

**Benchmarking in a Danish water utility
- traditional and environmental (by LCA) indicators**



- Summer 2012 Copenhagen Energy and 7 other water utilities in the area of Copenhagen merged
- New Company called HOFOR
- Went from 0.5 to 1 million water customers
- Company still also covers district heating, district cooling and natural gas customers (0.5 million) in Copenhagen

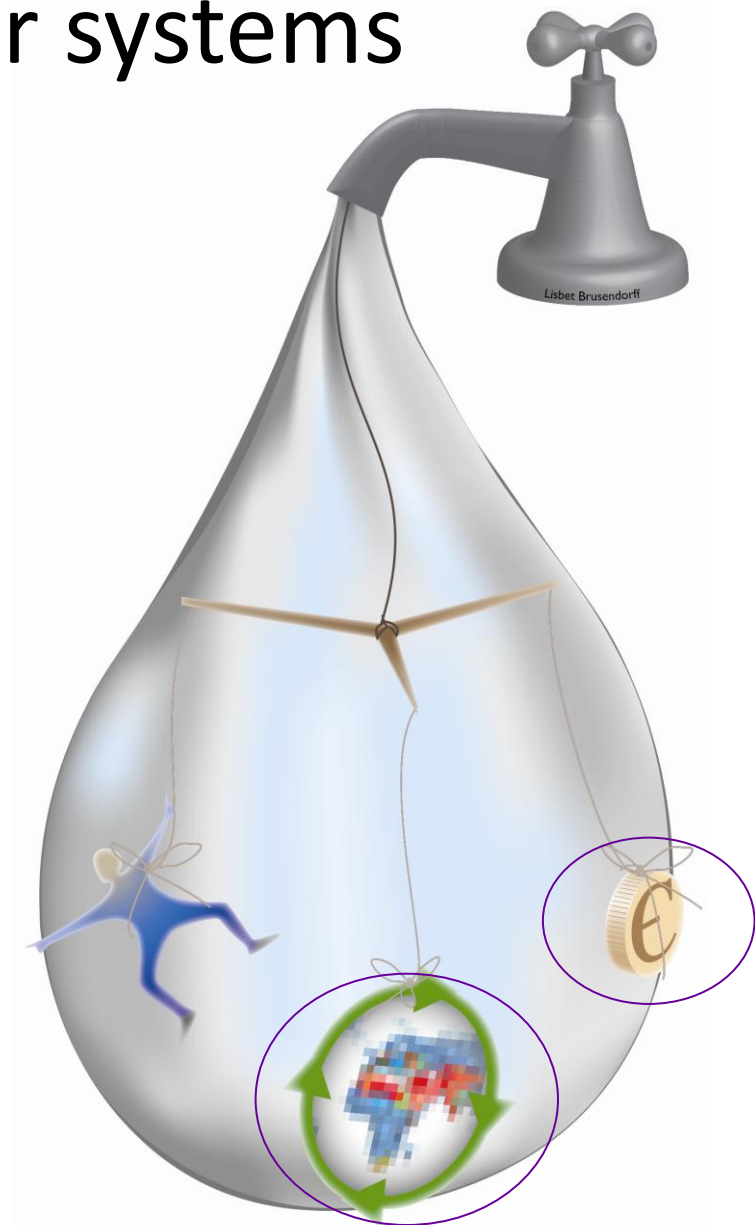


Benchmarking Copenhagen Energy

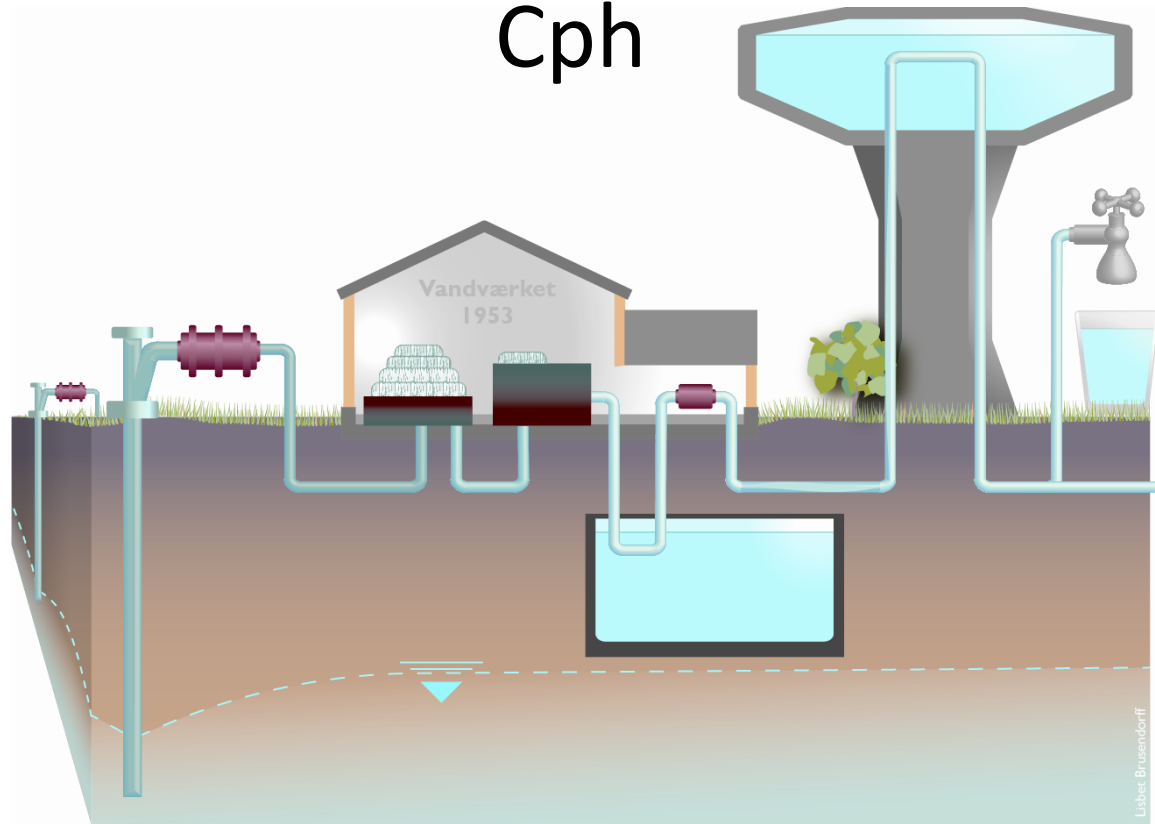
- History:
 - Has been done on a voluntary basis for 15 years
 - Copenhagen Energy has been involved in the upstart of Danish benchmarking and on the international level
- Traditional benchmark indicators, e.g.:
 - Water price/m³
 - Energy consumption/m³
- Environmental indicators:
 - Water loss
 - Energy consumption or CO₂-emissions/m³
 - Water consumption (m³/person/yr)
 - Could environment cover LCA?

Benchmarking environmental evaluation of water systems

- Economy
- Environmental
 - Standard LCA, including carbon footprinting
 - Water footprinting



Environmental evaluation of water supply in Cph



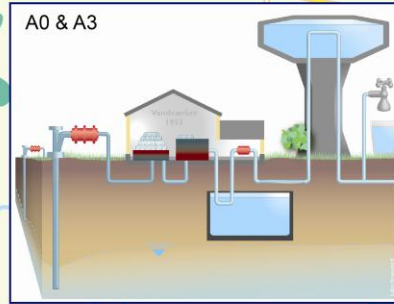
- LCA of water supply system also integrating impacts of freshwater withdrawal
- Comparative study of base case and 4 alternative cases for water supply
- Can LCA be used for environmental benchmarking in a utility?

