
Building blocks of the policy review
on
Water Scarcity & Droughts
in the EU

# Alternative water supply options

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# Background

- Assessment of four alternative water supply options in Europe (2008)
  - desalination, wastewater re-use, rainwater harvesting, groundwater recharge

- Aspects considered:
  - Risks and impacts
  - Mitigation options
  - Sustainable development

- Outcome - Report on DG ENV website

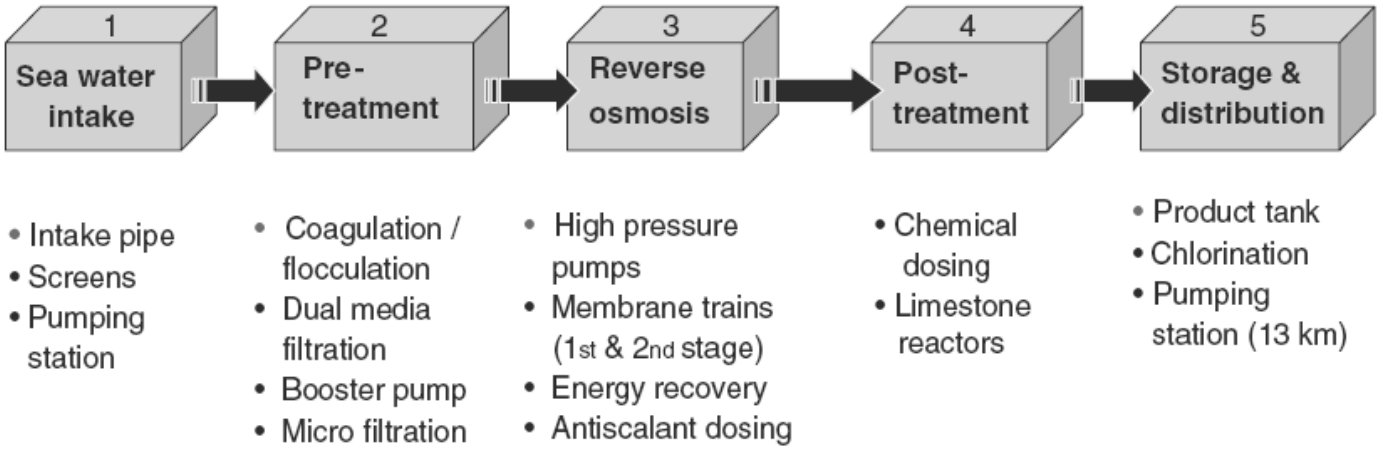
# Issues investigated

- Can alternative water supply options improve water resources?
- What are the associated risks and impacts (environment, economics, society)?
- Can negative impacts be mitigated?
- What are the conditions for sustainable development of alternative water supply options?

# Desalination

- Desalination removes dissolved minerals and mineral salts (de-mineralisation) from feed-water (fresh water, brackish water, saline water, but mainly from sea water)
- Most common in Southern regions close to coasts, but also Northern regions
- Reverse Osmosis most widespread technology

## Larnarka desalination process stages



# Desalination

- Several countries in southern Europe are increasing national capacity (Spain will increase to > 700 M m3/day)
- Suitable replacement for mains supply drinking water, but supply regime rigid and inflexible, best suited for supplying fixed amounts of water
- Environmental and economic concerns about high energy use
  - Mitigation measures include improving efficiency and tapping renewable energy supplies
- Environmental concerns about brine disposal
  - more research needed on marine impacts if disposed at sea

# Desalination

| Energy type | Estmated costs (€/kWh) |
|---|---|
| lectricity from fossil fuels (hard coal, lignite, gas) | 0.03 to 0.05 |
| Electricity from wind or hydro prower | 0.06 to 0.11 |
| Electricity from solar (photo voltaic cells) | ~ 0.36 |
| Electricity from solar (parabolic through) | ~ 0.12 |

