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Metering drinking water in Armenia: The process and impacts

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ABSTRACT

Metering water consumption and innovative meter-based billing practices have been advocated by economists as essential ingredients for effective water management. This paper scrutinizes the process of introduction of metering for municipal water supply in Armenia. The primary objective is to analyze the transition to a water-metering based system, focusing on the associated transformations in the water governance and the effects of water metering on household consumers and in the operation of water companies. This paper reveals that within a short period of time the water metering reached a near-universal level with some utilities of 99%. Individual apartment rather than building block level metering makes it a unique case. Metering improved reliability of water supplies and increased water use efficiency. The water conservation effects of metering were higher during the initial period after installation of meters and the last period of 2009–2010 when the tariffs increased. In the short-run, a nearly four time decline in residential water demand was observed. However, substantial cuts in water bills observed by households and absence of price increase resulted in a rebound of consumption by up to 70%. In the long-run, metering was accompanied by a 48% reduction of residential water demand, even in view of improved water supply services, such as daily duration. Finally, simplification and clarification on meter testing and replacement procedures can be crucial for water loss prevention measures.

1. Introduction

The last two decades have witnessed water sector reforms in both industrialized and developing countries. In some countries, water metering has been introduced and is required by legislation. Metering comprises a critical aspect of future building operational and conservation improvements. For example, according to the USA federal metering requirements, all new construction and renovation projects exceeding $200,000 are to be equipped with electricity, natural gas, and water meters with remote reading capabilities (DOE, 2007). In other countries, for example the UK, mandatory water metering is not introduced because of concerns about the potential adverse impacts on low-income households. Hence, various incentives are introduced (for example, free installation) to promote an increase of customers willingness to connect to metering on voluntary bases (Gregory, 2009).

Currently, in most countries belonging to the Organization for Economic Co-operation and Development (OECD), water metering exists in most single-family houses, but most multi-apartment buildings that house the majority of OECD population are equipped with block level meters (at the lower floor of the building) rather than individual apartment meters, and universal metering is still a controversial issue in a number of countries (Staddon, 2008) with impacts of metering depending upon the context of implementation (Walker, 2007). According to the study of the Environment Agency (2008), in many European countries, households are almost universally metered. For example, in the Netherlands, 75% of apartments are individually metered. In most cases, domestic metering is on building level, which creates lower incentive for individual users to control their water consumption than in the case of individual apartment meters (Mayer et al., 2004). In Eastern Europe, water metering is also more common at the building level. The studies on water metering in the region of Newly Independent States (NIS) are scarce. In Ukraine, only 9% of multi-apartment buildings have water meters. In Kyrgyzstan, household metering hardly exceeds 1% (EEA, 2007). In this context, the case of metering in Armenia is rather unique with individual water metering level being almost non-existent in the early 2000s and currently ranging from 67% to 99%, depending on water utility.

Theoretically, if water is not metered, users have no incentive to consume water efficiently (Harris, Tate, & Renzetti, 2002). They are reluctant to acquire low-flow fixtures and water-efficient appliances, repair leaking water appliances, or stop lawn watering during rainy seasons. Metering enables wise measurement and management of water resources. The data provided by meters informs about water performance needed to promote behavioral

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and operational changes by both the users and water utilites. Moreover, metering is a necessary but not sufficient condition for linking the water costs in proportion to water consumption and the payments with quantity consumed, which is generally regarded as the fairest way to pay. Traditionally, utilities were billing the water consumers using flat rates or property taxes. Introduction of metering opened up new opportunities for transition from the old water tariff structure to new consumption-based or volumetric tariff policy principles providing genuine incentives for improving efficient water supply and consumption (Zetland & Weikard, 2011; Drozdov, 2002). On the supply side, it enables improvement of transparency of utility operations by ensuring more pragmatic control of water supply service quality (Drozdov, 2002). On the demand side, it creates the right incentive for users to make daily decisions on how and how much water to consume.

Hence, not being a water efficiency and conservation technology per se, water metering has a potentially large impact on water demand. Various studies show an average of 15–40% cut in household water consumption due to metering (Inman & Jeffrey, 2006; Mayer et al., 2004). The study of the impact of water metering in two Canadian cities shows 50% more per capita water demand in the completely unmetered city as compared to the completely metered one (Harris et al., 2002). In Denver, CO, USA, water metering resulted in 32% savings (RAU, 2004). Inman and Jeffrey (2006) argue that metering has the benefit of enhancing the user's awareness about their consumption, especially, if it is accompanied with specific tariff structures, such as increasing block structures, which means higher payment for the increased quantity of water used. It is common that the studies on the impacts of metering are done together with tariff changes (Drozdov, 2002; Harris et al., 2002; Staddon, 2008).

