

Climate ≈ water

Bridging the gap between adaptation strategies of climate change impacts and European water policies



SEVENTH FRAMEWORK PROGRAMME

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Water Research Institute of the
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**Research needs in alternative
sewage treatment and water
reuse technologies**

October 13 – 14, 2011

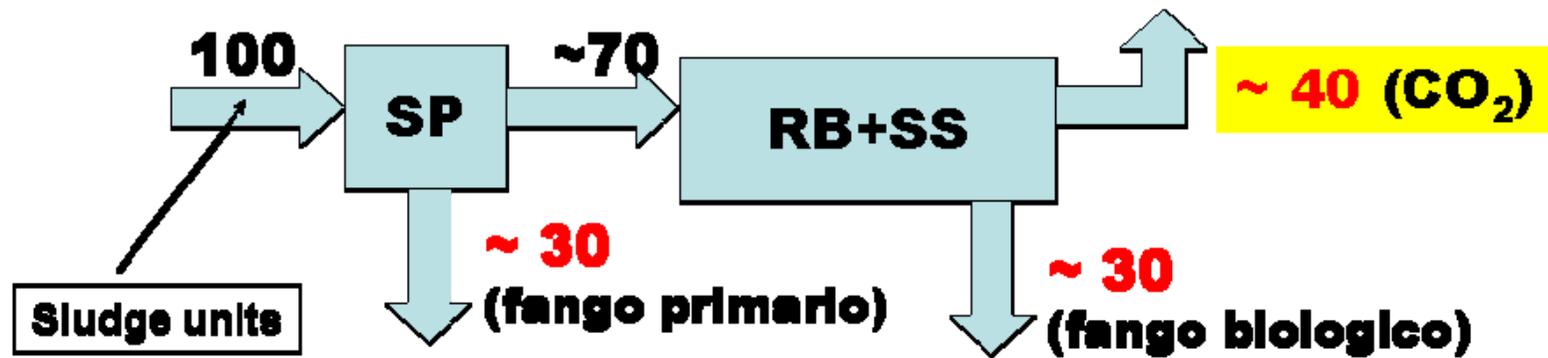
When dealing with technologies to reduce GHG, so to contrast climate change, the importance of the **contribution of waste water treatment plants** is usually neglected, even though they play an important role. In fact:

- treatment plants are everywhere;
- they work 24 hrs/day;
- their contribution in terms of GHG emission is as much significant as that of transport;

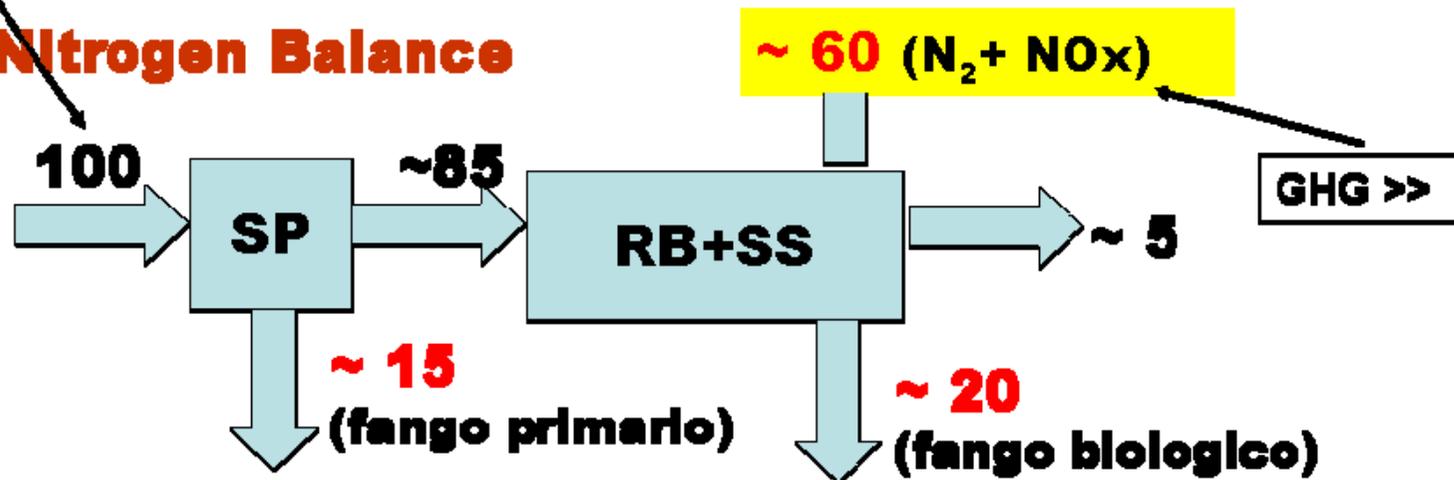
Research on this topic has not been performed almost at all.

