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The Case for Improving Water Efficiency in MENA Countries

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A range of contemporary pressures – rising populations, economic development, and climate change – are increasing the strain on water supplies in many regions of the world today. Nowhere is water scarcity felt more acutely than in the arid countries of the Middle East and North Africa (MENA). Given the magnitude of the shortfall between demand and supply in so many countries in the region, it is surprising that water management remains so technically and economically inefficient.

This policy brief defines the concept of water use efficiency and describes options that could be used in MENA countries to improve it. It also discusses some of the key practical limits of, and objections to, application of water efficiency principles. We finally consider a set of water-related dynamics that are helping to create new threats in this region, and that make efficiency improvements all the more imperative. If improved outcomes are to be achieved in the water sector and for populations in the region, there is an urgent need for forward-looking policy development, coupled with rigorous evaluation to generate evidence of the effectiveness of efficiency-improving interventions.

What is water use efficiency?

From a technical point of view, high levels of water efficiency are achieved by minimizing losses that occur between the source of water and the point of use. In other words, physical efficiency is maximized when the amount of water that is actually used by producers and consumers most closely matches that which is abstracted from the natural system. Leakage and infiltration; non-productive evaporation; or inefficient end user technology can all contribute to water losses. Substantial reductions in these physical losses can be achieved by improving technology: Lining and covering of irrigation canals, timely and effective maintenance in piped water and sewer networks, better management of water storage, use of drip irrigation, installation of domestic water conservation devices, or development of systems that enable the recycling and reuse of drainage water. To be sure,

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many MENA governments have made major and vital investments to stimulate the adoption of such technologies. Yet there is tremendous scope for further saving; for example, drip irrigation remains far from universal throughout the region today, even as agriculture remains the dominant consumer of water. Similarly, the reuse of wastewater continues to be limited by lack of infrastructure for collecting and treating wastewater, and also for socio-cultural and political reasons.

The perspective of technical water use efficiency however misses important features of the water consumption problem. In particular, it places undue emphasis on the achievable water savings that would occur without behavior change, except for that required to adopt the types of new technologies that are described above. In fact, engineers' own estimates of efficiency gains from technology adoption often fail to be realized because they omit important changes and adjustments in behavior. For example, consumers using water conservation devices effectively face cheaper prices for water because they require less water to achieve a given improvement in well-being. As such, they may respond by increasing overall water consumption for other purposes, a phenomenon that is commonly termed the rebound effect. This "efficiency paradox" has been shown to apply for both energy- and water-conserving devices, and is but one example of the type of response that may lead to reduced net savings from technical efficiency improvements. Another type of response that reduces savings can occur at higher levels of the allocation system, if water management institutions reassign saved water to lower productivity users, thereby generating little additional value. Behavioral changes can also enhance savings, if individual users become convinced by social norms or environmental arguments about the need to conserve water.

Thus, a more holistic view of efficiency is necessary if economically-relevant reductions in water shortfalls are to be achieved. Under this economic conception of efficiency, end users of different types have varying valuations, or willingness to pay, for a specific unit of water. If the costs of obtaining that unit exceeds a user's valuation, he or she will choose to forgo acquiring it. For the policy-maker interested in optimizing efficiency under conditions of scarcity, the key point is that excess demand for water can be managed by raising the cost to end users until the total amount consumed is just equal to the available supply.

For policy-makers who take an economic view of efficiency, the good news is that a range of solutions can be utilized to raise the effective cost of water, and thereby more effectively manage water scarcity. Pricing tools can be used directly to change consumption behaviors, or indirectly to induce household and firm investments in water-conserving technologies (of the types described previously) that lead to reduced consumption. More generally, higher prices can help promote a long-term trajectory of economic development that is more sustainable and sensitive to water availability constraints. Non-price instruments such as centrally-managed sectoral reallocation of water can achieve similar ends, if managing institutions are able to accurately determine the true value of water, and to specify allocations accordingly. Because such valuations are dynamic and typically hard for the policy-maker to measure,

tradeable water rights schemes, as implemented in Australia, the Western United States, and Chile, can be used to encourage users to reveal their valuations through participation in the market. Furthermore, each of these institutional solutions can be implemented alongside technology and behavior change promotion activities, and supply enhancement investments, to make a limited supply of water go further and last longer, and to make infrastructure investments more effective.

1. Why is achieving water efficiency challenging?

To many, it is puzzling that high levels of inefficiency continue to prevail, and that water sector institutions remain difficult to reform, even when scarcity is acute (e.g., in MENA). After all, many of the solutions described above are relatively simple in theory. Making sense of this situation requires an appreciation for what makes this resource unique, compared to other natural resources that typically present fewer such management problems.

One of these important features is that water is uniquely essential for life, largely because it has no substitutes, at least for some purposes (i.e., drinking, food production, and basic hygiene). To be sure, arguments against raising water prices are often made on the basis that there is something unethical about charging high prices for something that is so necessary. This argument is often made in debated about water tariffs despite the fact that other necessities of life (e.g., food or fuel for heat) are primarily allocated using market mechanisms.

