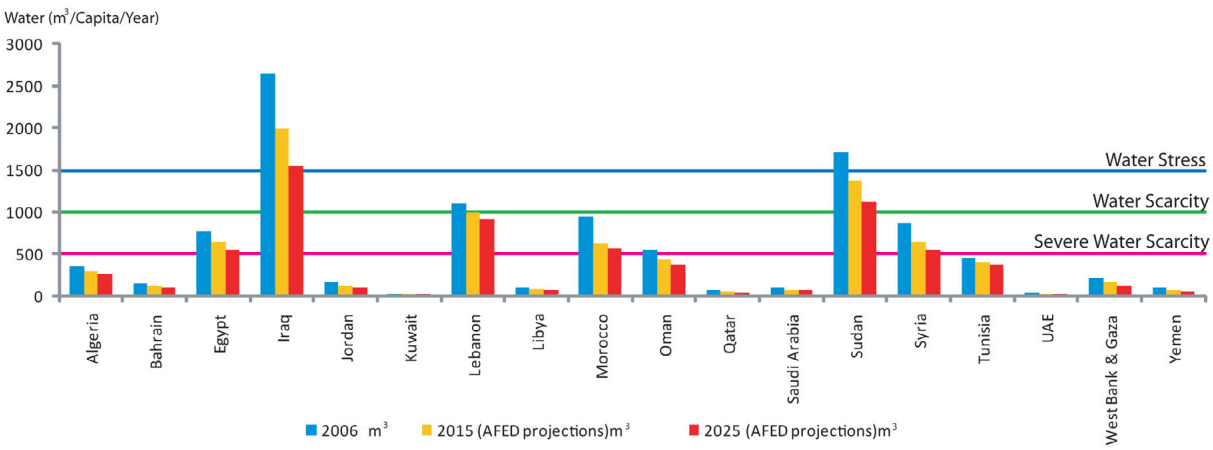
CHAPTER 1

Introduction

Water stress is a global problem with far-reaching economic and social implications. At its roots lies a very basic supply-demand mismatch. While the demand for water is rising in all sectors, the quantity of good quality water that can be accessed with ease and low cost is declining. This decline is particularly rapid in the Middle East and North Africa (MENA). The MENA region is the driest region in the world. The average rainfall in Arab countries varies between 0 to 1800 mm, while the average evaporation is around 2000 mm.[1] Renewable fresh water availability is already below 1000 cubic meter per person per year, compared to over 6000 worldwide. Seven countries in the region are using more water every year than is available to them, mainly by over-pumping aquifers.



Source: AFED Report "Water: Sustainable Management of a Scarce Resource", 2010
2006 figures are from FAO/UNESCO
2015 and 2025 figures are projections prepared by AFED

Figure 1.1: Freshwater availability in Arab countries[2]

As can also be seen in **Figure 1.1**, a great majority of MENA countries are already experiencing severe water scarcity and half of the people in the region already live under conditions of water stress.

Driven by increasing population, growing urbanization, changing lifestyles, and economic development the demand for water is

[1] AFED (2009). Climate Change: Impact of climate change on Arab countries.
[2] AFED (2010). Water – Sustainable Management of a Scarce Resource.

rising. According to a 2007 World Bank study,[3] renewable fresh water availability per capita is expected to halve by 2050 (relative to 2007), a trend that will likely be exacerbated as climate change makes countries hotter and drier.

El-Houareb dam (Merguellil watershed, Tunisia) completely empty at the beginning of May, 2008 (photo Stephanie Guidon, IRD).

Addressing water scarcity challenges in Arab countries is not going to be easy. Radical changes in existing practices and water-use behavior are needed in all sectors. These changes will require the introduction of technical, managerial, and financial innovations as well as the cooperative and concerted action from all actors of society, including businesses, citizens, and policy makers.

On the supply side, the challenge involves developing sustainable sources of water while at the same time preserving the quality of existing sources and assuring effective and fair distribution to users. These steps alone cannot be enough and have to be complemented with changes in the demand side, where a culture of "accomplishing more with less water" becomes a norm in businesses and in other human activities.

This handbook was developed to help industrial, institutional, and individual consumers improve water use efficiency in buildings, agriculture, and in industrial processes. The goal is to provide general steps and useful data that can be used by decision makers to develop comprehensive water efficiency programs.

THE CONCEPT OF WATER EFFICIENCY

Water efficiency is an indicator of the relationship between the amount of water required for a particular purpose and the amount of water used or delivered.[4] A related concept is water conservation where the emphasis is on the accomplishment of a function, task, process, or result with the minimal amount of water. While the two concepts are often used interchangeably, there is a difference between water conservation and water efficiency. Water efficiency concerns reducing waste rather than restricting use. It also emphasizes the influence users can have on water consumption by making small behavioral changes to reduce water wastage and by choosing more water efficient process steps and products. Examples of water efficiency actions include fixing leaking taps, taking showers rather than baths, installing displacement devices inside toilet cisterns, and using dishwashers and washing machines with full loads.

Water saving device on the Japanese toilet: Filling toilet flush tank while washing your hands. Source: Wikimedia Commons.

[3] World Bank (2007). Making the Most of Scarcity.
[4] Vickers, A. (2002). Water Use and Conservation.

Another important dimension to water efficiency is the emphasis on closing the water cycle through recycle and reuse. For example, water discharged from one activity can be reused for the same or a similar activity. In other cases, water may not be fit to be reused in the same activity but it can be reused for another one that can tolerate lower quality water, after applying some treatment if necessary. In such cases, reuse and recycling improve water efficiency at a system level. Collectively, all these steps fall under the definition of water efficiency, as their purpose is to obtain the desired result or level of service with the least necessary water.

