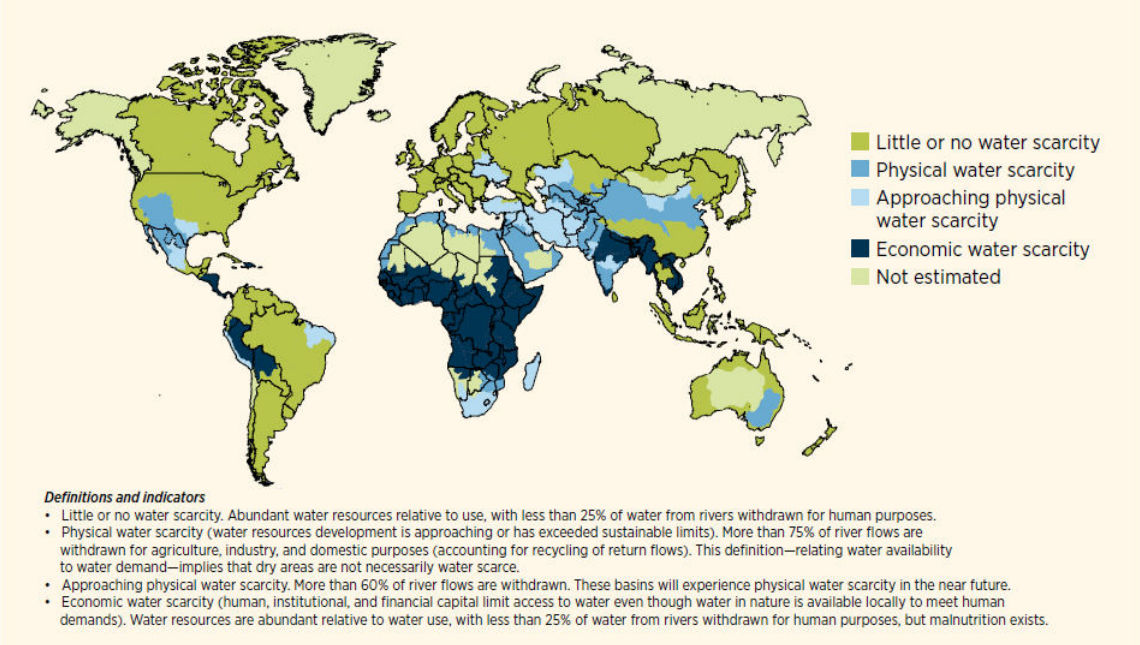
# APPENDIX

# Water Management in Buildings

## Introduction

Figure A1 illustrates the physical and economic water scarcity worldwide. Water scarcity is a global issue arising from the supply–demand imbalance. The availability of good quality water is on the decline. Renewable freshwater availability per capita is on the decline and will be halved by 2050 relative to 2007 (The World Bank, 2007).

**Figure A1: Global Physical and Economic Water Scarcity**




Source: Connor et al. (2012), UNESCO.

By 2025, 1.8 billion people will be living in countries or regions with absolute water scarcity, and two thirds of the world's population could be living under water-stressed conditions. With the existing climate change scenario, almost half the world's population will be living in areas of high water stress by 2030.

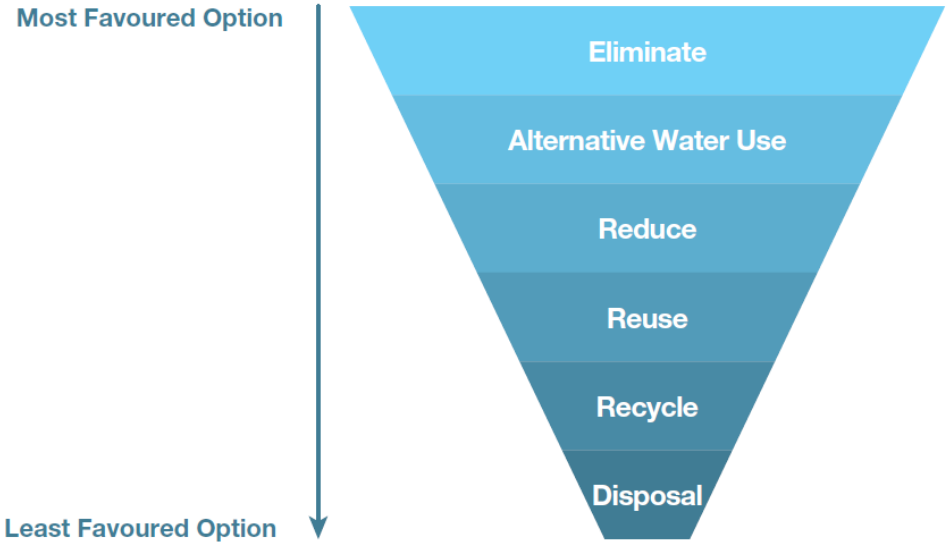
Increase in population, urbanisation, industrialisation, and lifestyle changes cause a rise in water demand, which is further worsened by climate change. Thus, access to a clean water supply will be of great concern in all parts of the world.

