WARES

Renewable energy at water utilities

WARES Conference

June 4th, 2014, Oulu, Finland

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Northern Periphery Programme 2007–2013

Innovatively investing in Europe's Northern Periphery for a sustainable and prosperous future

European Union
European Regional Development Fund

wares
water asset renewable energy solutions

- WARES is a 2-year strategic Northern Periphery Programme project which explores the opportunities to generate renewable energy at water utility assets
- The focus is on sites with previously unused, hidden potential.
- The outcomes of the project will be used to propose a scheme of policy refinements for each region.

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wares Partnership

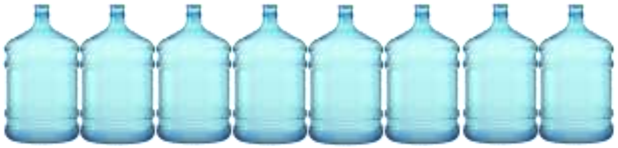
WARES Activities

- **WARES pilot sites explore opportunities for**
  - micro-hydro, in-pipe hydro
  - small and medium-scale wind energy
  - solar power
  - energy from biosolids
  - waste heat from wastewater
- **Provide practical solutions to utilize these assets**
  - Technical and economic assessment, financial plans
  - Assess also the social impact of renewable energy investments

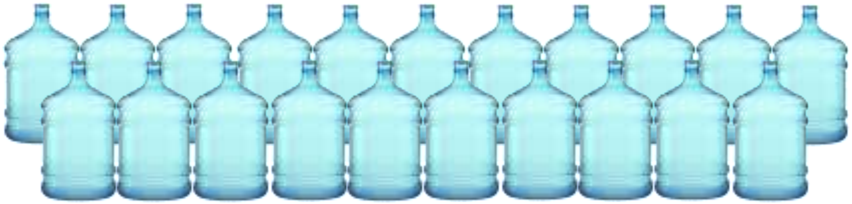
The water - energy nexus

- Two of the most fundamental resources driving civilization
- Intrinsically interlinked
  - Energy is consumed at every stage of the water supply chain
  - Water is a key resource in energy generation
- Both resources are limiting the other
- Both are running short
  - Justification to view them together

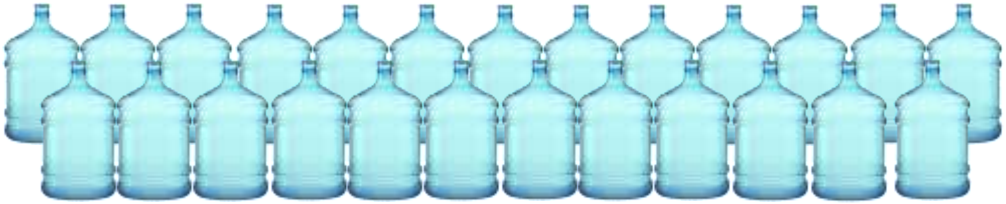
How much water is required to generate 1MWh of electricity



Gas/steam combined cycle *28,000 – 75,000 litres*



Coal and oil *80,000 – 190,000 litres*



Nuclear *95,000 – 220,000 litres*

How much energy is required to deliver 1 million litres of clean water?

Lake or river ~*370 kWh*

Groundwater ~*475 kWh*

Wastewater *620 – 870 kWh*

Seawater *2 580 – 4 360 kWh*

Case Oulu, 2012:

10,534,371 m^3 drinking water
6,320,623 kWh electricity

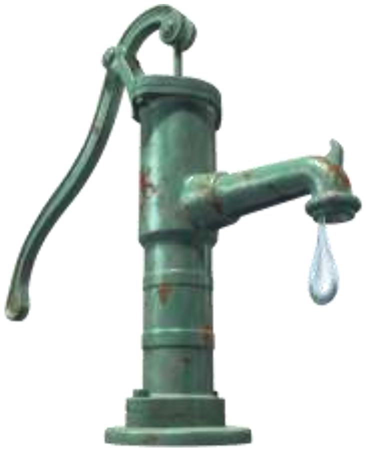
= 1 ML drinking water "costs" 600 kWh

17,504,819 m^3 wastewater treated
5,731,943 kWh electricity

= 1 ML wastewater treatment ~300 kWh

Energy intensity of water services - drinking water

- Pumping!
  - The largest energy consumer at drinking water side
  - Can cover up to 70 – 80 % of overall electricity use
  - Especially pumping groundwater
    - Elevate from lower source up to the treatment plant
      - In some places (e.g. San Diego) it was found that producing water even from wastewater was more energy efficient!
      - On the other hand, groundwater often require less purification…



Energy intensity of water services - wastewater

- Sludge treatment
  - Aeration processes
    - 50% electricity of ww-treatment plants!
  - Primary clarifiers
  - Dewatering solids
  - Pumping

- Advanced treatment processes
  - UV processes
  - Membrane technologies

- Space heating costs
  - Can be considerable in cold climates!