LCA of water supply technologies

4 alternative cases which fulfill the water flow requirements of the EU water framework directive

A0 Base case alternative

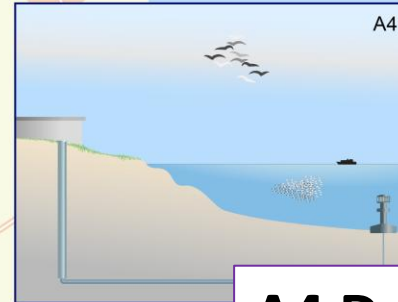
A3 New well fields +20km



A1 Rain- & stormwater harvesting



A2 Compensating actions



A4 Desalination of seawater

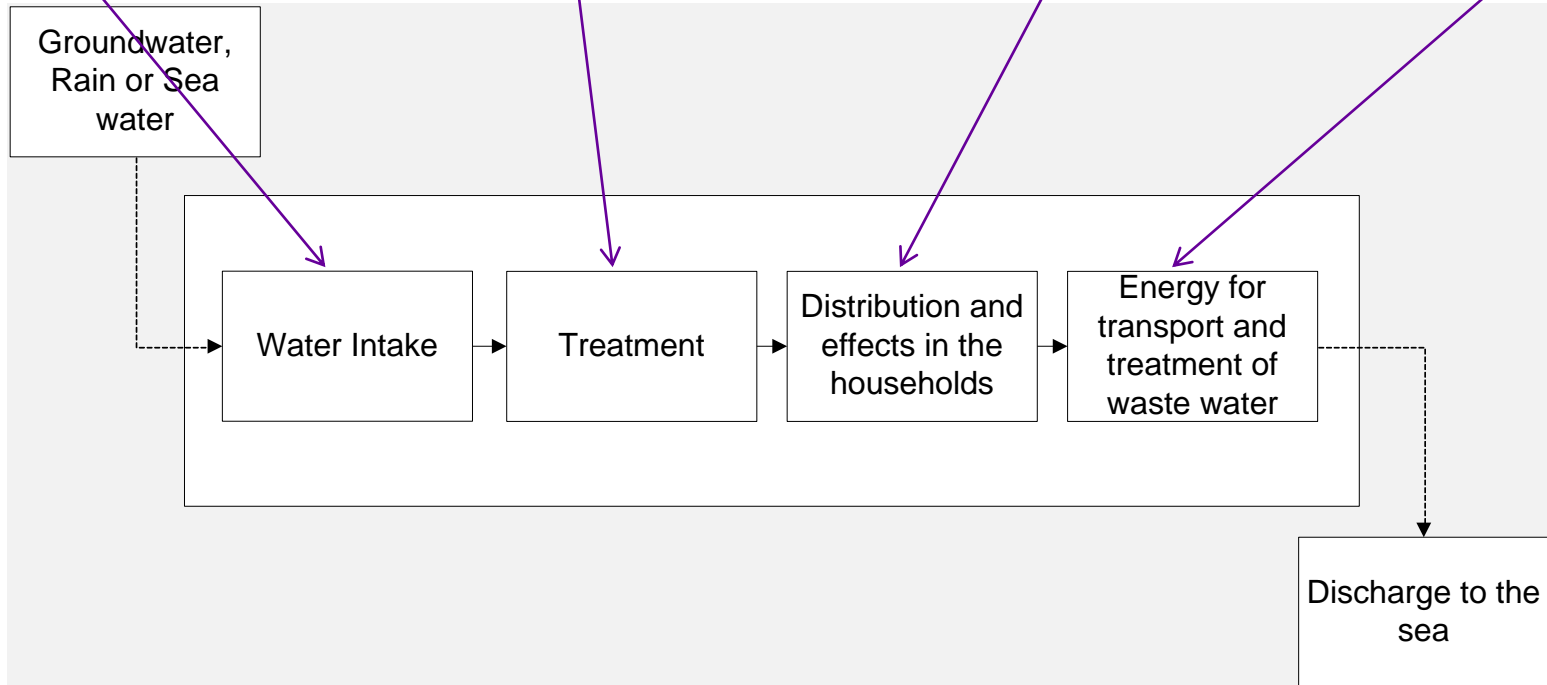
System boundaries

