Water Days

July 2009

Agenda

- Water's Carbon Footprint
- Water's Carbon Footprint in the GCC

"water-energy nexus" is a broad label for the set of interactions caused when humans develop and use water and energy

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Carbon footprint

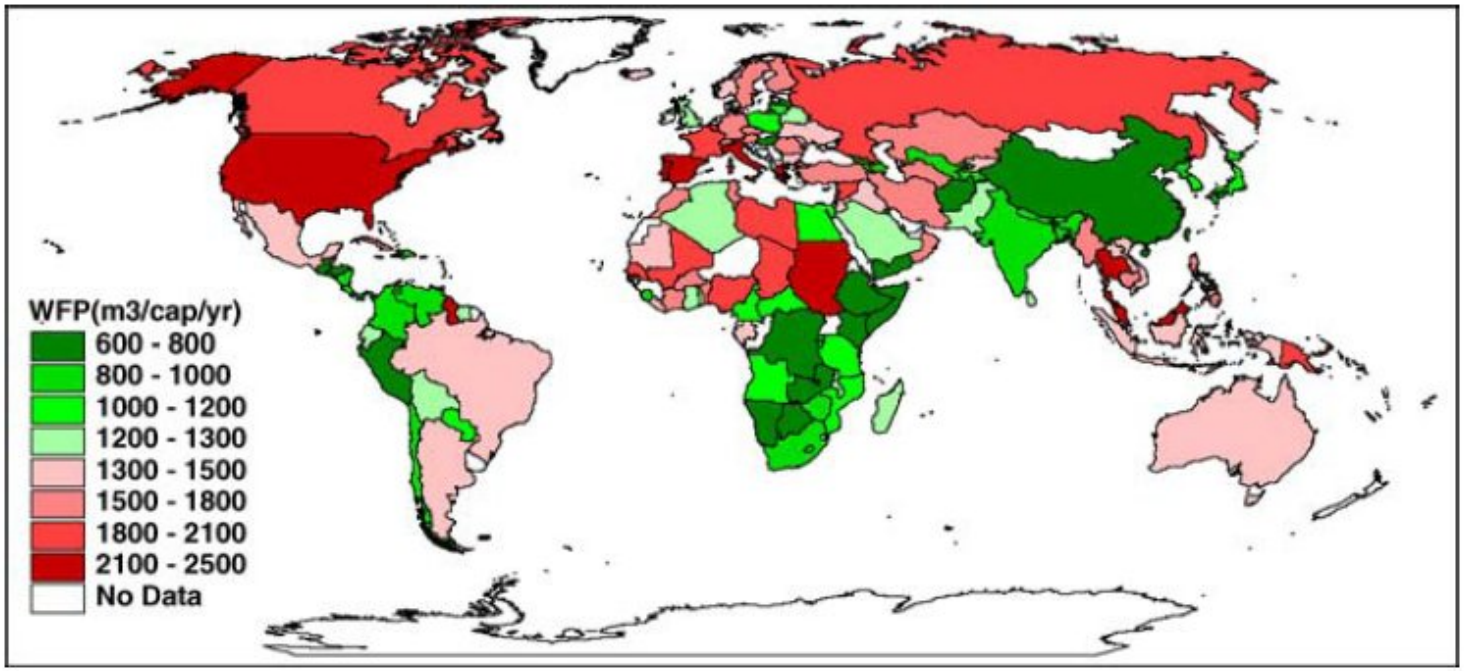
- Carbon footprint measures energy use in terms of the volume of carbon dioxide emissions (in tons).

compare to:

- Ecological footprint is a measure of the use of bio-productive space (hectares).
- Water footprint measures water use (in cubic metres).

The carbon footprint is measured in terms of tons of carbon dioxide emitted and determined by adding up the impact of all greenhouse gases generated by a specified activity.

