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Setting the Scene
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- Water is essential for all life on earth.
- Human beings can live 20 days without food but no more than 2 days without water.
- It takes 10 to 100 times as much water to grow the food we eat as the water we drink.
- The world is facing a crisis over water.
- The wars of the future will be over water, not oil.

One hears so many statements of this kind about water that they have come to sound trite. The problem is that they are also true C except the last one about water wars, which are highly un-likely. The facts are stark; every year they are getting more stark; and nowhere in the world are they more stark than in the Middle East and North Africa (MENA).

Water in the MENA Region

On a global basis, watersheds in arid and semi-arid regions are home to about one billion people but contain 70% of the world=s poorest people, and 44% of the children whose growth is stunted by malnutrition.

The MENA region itself has 5% of the world=s population but less than 1% of its renewable freshwater availability. Of 20 nations with internal renewable fresh water availability below

Annex 1

1000 cubic metres per capita, 15 are in MENA. Four others are in East Africa and Hungary is the fifth. If we take a more sophisticated measure of water shortage -- the ratio of annual water withdrawals to total available water (without taking account of cost) C MENA stands out with a ratio of 58%; next closest is Eastern Europe at 41%; no other region is above 14%. The only exceptions to the general conclusion of severe water scarcity in MENA are Algeria and Morocco in the Maghreb, and Lebanon and Turkey in the Mashrek C and each of them faces significant regional water stresses.

Three Approaches to Resolving Supply-Demand Gaps

Broadly speaking, there are only three ways out of this dilemma of inadequate fresh water. The first is to eliminate **population growth** in developing countries and income growth in industrial ones, which are entirely appropriate goals but not on the table here.

The traditional response to gaps between water supply and demand is to **increase supply**. Government institutions for water management throughout MENA share two characteristics: first, they are highly centralized; second, they are designed to work almost entirely on the supply side. From one perspective, the supply-side water agencies in MENA countries have been successful. In most cases they have done the task given to them very well with competent engineering and minimal corruption. The problem is the task itself. With more than half of the region=s renewable fresh water supply already being used, the scope for future construction is limited, particularly if one makes the logical assumption that the best and cheapest sources of water have already been tapped. Today water agencies are turning their attention to desalination, inter-basin transfers by pipeline, and large-scale water shipments by sea. All of these options are technically feasible, but none is cheap or easy: most are highly capital and energy intensive; many have severe ecological impacts; and all are politically complex.

Therefore, we come to the third of the three broad approaches to reduce or mitigate the frightening water demand scenarios for MENA: **demand management**. Given the title of our network at IDRC, I am sure that it is no surprise to you that we are enthusiastic about demand management. What may be more of a surprise is that the scope for water demand management is large. How can this be, you may wonder, in a region of relatively low incomes, and where water has historically been carefully husbanded. The answer is a bit complex. It is true that a Bedouin gets along with as little as 5 litres per day, or less than 2 cubic metres per year. However, very few people live the Bedouin life style, and the region is increasingly urbanized. Moreover, though low income implies low levels of use, it does not imply efficient use, and with lots of low-income people that can cumulate to lots of inefficiently used water. Similarly, low income generally implies low absolute expenditures for water, but it does not imply low cost per unit of water. Poor people pay commonly up to 10 times as much per litre of water of questionable quality as do richer people for water of good quality.

Before going further, let me temper my point a bit. Though I favour emphasis on demand management -- A lot more emphasis! -- I am not saying that, to use an expression from American cowboy movies, all the white hats are on one side. If supply side approaches are capital intensive, energy intensive, ecologically questionable and politically complex, demand side approaches can suffer from exactly the same problems. The difference is that, on a unit basis -- that is, comparing a cubic metre of water saved compared with a cubic metre supplied -- demand side approaches tend to be less capital intensive, less energy intensive, less ecologically damaging and not so much politically simple but characterized by

politics that tend to be intra- rather than inter-national.

Six Sectors and Two Dimensions

I am not going to review specific options for demand management. Rather I will set the stage by suggesting that we look at water use in six sectors, each of which has two dimensions. Four of these are end-use sectors:

1. Residential and commercial potable water -- the water we need for drinking, cooking, and washing dishes and hands.
2. Other residential and commercial water -- the amounts we need for washing clothes, bathing, flushing toilets and other uses around buildings (including home gardens, which can be a significant part of food supply).
3. Industry, which can be further broken down into cooling water and all other uses.
4. Agriculture, which can be broken down into water for plants and water for animals.