Greenhouse gas emission

COD Balance



Nitrogen Balance



AEROBIC vs ANAEROBIC processes (per 1000 kg di COD)

AER.) $\text{COD} + \text{O}_2 \rightarrow \text{CO}_2$ (50% COD) + Fango (50% del COD) + H_2O

AN.) $\text{COD} \rightarrow \text{CH}_4$ (60% COD) + CO_2 (30% COD) + Fango (10% COD) + H_2

	AEROBIC	ANAEROBIC
Sludge production	400-600 kg	20-150 kg
Energy consumption	1100 kwh	-3300 kwh (CH_4 production !)
Nutrient consumption	Fossil fuel used	no
Nitrogen	20-25 kg	1-5 kg
Phosphorus	1,5-2	0,5-1

A different perspective

Up to this point what alternative sewage treatment technologies can do in terms of reduction of emission of GHG that are responsible for climate change.

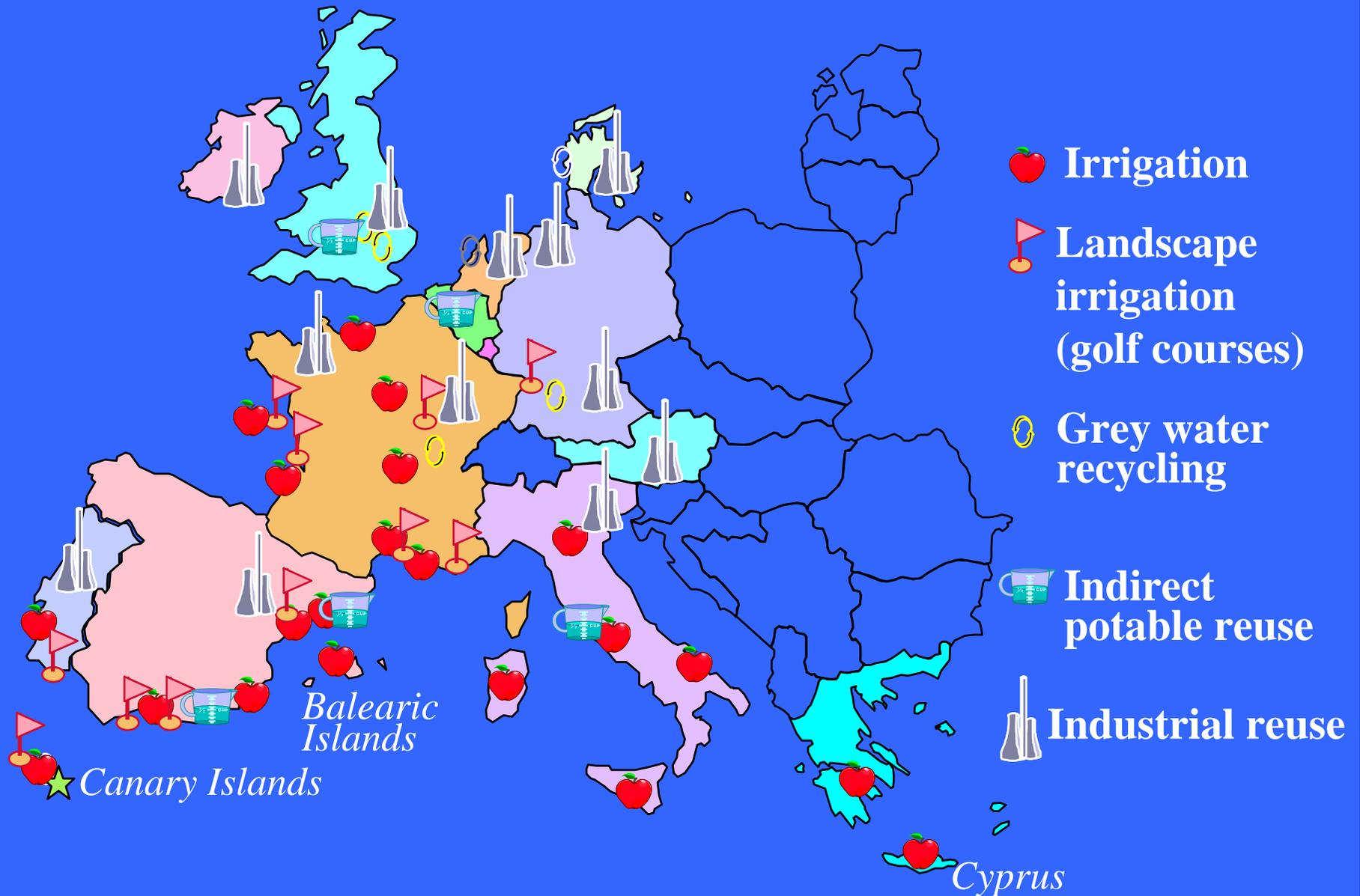
Now the problem is considered mainly from the point of view of **water saving**. One of the most likely consequences of climate change is, in fact, a reduction of water availability in many parts of Europe. This is the reason why not only sewage treatment, but also water treatment technologies are dealt with.