**Water Efficiency in Buildings**

As buildings consume 20 percent of the world's available water, water efficiency will be an important aspect in building design, construction, and operation with the increasing development of green buildings worldwide.

To improve water (use) efficiency in buildings, a systematic approach is required to ensure the success of all water efficiency initiatives undertaken and to achieve the highest possible return on investment (ROI). Cost-effective water-efficient opportunities have to be identified and prioritised.

**Figure A2: Water Efficiency Hierarchy**




Source: Invest Northern Ireland.

The water efficiency hierarchy shown in Figure A2 can be applied to all types of buildings such as offices, shopping centres, hotels, hospitals, as well as residential and institutional buildings. Water consumption depends on the type and function of a building including the type of facilities provided in the building. The following table illustrates the key areas of water consumption for different building categories:

**Table A1: Water Consumption in Key Areas for Different Buildings**

| | Toilets | Showers | Kitchen/Sink | Laundry | Food & Beverage | Air Condition | Landscape | Pools |
|---|---|---|---|---|---|---|---|---|
| **Residential** | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ |
| **Office** | ✓ | | ✓ | | | ✓ | ✓ | |
| **Retail** | ✓ | | | | ✓ | ✓ | ✓ | ✓ |
| **Schools** | ✓ | | | | ✓ | ✓ | ✓ | |
| **Hotels** | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ |
| **Hospitals** | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | |

Source: Author.

With key areas of water usage determined, it is possible to identify areas of water use where adoption of water efficiency strategies could be effectively implemented.

**Water Efficiency Strategies**

The water efficiency category for buildings addresses indoor use, outdoor use, and metering. Implementation of water saving strategies depends on project-specific water usage characteristics.

- **Toilets:** Toilets account for a major water use in most buildings. It is not only a good area to target but shall be the primary target for water efficiency improvement. This could be realised through behavioural changes and installation of water-efficient fittings.
- **Water closets:** Water closets that use more than 6 litres of water per flush, which are often provided in conventional flushing systems, are very inefficient. Low-flow systems with reduced flow of 4.5 litres per flush as well as dual-flush systems are readily available.
- **Urinals:** Urinal trays that employ a cyclic flushing system were a common fixture used in the 1970s and 1980s with a considerable amount of water being wasted. Urinal bowls introduced as replacements consume up to 3.8 litres per flush and are also very inefficient. Low-flow urinals using less than 1.0 litre per flush as well as waterless urinals are available.
- **Wash hand basins:** Conventional faucets have inefficient flow rates of greater than 6 litres per minute. Modern water-efficient faucets come with flow limiters to reduce water flow rates. Other water saving features available include automatic shut-off or self-closing taps and sensor operated taps that provide on-demand use.
- **Showers:** In the domestic sector, baths and showers account for up to 30 percent of total water consumption. In terms of water efficiency, showers are preferred over baths

but conventional shower heads with up to 13 litres per minute flow consume up to 65 litres of water for a 5-minute shower. Water-efficient shower heads, including those fitted with an aerator, have a much lower water flow and could save up to 50 percent of water use.

- **Shower mixers:** Shower mixers are provided for installations with hot and cold water supply. Automatic or easily adjustable shower mixers with temperature indicators would reduce water use as water wastage could be as high as 10 percent of the amount of water used in a shower while trying to adjust for a comfortable shower temperature.

**Water Consumption in Air Conditioning Systems**

Cooling towers can account for a high proportion of a building's total water consumption. Options to reduce water consumption in cooling towers include:

- specifying and selecting cooling towers with low drift loss
- exploring the application of non-chemical water treatment
- periodic checking of overflow levels and float valves settings to avoid overflow
- using alternative water sources.

**Landscaping**

Landscaping is an area where the non-use of potable water should be targeted. Good landscape design and proper management of landscape irrigation should be prioritised to reduce reliance on potable water use for watering. To avoid the use of potable water for irrigation, use of alternative sources such as recycled grey water or harvested rainwater should be considered.

**Alternative Water Sources**

To complement the water efficiency initiatives, use of alternative water sources is a viable option and offers multiple benefits and advantages. The following table lists three main alternative water sources and application for buildings:

**Table A2: Alternative Water Sources for Buildings**

| Rainwater Harvesting | Wastewater Recycling | Air Conditioning Condensate Water Recovery |
|---|---|---|
| Landscape irrigation | Landscape irrigation | Cooling tower makeup water |
| Toilet flushing | Toilet flushing | Toilet flushing |
| Laundry | General washing | General washing |
| Water feature | Cooling tower makeup water | Landscape irrigation |
| Cooling tower makeup water | | |
| Floor washing | | |
| Car wash | | |

Source: Author.

## References


World Bank (2007), 'Making the Most of Scarcity: Accountability of for Better Water Management Results in the Middle East and North Africa', *MENA Development Report,* Washington.

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