facilities for intake of water, energy

materials, chemicals, energy

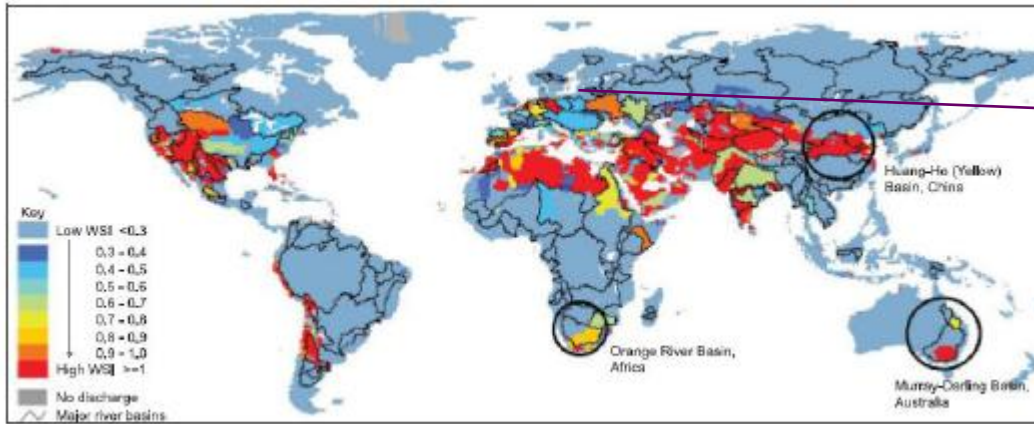
energy, effects of reduced water hardness

transport and treatment of wastewater



Freshwater withdrawal impacts

yet not a part of standard



(ref. Smathkin et al, 2004)

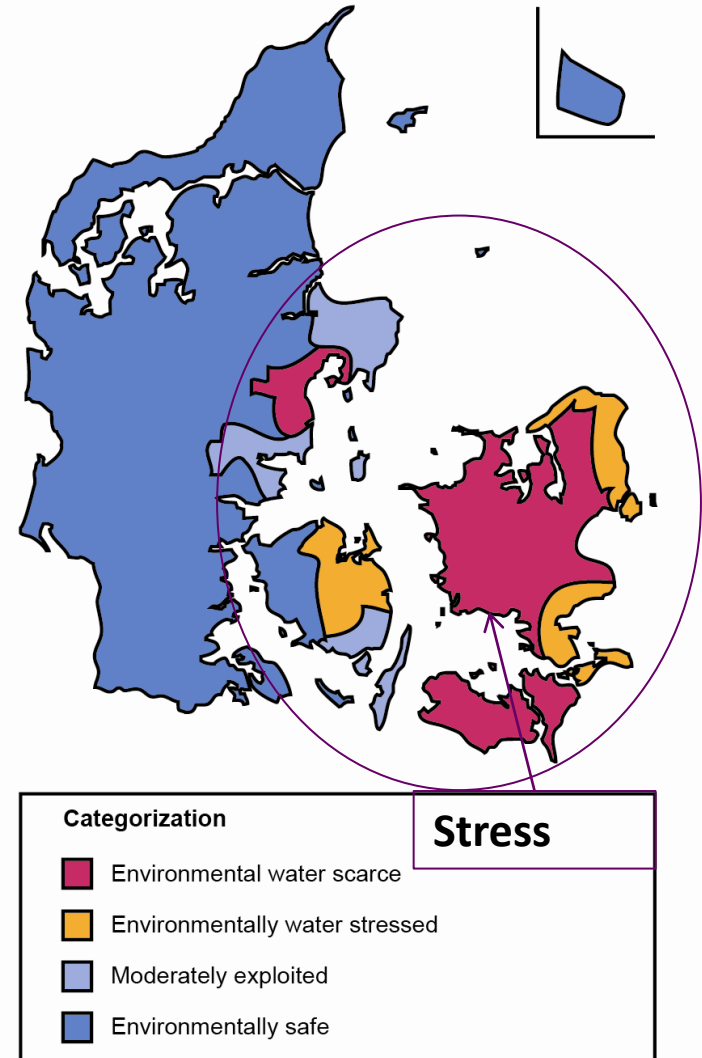
- Water stress indicator (WSI)
- $WSI = WU / (WR - EWR)$

water use (wu)