The remaining two sectors of interest for water demand management are less conventional. The fifth sector is the notoriously leaky **delivery system** that gets the water to final user. When one-third to one-half of the water that is put into the distribution system leaks or is diverted through breaks in the system or from unlined canals, it does not make much sense to urge marginal changes on the final consumer.

The sixth sector is the **ecological demand** for water, or more broadly the amount of water that must be left in the river, the lake, or the aquifer to maintain essential services. Some of these services are quite direct, as with transportation, hydro-power and fishing; others are indirect as in waste dilution, habitat preservation and recreation. This ecological demand is large but, because it is not subject to the same kinds of demand management as the other five sectors, I will put it to one side for the rest of this talk.

Generalizing very broadly, I am confident that in each of the other end-use sectors apart from the last, we know how to cut effective water use (by which I mean the difference between input water and the service provided by the water) by factors of two to five by known technologies that, to repeat, may not be cheap or free of environmental effects, but that are almost uniformly cheaper and less damaging than supply-side alternatives.

I also suggested that demand management in each of these sectors has two dimensions, which are, once again, supply and demand. This must sound a bit tautological. How does supply slip back into the picture? Because it is generally more convenient to treat local, small-scale sources of water as part of demand management rather than as part of supply management. Demand management has to be accomplished for the most part at the household, the farm or the establishment level, and that is also the appropriate scale for many local supply options. For example, with rainfall of 350 to 500 mm a year, it is quite possible to collect enough water from the roof of a typical single-family home to cover potable water uses for a year. The real trick is not to collect the water but to store it in such a way that it stays clean. As a second example, it is possible to use computer models to extend the methods Nabateans developed millennia ago for water harvesting to areas with annual rainfall of 100 mm a year and achieve viable crop yields.

Research: Essential to Both Policy and Action

Let me close by changing the direction of this presentation to emphasize how little of what I have said to now about water demand management will have any effect on the worsening water situation in the absence of research. Research is needed at every level from national

governments and international agencies at one end to communities and households, firms and farms at the other. Moreover, though there is ample scope for technical research to improve the tools and methods themselves, this is not the big problem. Most of them have been around in one form or another for centuries. The research we now need is about the economics of demand management, about gender and social impacts, about ways to induce adoption, and about the institutions that can creatively manage and accelerate the process -- in the broadest sense of the word, about governance for water demand management.

I can illustrate my point about the need for research by focusing briefly on two specific issues: water pricing and water institutions.

1. Water pricing is every economist's first response to the question of supply-demand gaps in water. Both of the first two grants made by the WDMRN focus on water pricing. As an economist I lend my support to this approach in general but I have to add that, no more than any other approach, is it simple. Equity effects and gender effects, among others, can be severe, particularly at the household and farm level. Changes in traditional means of allocating or distributing water are not to be imposed without careful consideration of the impacts, and that means research. And we need just as much research on those non-price methods of water allocation, some of which turn out to be both efficient and equitable.

2. Water institutions are one of the great unexplored areas for improved demand management. The typical prescription is to bring all water institutions together, an approach that I find extraordinarily naive. Given all the dimensions of water, such an agency would be too complex to survive, and it would surely exaggerate existing tendencies toward centralized management. One challenge for research is to look in the opposite direction, toward decentralization and perhaps even privatization of water management. Both demand management and local supply have to be implemented by the household, the farm, the establishment, or the local community where the water is being used, and evidence is accumulating to suggest that local water management is a neglected domain for study. Even if one stays with more centralized agencies, how should the system be designed so as to encourage inter-sectoral shifts of water C mainly from agriculture to other uses C while maintaining equity and without fomenting riots in the streets. (In my view, inter-sectoral water conflicts within a nation are much more contentious than international ones between nations - one reason why water wars are so unlikely.) Again, the need for research is evident.

There are many other illustrations of gains that can come with research on water demand management. IDRC-funded research has, for example, led the way in demonstrating that a lot of the food consumed in cities is grown or raised inside those same cities, and that improved policies can ensure that this food is abundant, safe and nutritious. However, our work is only a small part of what is needed and what could be accomplished with better knowledge and wider application of demand management. We have much, much further still to go. ***If I put my views into a single sentence, I would say that demand management remains at once the best option yet the least understood option for water in the coming decades.***

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Wastewater Treatment and Reuse for Food and Water Security
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