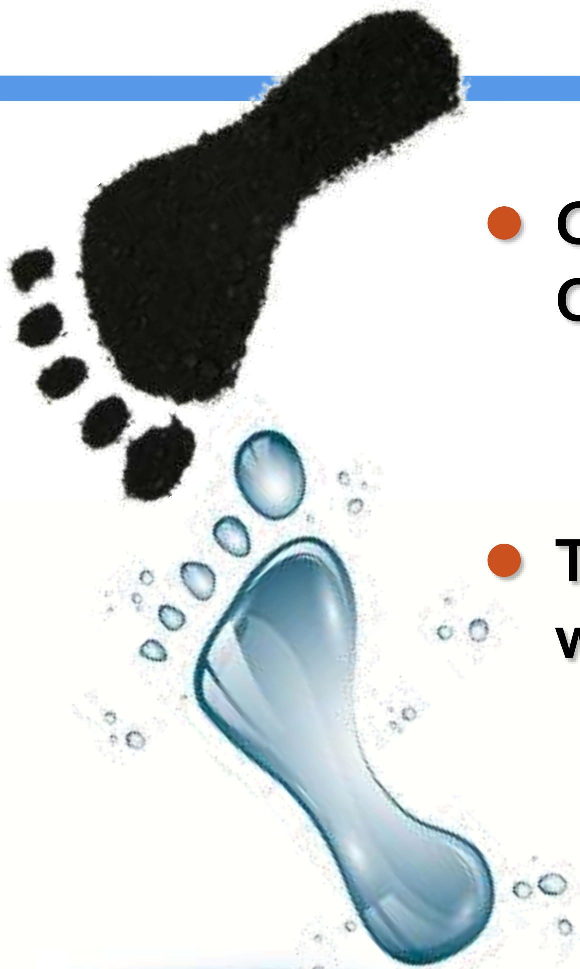
Water = Energy down the drain?

- Water conservation lowers energy use considerably
- End-use of water consumes more energy that any other part of the urban water conveyance and treatment cycle
  - Especially energy intensive uses like washing clothes and taking showers…

Need to co-manage energy and water resources

- There is an inherent connection between energy and water use
- Despite this inherent connection, it's actually uncommon to see energy and water utilities collaborating to identify best practices to save energy and water
- If energy and water utilities worked together, their could uncover joint cost-saving solutions
- Would save more money and utilities could share data to better understand their holistic energy-water footprint
- Water scarcity is largely absent from the debate over which energy sources are going to be the most reliable in our energy future

Water footprint meets carbon footprint



- Carbon Footprint addresses the EU Climate Objectives

- The Water Footprint is informative for EU water policies

A new way of providing environmental services?

- Since the mid nineteenth century urban sanitation in industrialized countries has been characterized by centralized sewers

- This system has become such an established standard that both the reasoning behind its development and its suitability and sustainability in the twenty-first century has long gone unquestioned

- Infrastructures for energy and water supply, as well as waste and wastewater management in contemporary cities are based on complex centralized supply, collection and disposal systems

- Among the well-known advantages, they have system immanent disadvantages, which are barriers for effective integrated resource management.

From centralized to decentralized – Parallel linear flows to synergies

- New and innovative urban infrastructures, which are based on the integrated management of resources, such as water, waste and energy
- Can contribute significantly to the reduction of resource consumption and related emissions as well as to the sustainable development of cities
- Such structures are based on decentralized systems that, in contrast to centralized systems based on linear resource flows, allows for synergies between different systems

Toward an integrated resources management

- The biggest challenge is the introduction of adapted operation and management structures for these new structures
- There are also significant differences in legal and institutional framework of specific regions and nations
- Ultimately, these decisions will have to be made in concert with issues regarding land-use, preservation of biodiversity, etc…

Step toward a closed loop recycling and zero-emission society!