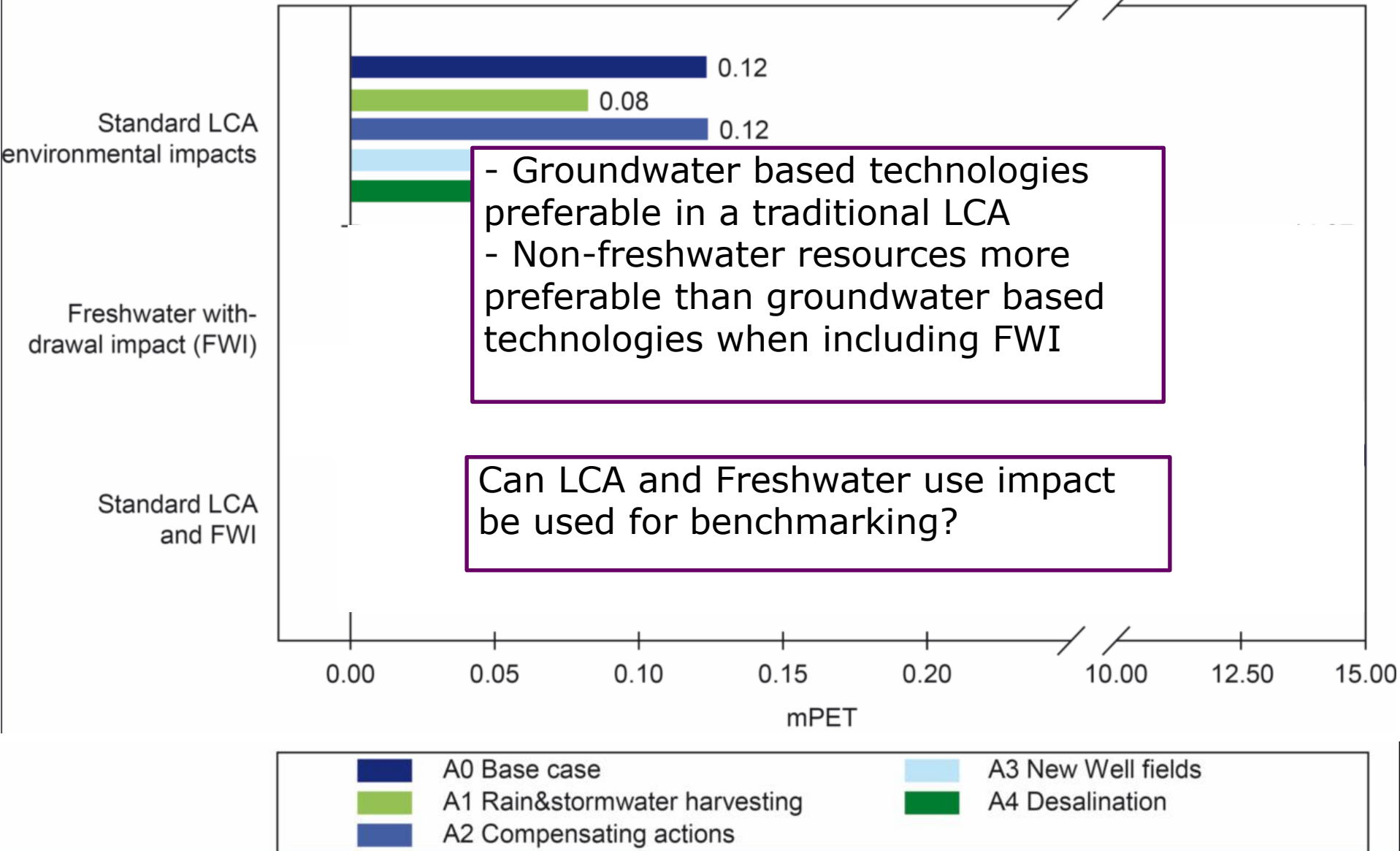
renewable water resource (wr)

environmental water requirements (ewr)

LCA: $FWI = Q_i \times CF_i$



Results of LCA and FWI



Benchmarking Copenhagen Energy

- 2009 - New legislation regulating the Danish water sector
 - Covers water utilities delivering $>200.000 \text{ m}^3/\text{yr}$ (200 Danish utilities)
 - Transparency of water price
 - Every year the authority sets the maximum water price for each utility
 - Mandatory efficiency improvement (except from certain tasks such as expenses for e.g. water safety plans, water saving initiatives)