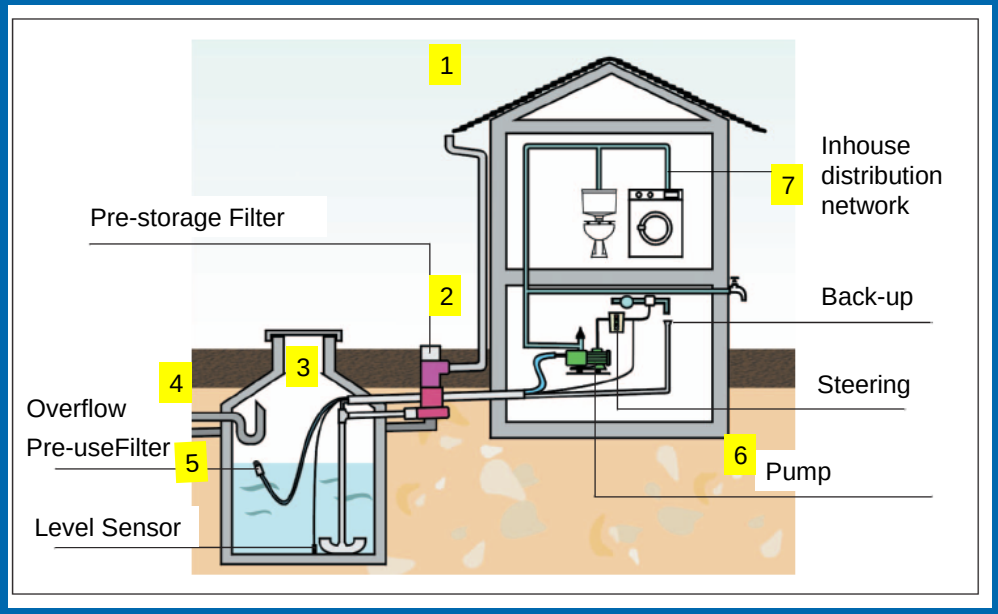
Unit costs and water fees from case studies

| Case study | Unit costs (€/m3) | Water fees (€/m3) |
|---|---|---|
| Cyprus (2007) | 1.02 | 0.77 (house) |
| Malta (2008) | 1.28 | 0.38 (house) |
| Spain (2008) | 1.00 | 0.3-0.4 (farmers) |

- Source: European CASES project (www.feem-project.net/cases/)

# Rainwater harvesting

- RWH includes collection, storage and use of rain water
- Components include:
  - Roof water collection
  - Filters
  - Storage facility + overflow
  - Extraction, filter + pump
  - In-house distribution




Typical 4 person house in Germany

- Investment 4 m3 system 4950 €
- Operation 75 €/year
- Savings 275 €/year
- Recovery time ca. 25 years

# Rainwater harvesting

- Not much information about its uptake across EU-27 – individual households or large buildings
- indirect replacement of mains potable water supply – used for non-potable purposes (toilets, washing machines)
- Main benefits are:
  - Less use of mains water
  - Reduced urban storm-runoff (and less water quality problems)
- Main concerns are:
  - investment costs of installation, especially if retrofitting (double internal water distribution system).
  - rainfall distribution may not be evenly spread across the year (relatively large and costly rainwater storage tank)
- Mitigation measures needed to reduce financial burden to improve the rate of uptake.

# Rainwater harvesting

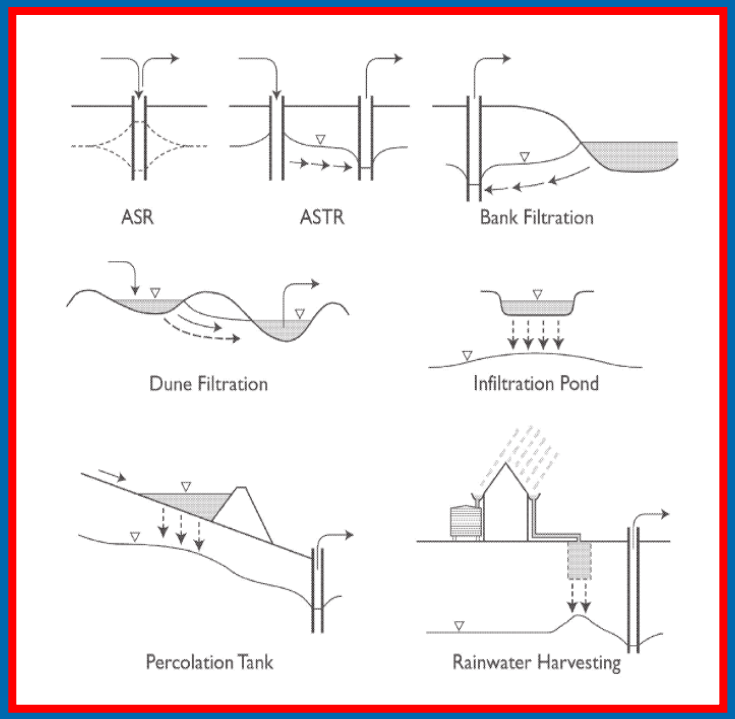
- Large difference in investment costs between Belgium and Malta
  - Larger size needed due to rainfall distribution
  - Cistern built rather than prefabricated
- Germany storm water fee (1.7 €/m2 of sealed surface)
- Belgium all new or restored houses required to have RWHS