Premise

- Not to waste water is becoming day by day an increasingly outstanding issue.
- The word “wastewater” implies that the result of water use is a waste product.
The question if “wastes are wastes indeed”, needs to be asked at any location of productive activities.
- In the case of wastewater treatment facilities, this has caused a progressive paradigm shift from “pollutants removal” to “resource recovery”.
- This means that **wastewaters are not considered** anymore as wastes, but **as a source of** valuable substances/materials, energy and **water itself**.

Water reuse in EU Countries

Different types of reuse



Research needs (technological) 1

With this reference, important progress have already been made in the last decade and a lot of researches projects are currently carried out, stemming from particularly impelling research needs.

Among these:

- technologies to increase the performance of wastewater treatment plants to allow them to tolerate fluctuating amounts and types of wastes;
- enhanced solids separation from raw wastewater to allow a more efficient recovery of organic matter for use, for example in energy production;
- further improvements of anaerobic processes that consume less energy, produce potentially valuable byproducts and less biosolids.

Research needs (technological) 2

- wetland plant and biogeochemical interactions together with the fate of contaminants within the system;
- enhancement of the function of microbes used in the biological treatment systems;
- improvement of methods to separate grey from black water, to collect a more concentrated wastewater at central treatment facilities;
- reclaiming gray water and making it available for uses for which potable water is not necessary. Development of model systems to demonstrate resource recovery by contained communities such as apartments;

Research needs (**technological**) 3

- detection and fate of pathogens and the potential epidemiological risk they pose, together with the study of survival of pathogens and the ability of different treatment systems to kill them;
- methodologies to better control wastewater treatment and the quality of effluent from wastewater treatment plants. The goals of this research are the determination of how particular nutrients and contaminants enter the water stream, of the fate of these nutrients and contaminants and of the excess of these substances on the water system;

Research needs (social)

- Research findings and recommendations can play a key role in gaining public support and willingness for any resulting changes to current systems.
- Besides, even though not part of sewage treatment technologies, it has to be underlined the need of research on social perception of water reuse.

Water reuse is, in fact, currently often limited because socially not accepted.

.....last, but not least

- The rethinking of wastewater treatment plants as a whole.
Today these plants are generally large centralized facilities that treat wastewater from enormous sources and that have little flexibility.
- Modern wastewater treatment should fit the local situation.
This includes the evaluation of the effects of climate, topography, local availability of water, economics and the needs of the community.

For example, a system for a small Finnish town located on the shore of a large lake would be different from one in the arid Southern Italy.

The Finnish town may have energy, not water as a crucial need. The opposite will be probably true for the Southern Italian town. Thus a system in the Finnish town could produce energy as end product, while the one in Southern Italy could produce water for reuse as end product.

.....last, but not least (2)

- These new paradigms, however do not mean that centralized treatment is no longer viable. Especially in urban areas, centralized treatments may be unavoidable.

Also in this case alternative systems need to be explored that differs from the existing ones.