Another of water's important features is that it alternatively exhibits properties of a fully private or a fully public good, or something in between, depending on its use. Fully private goods are rival and exclusive in use, meaning that units of the good that are consumed by one agent are unavailable for others (i.e., they are rivalrous) and that well-defined property rights govern the use of specific units (i.e., they are exclusive). Fully public goods are neither rival nor exclusive. The fact that water can lie at different points along this spectrum arises from its mobility, renewability, and variability, as well as the possibility of building infrastructure to control it, aspects which relate to water's exclusiveness. Then, water is useful for myriad purposes that are not all similarly rival – domestic, agricultural, industrial, recreational, and environmental, to name a few. This diversity of uses in turn challenges efficient allocation, especially because the economic value of a single unit of water may reflect its use for several purposes at different locations and times, and because these uses also affect water quality. The latter further relates to water's pollutability, which is itself both a helpful and troublesome attribute of the resource. On the one hand, water can be, and is, used throughout the world to flush a wide range of contaminants out of communities; on the other, this means that non-users and the environment may be harmed through externalities that often go uncompensated and that turn what appear to be non-consumptive uses into rival uses nonetheless.

These various properties of water have important implications for water management that are sometimes underappreciated by economists who advocate for use of efficiency-improving policies. For example, besides the issue of essentialness, the idea that higher prices would improve water allocation often cuts against deeply ingrained cultural beliefs that are tied to the complicated exclusiveness of the resource. The idea of raising tariffs may thus be challenged by rights-based arguments or perspectives. Meanwhile, some of the key challenges that often confront water markets are how to effectively deal with transmission losses and changes in water quality. Such arguments must typically be accommodated, whether they apply to domestic consumption or other seemingly less vital needs (such as those of rural farmers). Efficiency-focused solutions thus require strong and effective management insti-

tutions. In other words, politically-palatable policies to enhance water efficiency must somehow find ways to ensure that basic needs – as defined within affected societies – will not be compromised in the name of efficiency.

Infrastructure poses a somewhat different type of conundrum. Many of the investments that enable water use, such as water treatment plants, dams, and piped networks, have very high fixed costs. As a result, it is usually economically more efficient for a single operator (e.g., a municipal utility) to provide services than to have multiple suppliers (e.g., decentralized water supply networks). Similarly, it is better to invest in greater capacity than is needed in the short term since further expansion in the near future will be relatively costly. In most developed countries and in the MENA region, the public sector has historically been heavily involved in subsidizing such investments, and in managing or regulating their operators. Yet this also requires strong governmental institutions and an ability to bear the high financial costs, neither of which are consistently present in less-developed economies. Efficient pollution control that limits costly spillovers or otherwise compensates parties that are harmed by them similarly requires strong government institutions. Finally, rights-based arguments may also be used to challenge polluters and infrastructure development, if these activities have negative distributional consequences for other pre-existing water uses.

2. Emerging water concerns in MENA

As a result of the region's general aridity, people and societies in MENA have developed a range of effective coping mechanisms for dealing with scarcity and drought conditions. Nonetheless, a variety of trends and pressures today are increasing the urgency of more efficient water management. Populations continue to rise, increasing the demand for water for domestic and other purposes. Climate change is reducing rainfall and increasing its variability throughout the Mediterranean region, further exacerbating existing stresses. Neighboring non-MENA countries that share water resources with the region are increasingly making use of these shared resources, altering the amount, timing, and quality of inflows. Finally, the landscape for financing large water projects is evolving towards more private sources and away from donor or development bank assistance, which may have less favorable loan conditions that will work to increase long-term public sector debt.

These varying conditions make it all the more critical to enhance cost recovery and improve allocative, water reuse, and water delivery efficiency, given the high cost of developing new supplies. For most countries, this will mean reducing the total amount of water being sent to the irrigated agriculture sector, which remains the dominant user of water in the region. And while some argue that irrigated agriculture must be supported for the purpose of ensuring food security, the reality is that few MENA countries today are self-sufficient in food production. Rather, these countries will have to rely on the global food system (and the trade of virtual water) to feed their populations. Meanwhile, utilities and water distribution systems will need to be much better maintained and managed, to reduce both physical and administrative losses that arise from ineffective billing systems. Such improvements would enhance cost recovery and in turn improve long term operation and maintenance. Finally, water quality challenges will need to be confronted by improving collection and treatment of wastewater, which itself will facilitate investment in water reuse.

3. The need for policy testing and evaluation

Policy-makers involved in the water sector in MENA clearly have a range of policy options available to more effectively manage this scarce resource. Overall supply can be increased first through investment in water reuse and, at a much higher cost, with desalination. Losses of existing resources from leakage and non-productive evaporation or drainage can be reduced substantially using technology. Ongoing efforts in the region to rigorously document the impacts of these types of improvements – for example by the Millennium Challenge Corporation for its large urban investment in water and wastewater infrastructure in Zarqa, Jordan – aim to provide valuable information that could inform future similar planning efforts in the region. More similarly ambitious evaluations of impacts from sectoral investments are sorely needed, to better understand what works and what does not, and why.

At the same time, it is unlikely that supply improvements and technological changes alone will lead to sustained and significant progress unless they are coupled with other actions to make water use more efficient. And while the institutional solutions seem simple on paper – higher tariffs, use of water productivity principles or perhaps markets to reallocate water to high value uses, and stronger regulation to reduce pollution and rent-seeking by water suppliers – there has been limited rigorous evaluation research to date on identifying ways to effectively implement institutional changes while balancing other sector objectives. There is thus a tremendous need for policy experimentation that would better establish the consequences of such institutional and financial reforms, and the extent to which these can be combined with more traditional investments in infrastructure. Such experimentation could pay particular dividends as MENA countries work to cope with ever-tightening water supplies, increasing water quality degradation, and new threats arising from climate change.

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