Water footprint not = water's carbon footprint



Average national water footprint per capita (m3/capita/yr). Green means that the nation's water footprint is equal to or smaller than global average. Countries with red have a water footprint beyond the global average

Size of the global water footprint is largely determined by the consumption of food and other agricultural products

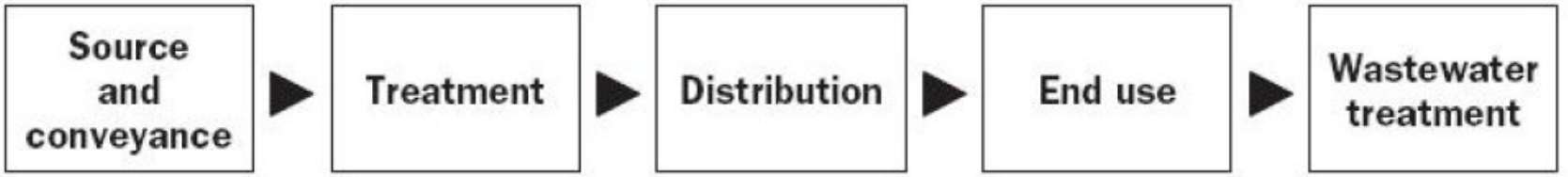
Water Resources Management (2007) 21:35–48; Water footprints of nations: Water use by people as a function of their consumption pattern; A. Y. Hoekstra · A. K. Chapagain

Water's carbon footprint

- Water use requires significant amounts of energy

- Water is heavy at 3.8 kilos to the gallon and energy is required whenever it is moved, treated, heated or pressurized.
  - Energy required for supplying and treating water and wastewater constitutes the largest municipal energy cost.

The energy inputs of a typical water-use cycle can be broken down into five basic stages:



Water's energy inputs

- Pumping wastewater is inherently more inefficient than pumping freshwater because pumps are designed to accommodate solids in the wastewater stream.
- Residential water heating comprises the largest share of water-related carbon emissions.

Source Types	Energy Intensity (kWh/ MG)
Surface Water (Gravity Fed)	0
Groundwater	2,000
Brackish Groundwater	3,200
Desalinated Seawater	13,800
Recycled Water	1,100

Water Use Cycle Segments	Range of Energy Intensity (kWh/ MG)	
	Low	High
Water Supply and Conveyance	0	14,000
Water Treatment	100	16,000
Water Distribution	250	1,200
Wastewater Collection and Treatment	700	4,600
Wastewater Discharge	0	400
Total:	1,050	36,200

Measures to reduce water's carbon footprint

- Retrofitting water using fixtures and appliances reduces hot water use by approximately 20%
- All indoor water saved in the residential sector results in energy savings from avoided water deliveries and wastewater treatment
- Reduction in water distribution system leakage saves water and electricity, and reduces CO2 emissions
- For every 10 percent increase in forest cover, treatment and chemical costs decreased by approximately 20 percent
- Link between water and energy presents the climate change community with a valuable opportunity to better manage two of our most valuable resources

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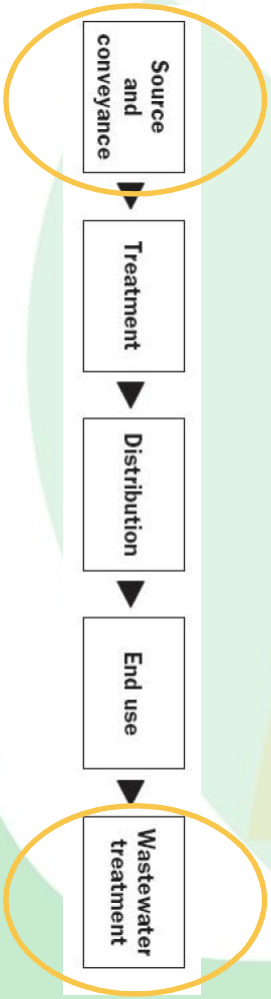
Water's carbon footprint in the GCC



2005 Desalination production	millions of m3	T CO2
Bahrain	123	378,996
Kuwait	589	1,814,868
Oman	68	209,526
Qatar	250	770,317
KSA	1,063	3,275,390
UAE	813	2,505,072
Total	2,906	8,954,170

Wastewater	Treated (m3/ d)	T CO2
Bahrain	400,000	39,119
Kuwait	425,000	41,564
Oman (Muscat)	50,000	4,890
Qatar	320,000	31,295
KSA	1,840,000	179,946
UAE (Abu Dhabi+Dubai)	1,040,000	101,709
Total	4,075,000	398,522

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Measures to reduce water's carbon footprint

- Greywater can also be used to reduce energy use through an increasingly popular method called drain water heat recovery. This method uses a heat exchanger to recover heat from the hot water used in showers, bathtubs, sinks, dishwashers, and clothes washers. The energy used for water heating can be reduced by 30% or more with these devices, with an expected payback range from 2.5 to 7 years.