Unit costs and water fees from case studies

| **Case study** | **Unit costs (€/m3)** |
|---|---|
| Belgium (2008) | 1.8 to 4.0 |
| Malta (2008) | 5 to 11 |

# Groundwater recharge

- hydrologic process where water (rainwater, surface water, reclaimed water) moves downward from the soil surface towards groundwater
- Natural infiltration or injection through a bore-hole
- Benefits include recharge of over-exploited aquifers + prevention of salt water intrusion
- Primary risks associated with recharging with reclaimed water




Toreele Project Belgium

- Investment 2.5 M m3/year 6 Million € (ca. 0.15 €/m3)
- Chemicals analysis + discharge 0.21 €/m3
- Energy and Maintenance 0.1 €/m3
- 1 m3 costs ca 0.5 € (transferred water 0.77 €/m3

# Groundwater recharge

- Technology includes recharging with tertiary treated waste water or primary treated surface or rain water.
- Uptake most common in northern Europe
- Strict controls/monitoring when treating wastewater used - catastrophic effect on the groundwater if calamity occurs
- Environmental and health risks lower if surface or rain water is used for groundwater recharging

# Wastewater re-use

- Two types of wastewater re-use: direct and indirect
  - Direct involves no dilution
  - Indirect involves the mixing with other water (link here with groundwater recharge)
- Uptake Spain (496 hm3/year in 2006) and Italy (233 Mm3/year in 2000).
- Germany (43 Mm3/year in 2000), France (8 Mm3/year in 2000) and the UK (1 Mm3/year in 2000).

# Wastewater re-use

- Growing importance in Southern Europe (Spain 496 M m3/year in 2006)
- Not a direct replacement for mains supply drinking water, and used for irrigation, watering landscapes and industry.
- If used for non-potable requirements, capital costs and energy use relatively low (fast return on investments)
- Multi-sectoral uses, applied almost everywhere, centralised (e.g. national water authority) and decentralised (e.g. industrial plant, farmers, regional) approaches;
- Main concerns are environmental contamination and health risks. The general public or specific groups may refuse to consume products that are associated with the waste water re-use – the “yuk” factor.
- Currently no European legislation concerning quality controls and standards for wastewater reuse – national standards followed.
  - Mitigation measures ensure minimisation of environmenal contamination and health risks

# Wastewater re-use – environmental benefits

- Conservation of freshwater sources
- Recharge of aquifers through infiltration water (natural treatment)
- Use of the nutrients of the wastewater (e.g. nitrogen and phosphate) reduces fertiliser input
- Improvement of soil properties (soil fertility; higher yields)
- Reduction of environmental impacts (e.g. eutrophication and minimum effluent discharge requirements) from direct discharge systems.

# Wastewater re-use – environmental risks

- Risks to human health via the indirect consumption of or exposure to pathogens, heavy metals and harmful organic chemicals
- Risks to groundwater due to heavy metals, increased loads of nitrate and organic matter,
- Risks to the soil due to heavy metals and salt accumulation and acidification
- Risks to crops due to the presence of certain substances in the wastewater in such concentration that are toxic
- Risks to the general environment due to high concentration of toxic substances,  endocrine disruptive and pharmaceutical substances
- Need to store treated wastewater during the season when irrigation is not practiced (discharge to sea in Cyprus)
- Consumer's acceptance (farmers, public)

# Conclusions

- Alternative water supply options can be successfully used to solve water management problems, related to droughts, storm water management and water quality issues
- For some of the regions, alternative water supplies are becoming the largest contributors to meeting water demand – 'water hierarchy' has to be respected
- Due to the overriding importance of local factors there is a need to find local solutions to local problems: mitigation measures have to be designed to deal with local conditions - it is not possible to provide an EU wide set of best available mitigation options
- Alternative water supply options may be more expensive then conventional options, but subsidies to compensate for price differences should serve only for helping the users in the transition towards a more sustainable use of water where the price of water reflects its true cost
- The requirements of the WFD to implement integrated water management and cost recovery programmes will contribute to a better appreciation of the benefits of alternative supply options – complementary technologies.
- The role of the alternative water supply options will grow in the future due to climate change and the reduction of water availability so particular attention should be paid to their implementation and the continuous improvement of knowledge in the field.

***Thank you for your attention***

***Questions?***