RELATED CONCEPTS

Water Productivity

Water productivity is another useful measure of the amount of water used to generate an amount (or value) of product. It is typically used in assessing improvements in agricultural water productivity (water productivity in crop, livestock, and aquaculture production). However, the term is increasingly being used to measure water productivity in industrial output. For instance, we speak of the amount of water used per tons of product in comparing industrial water productivity across companies or countries. For additional information on this concept see The Stockholm Environmental Institute: www.sei.se

Water Footprint

The water footprint is an indicator of water use that incorporates a life cycle perspective in the accounting of water use by a consumer or a producer. The water footprint of an individual, community, or business is defined as the total volume of freshwater that is used to produce the goods and services consumed by the individual or community or produced by the business. For businesses, the water footprint is useful when a company wants to consider not only water use in its operations but also in the company's supply-chain. This persepctive can be very helpful in assessing water risk for businesses. For additional information on this concept see The Water Footprint Network: www.waterfootprint.org

Virtual water footprints of three common products (Source: www.fao.org).

FACTORS MOTIVATING THE MARKET FOR WATER EFFICIENCY

Today, there are a number of developments and trends that are affecting the landscape of water use and increasingly enabling markets for water efficiency products and services. Prominent examples include the following:

ENERGY INTENSITY OF WATER IS INCREASING

As the quantity of clean and easily accessible water decreases, water needs to be increasingly located from sources that have high concentrations of impurities - such as oceans, brackish groundwater, or wastewater - and thus needs to be treated more extensively. In parallel, when sources closer to the point of use get reduced, water - a heavy material itself - needs to be pumped over longer distances. Water purification and transportation require considerable amounts of energy and therefore not only add to the cost of water but can also put pressure on the energy supply network.

HIGHER VALUE-ADDING USES ARE PRIORITIZED

As the demand for a limited resource increases, a natural tendency to allocate more of the resource to high value-adding activity prevails. This usually means prioritizing industrial and commercial use over agricultural use.

WATER RISKS FOR BUSINESSES

For businesses and in particular those having a high level of direct or indirect water dependence, water-related risks and responsibilities are increasingly acknowledged by key stakeholders. Investors and creditors in particular are placing increasing demands on businesses to assess and communicate water-related risks as well as to develop strategies to address them. Businesses are also under growing pressure to adopt corporate responsibility measures that positively affect the quality and availability of water.

AWARENESS Of INDIVIDUAL AND NATIONAL WATER-FOOTPRINT IS INCREASING

Due to the expansion of global trade, environmental impacts and resource intensities of goods and services produced elsewhere are usually hidden from their consumers. Despite their error margins, the distressing information provided by initiatives like

Who can benefit from this handbook?

- Government facilities
- Home-owners or tenants
- Residential buildings
- Schools, universities, and other educational institutions
- Hospitals and medical offices
- Hotels, resorts, and restaurants
- Office buildings
- Shopping centers
- Industrial facilities
- Manufacturers
- Gardeners and landscapers
- Agricultural farms

VirtualWater[5] is raising consumer awareness about the water intensity of lifestyles. Such initiatives are intended to attract preference for goods that are less water-intensive.

PRIVATE SECTOR PARTICIPATION

Water provision, and sanitation, has traditionally been a public responsibility. Publicly-managed water services, however, frequently suffer from technical and economic inefficiencies. Private players, who have a proven track record of running systems more efficiently, are thus increasingly brought into the water domain. This practice is prone to ethical questioning. As long as they remain transparent and accountable to water users, however, private actors appear to make a contribution.

HOW TO USE THIS HANDBOOK

This handbook is a reference for identifying, analyzing, and prioritizing water efficiency opportunities in residential and commercial buildings, industrial facilities, and in agricultural farms. Rather than being exhaustive of all possible water efficiency solutions, the handbook provides guidance for systemically approaching water efficiency opportunities.

CHAPTER 2 provides generic steps for starting a water efficiency program. These steps are derived from many global case studies that have proven to be useful in developing a successful water efficiency program regardless of the local context.

CHAPTER 3 focuses on industrial operations and provides additional guidance for specific water intensive processes.

CHAPTER 4 focuses on buildings and highlights some of the key water saving opportunities in indoor/domestic use, facility management, and landscaping.

CHAPTER 5 focuses on the main aspects of improving water efficiency in agriculture including crop selection and irrigation methods.

APPENDIX A provides a list of successful regional initiatives and case studies, illustrating their potential water and cost savings as well as the payback on investment.

For further information on detailed technical solutions, users are encouraged to consult the added list of resources in APPENDIX B and the list of references in APPENDIX C.

[5] See Virtual Water Project at: http://virtualwater.eu

WATER NEEDED TO PRODUCE... (LITERS)

Apple

70 L/apple

Orange

50 L/orange

Cheese

5000 L/kg

Milk

1000 L/1 litre

Wheat

1300 L/kg

Bread

40 L/slice

Coffee

140 L/cup

Tea

30 L/cup

Rice

3400 L/kg

Chocolate

2400 L/100 grams

Jeans

10855 L/pair of jeans

Paper

10 L/sheet of paper. (A4)

Goat Meat

4000 L/kg

Beef Meat

15500 L/kg

Sheep Meat

6100 L/kg

Hamburger

2400 L/hamburger

Virtual Water (also known as embedded water, embodied water, or hidden water) refers, in the context of trade, to the water used in the production of a good or service. The precise volume can be more or less depending on climatic conditions and agricultural practice.