- A study by General Electric found that an average sized 1,000 MWh power plant that installs a water reuse system for cooling tower blow-down recovery would reduce the energy demand to produce, distribute and treat water by a net 15%, or enough to power over 350 homes for a year.

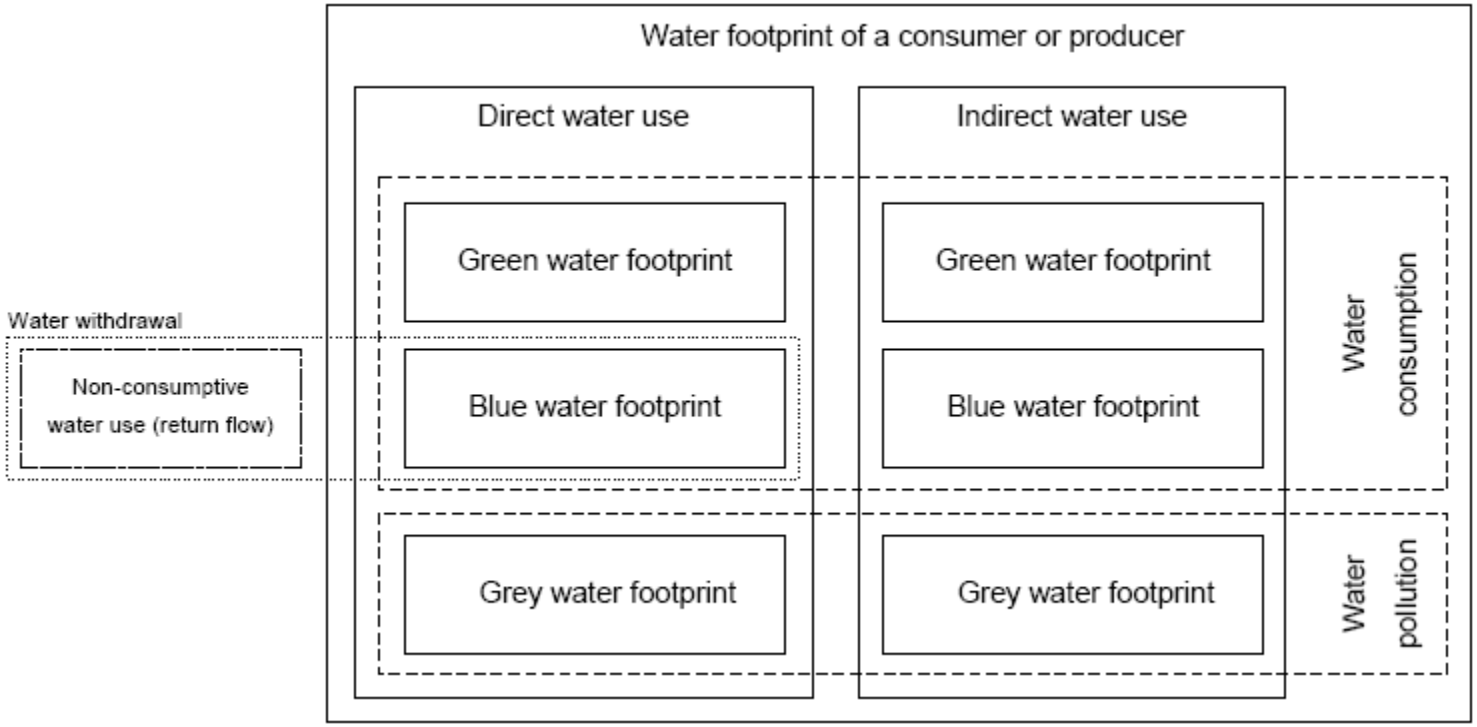


Figure 2.3. Schematic representation of the components of a water footprint. It shows that the non-consumptive part of water withdrawals (the return flow) is not part of the water footprint. It also shows that, contrary to the measure of 'water withdrawal', the 'water footprint' includes green and grey water and the indirect water-use component.