While there is not a shortage of studies on the water metering impacts conducted in many parts of the world, they are still scarce in the region of Newly Independent States (NIS). Moreover, the studies are usually focusing on specific aspects or impacts of metering and studies exploring the wider set of findings on the process and impacts of large-scale metering on county level are rare. Except for a few sections devoted to metering in some reports, no comprehensive studies are found in the NIS. Normally, the country studies are presented in a limited scope within wider water sector studies. The review of literature has revealed only one study on Moldova. Drozdov (2002) presents the successful case observed in Moldova, where the highest metering coverage of households with individual apartment meters up to 59% was reached in the capital city of Chisinau. The analysis of the results of the metering program in several municipalities of Moldova revealed water demand reduction in line with increasing water metering level.

The objective of this paper is to examine the process of transition to universal water metering and meter-based (volumetric) water pricing in Armenia and to frame it in the broader context of water the policy reform process to better illustrate the driving forces behind metering and the impacts. Hence, the central questions arising are: (a) what are the preconditions for water metering, and (b) what are short- and long-term impacts of metering on water consumers and water utility performance? The study focuses on conditions pertaining to Armenia as a country in transition. The first sections of the paper provide the analysis overview of the water reform prerequisites, important structural changes along with enabling legal and institutional environment for metering implementation. Special attention is given to the issue of mitigating adverse social consequences. The paper proceeds with an analysis of the short- and long-term effects of metering on water demand and water utility performance.

The findings show that within a short period of time the country succeeded in introducing large-scale metering within some utility areas with up to 99% near-universal metering, which is among the highest levels worldwide and unique in that it is individual apartment level metering in contrast to building block level metering. In the short-run, the significant conservation effects of water metering rebounded by up to 70% under the condition of unchanged tariffs. In the long-run, water metering was accompanied by an average of 48% cut in residential water demand. The paper also finds that favorable legislative and institutional settings and provision of social protection schemes for mitigating the adverse social impacts are critical for policy implementability.

2. Methodological and data considerations

The study draws upon the external desktop research technique. The research follows the multi-method research design and combines quantitative and qualitative research methods to provide a more complete set of findings. Document analysis is employed along with the time series analysis based on data extracted from academic publications, country studies, utility reports, as well as the database of the International Benchmarking Network for Water and Sanitation Utilities (IBNET) that provides comprehensive, disaggregated, and consistent data on many important variables over time across a set of water utilities. Whenever possible, IBNET data was validated against data provided by water utilities and the state regulatory agency. In case of significant variations, IBNET data was replaced. Indeed, availability of publicly accessible and reliable data is the major constraint in many countries of the region. Fortunately, this situation is changing gradually and, hopefully, in the coming years, more data will be publicly available. In Armenia, while water utilities are gradually providing more information, in some cases it is far from being satisfactory.

The analysis of short-term effects of water metering is conducted for a single urban area where data is available. The study of long-term effects looks at country level variations using a dataset of water utility level observations. It is based on the analysis of five water utilities currently operating in Armenia under various contractual forms of public–private partnership and serving 63% of the population. The analysis does not cover the operation of 580 village associations and agricultural water service companies. The study examines the drinking water supply focusing on the residential water use sector. This aspect needs some more explanation taking into account the transitional processes relevant to Armenia. Since the late 1980s with the collapse of the Soviet Union, industrial and agricultural water demand has experienced a major decline due to drastic reduction of activities in these sectors and closing down of many enterprises. According to data of the National Statistical Service of Armenia, industrial water use constitutes an average 8% of total water use in Armenia within the last 20 years. This strengthens the importance of residential water users in the total demand for water and for revenue generation of municipal water utilities. However, with the recent economic revival the share of industry, in contrast to agriculture, in the Gross Domestic Product of the country is gradually increasing, which would stimulate the subsequent rising demand for water and the need for further studies for this sector.

3. Drivers for water sector reforms

Prior to independence in 1991, the water infrastructure in Armenia was overall quite satisfactory. During the subsequent transition to a free-market economy, the country faced an economic depression characterized by the collapse of industrial base, a soaring inflation rate, dramatic welfare losses and increasing poverty. The water infrastructure suffered neglect and under-investment, being heavily reliant on state subsidies. The decade of unhurried action resulted in significant degradation of water networks and facilities.

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