and hence on good fiscal expenditure management. This has proven to be a problem especially in schemes that are administered and financed at the municipal level.

These practical considerations are obviously important. However, they point to an urgent need to improve social safety provisions more than they imply a need to postpone tariff reform. Fortunately, national authorities and development organisations are beginning to gain experience in working within existing constraints – and overcoming them.[41]

Block tariffs, for example, are now available to electricity consumers in Albania, Bulgaria and Serbia. In Moldova and Romania consumers have the option to either subscribe to a two-block tariff or a uniform pricing system. Armenia, Hungary, Kazakhstan, Romania and Tajikistan are among the countries that operate dedicated energy or water assistance programmes. Bulgaria and Georgia both have seasonal programmes that assist vulnerable consumers during the heating season. In Tajikistan the level of support also varies according to the season. To date, there are no targeted efficiency programmes in transition countries. Several countries have energy efficiency programmes, but they do not have a social objective and tend to target commercial consumers.

A precondition for the establishment and wider success of all these schemes is a deeper understanding of affordability constraints and of energy and water poverty more generally. Affordability problems are multifaceted and their underlying causes can be equally complex. This paper has tried to identify some of the main issues, but it has not reduced the need for further, more detailed analysis. It is surprising how little we still know about the consumption patterns and well-being of low income households. More conceptual and empirical work as well as practical experience is clearly needed for designing or refining social safety mechanisms. But equally important will be better and more detailed information about those income groups that are most vulnerable to tariff increases.

[41] This discussion draws on the detailed overviews in Velody *et al*. (2003) and IPA (2003).

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# ANNEX

Residential price and income elasticities in the sector of utilities, empirical estimates

| Source | Sector | Country | Price elasticity | Income elasticity |
|---|---|---|---|---|
| Taylor (1977)[1] | Electricity | | range from -0.81 to -1.66 | |
| Bohi (1981) [1] | Electricity | US | -0.7 | |
| Baker et al (1989)[2] | Electricity | UK | -0.76 | 0.17 |
| Bohi and Zimmerman (1984) [1] | Electricity | | range from -0.05 to -0.71 | |
| Larsen (2002) [2] | Electricity | Norway | | 1.02 |
| Dennerlein (1987) [2] | eEectricity | Germany | -0.38 | 0.42 |
| Silk and Joutz (1997) | Electricity | USA | -0.5 | 0.5 |
| Bernard et al (1996) [2] | Electricity | Canada | -0.67 (short run) | 0.14 |
| EBRD (2001) | Electricity | transition economies | -0.5 | |
| Halvorsen and Larsen (2001) | Electricity | Norway | -0.442 | range from 0.06 to 0.13 |
| NIEIR (2002) | Electricity | Australia | range from -0.20 to -0.50 | |
| Kamerschen and Porter (2004) | Electricity | Northern Europe | range from -0.85 to -0.94 | |
| Lampietti and Meyer (2002) | Heating | Armenia | -0.4 (short run) | 0.1 (poor), 0.2 (non-poor) |
| Lampietti and Meyer (2002) | Heating | Moldova, Kyrgyz Republic | -0.2 (short run) | |
| EBRD (2001) | Heating | transition economies | -0.5 | |
| Nesbakken (1999) | Heating | Norway | | 0.05 |
| Bohi and Zimmerman (1984) [1] | Heating | | range from -0.22 to -0.60 | |
| Garcia and Reynaud (2004) | Water | France | -0.25 | 0.03 |
| Barkatullah (2002) | Water | Australia | -0.21 | 0.07 |
| Chicoine et al (1996) [3] | Water | US | -0.71 | 0.01 |
| Critelli (1998) [3] | Water | Italy | -0.24 | |
| Dalhuisen et al (2001) | Water | | | 1.2 |
| Kim (1998) [3] | Water | Korea | -0.29 | |
| Nieswiadomy and Molina (1989) [1] | Water | US | -0.86 | 0.14 |
| Jones and Moriss (1984) [3] | Water | | | 0.4 |
| Berbeka and Berbeka (2001) [3] | Water | Poland | -0.2 | 0 |
| Höglund (1997) [3] | Water | Sweden | -0.2 | |

Note: Price elasticity is long run unless otherwise indicated.

Sources: [1] Dahl (1994), [2] Nesbakken (1999), [3] OECD (1999, 2003).