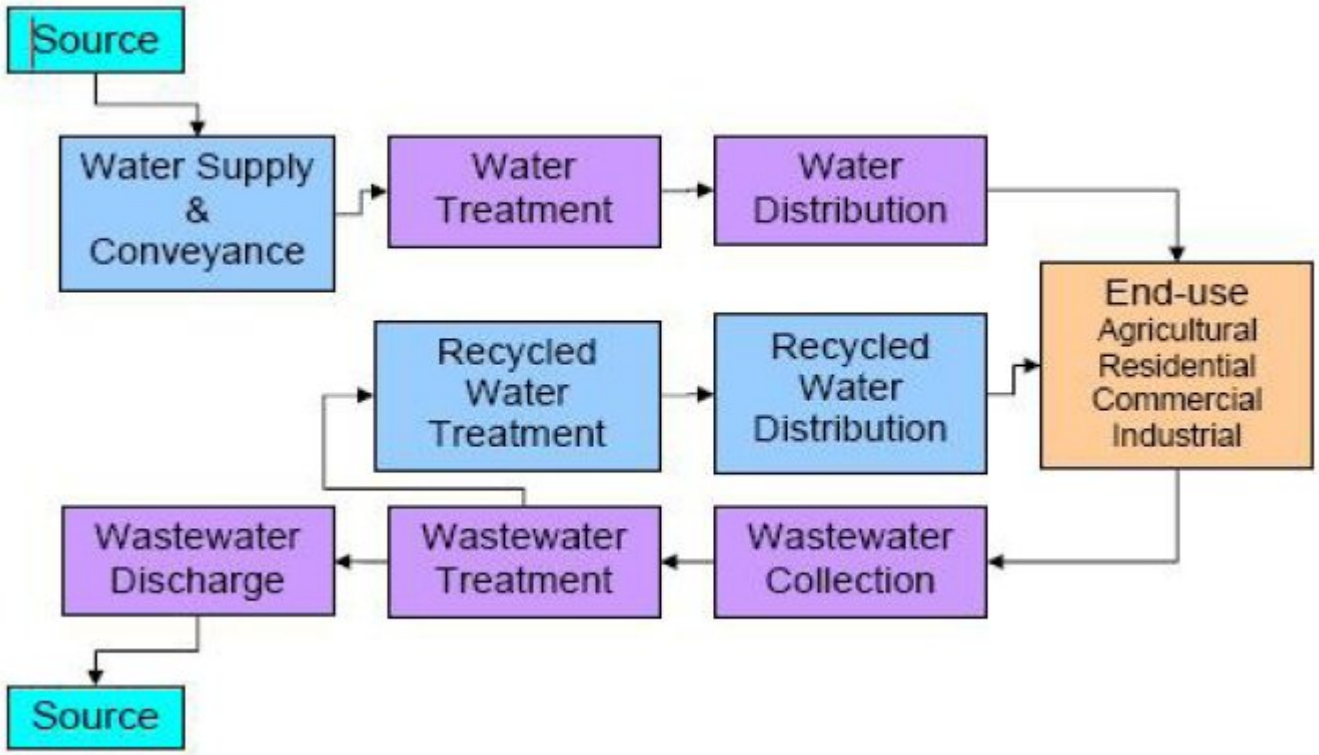
District cooling is a growing sector. According to a recent market analysis from Frost & Sullivan, a consultancy, the market earned revenues of US $580.0 million in 2008 and estimates this to reach US $2 billion in 2013, at a compound annual growth rate of 28%. Among all Middle East countries, Saudi Arabia seems to have the most untapped potential, with more than US $100 billion worth construction projects underway, according to Frost & Sullivan. Its rapidly expanding industrial base and population have increased the demand for power, which averages an annual growth rate of nearly 5%. The rising air conditioning needs account for almost 70% of this growth in power demand. By 2013, the district cooling market is expected to have an additional capacity of 4.5 million tons of refrigeration, mainly contributed by Saudi Arabia and Qatar. Source: Analysis of the District Cooling Market in the Middle East Region

Frost & Sullivan estimate that the Saudi Arabian market for district cooling comprises about 10% of the overall GCC market, but is a massively neglected market.

http://www.utilities-me.com/article-44-experience_counts/1/print/

Heating	Baths or showers, washing hands, dishes and clothes, industrial processes
Additional Pumping	Cooling towers, recirculation hot water loops, car washes or high pressure spraying, pressurization for high rise buildings, irrigation pressurization or lifts from canals on farms
Indirect	Energy used to run an air conditioning compressors that are water cooled

Types of Energy Embedded in Water at End-Use



From Klein, 7 and based on research by Robert Wilkinson