Research in this field includes:

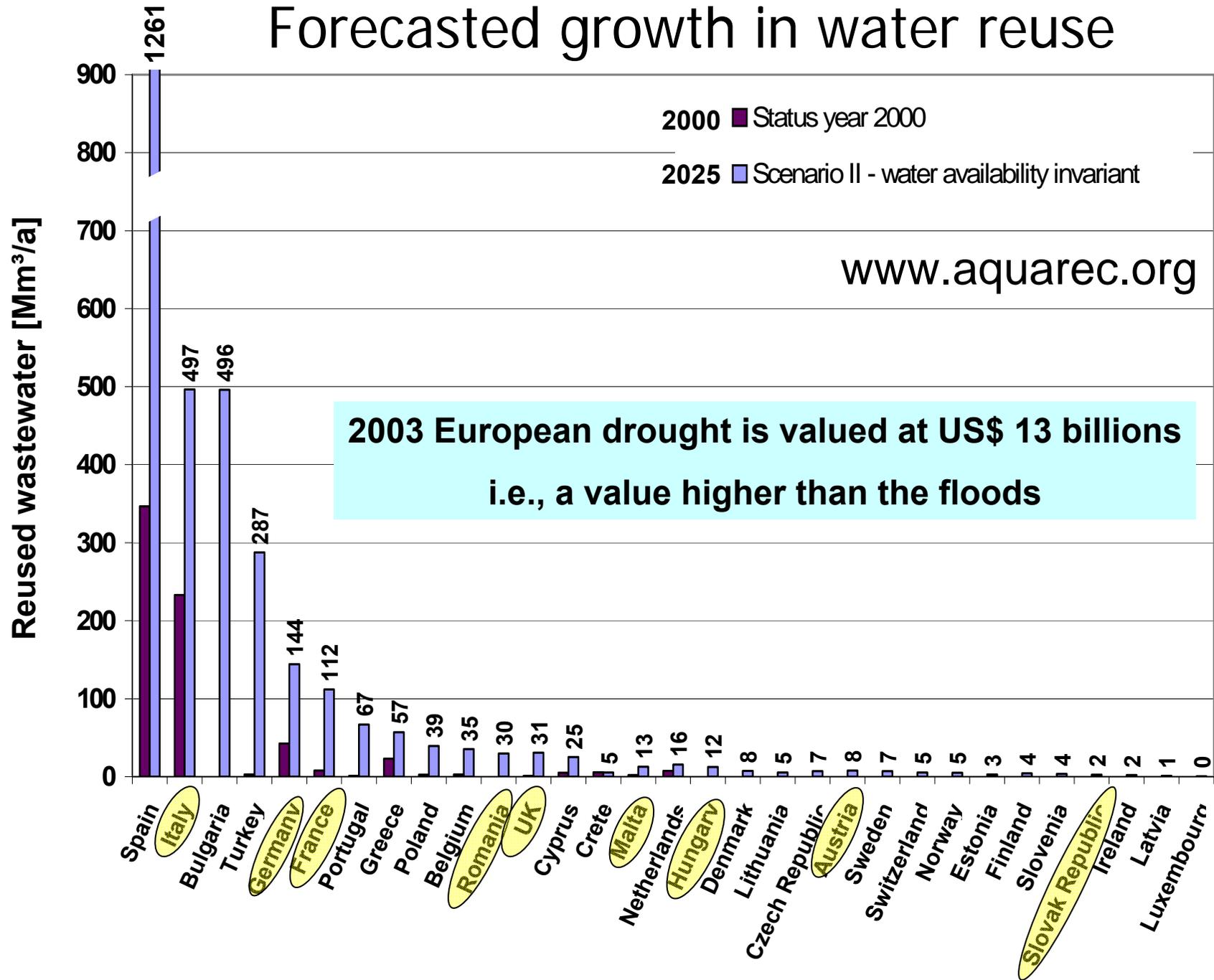
- new methods to separate waste at the beginning of the pipe;
- new processes to treat the waste within the pipe itself with innovative technologies;
- new conveyance systems to treat storm water differently from other waste water components.

.....last, but not least (3)

- Another important consideration is that wastewater treatment plants use water as a transport mechanism for wastes and this results in the pollution of clean water and in the dilution and mixing of wastes, that makes them more difficult to process at the plant.

Also research aimed at overcoming this problem is of an outstanding relevance.

Forecasted growth in water reuse



Thanks for attention!

