

demEAUmed: Innovative technologies for a safe closed water cycle in tourist facilities

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WATER REUSE CONFERENCE
Innovation for a competitive water reuse sector

- **Tourism** is central part of Euro-Mediterranean **economies**
(e.g. Spain – 11%)
- Tourism water **consumption** is typically between 150 and 600 L/d·h (higher than average urban people, high demand in summer)

demEAUmed - Demonstrating integrated innovative technologies for an optimal and safe closed water cycle in Mediterranean tourist facilities

ENV-2013.WATER INNO&DEMO-1 Water innovation demonstration projects

Total Cost: 5.83 M€
EC Contribution: 4.02 M€



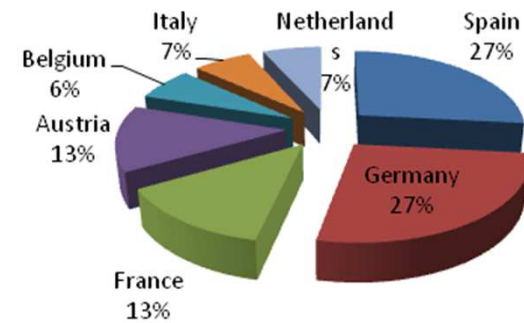
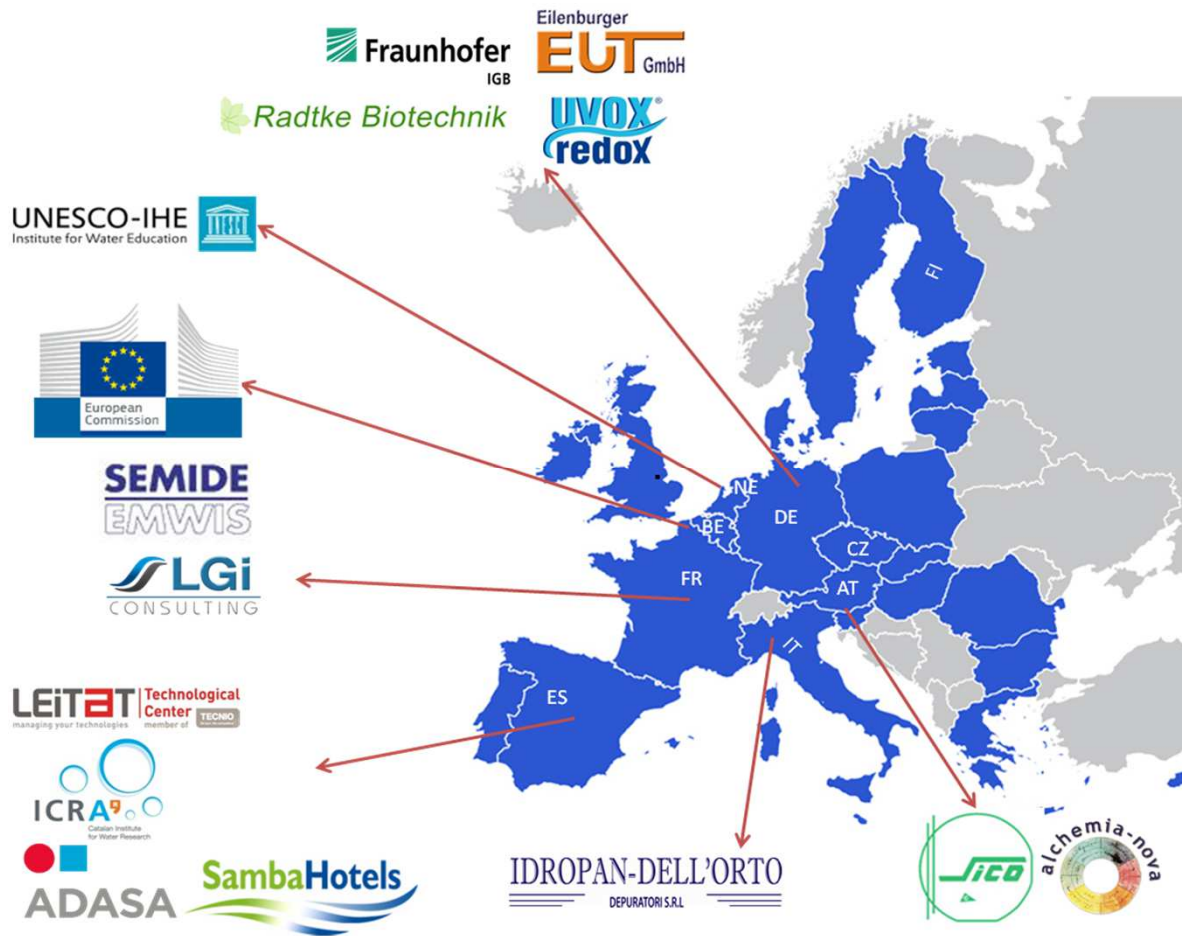
Objectives

Involvement of industry representatives, stakeholders, policy-makers and diverse technical and scientific experts to **DEMONSTRATE** and **PROMOTE**:

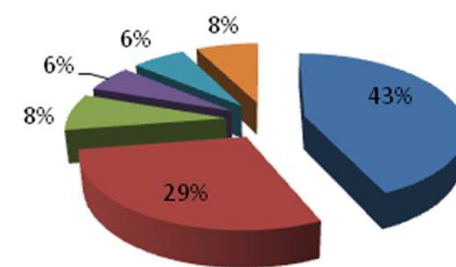
- ✓ The **integration of innovative water treatment technologies** for an optimal **closed water cycle** in **Mediterranean tourist facilities**
- ✓ **Fresh water consumption minimization**
- ✓ **Safe water management**
- ✓ **Monitoring, control and automation of water cycle**
- ✓ **Dissemination to other Euro-Mediterranean tourist facilities**
- ✓ **Creation of new market opportunities to European industry and SMEs**



demEAUmed - consortium

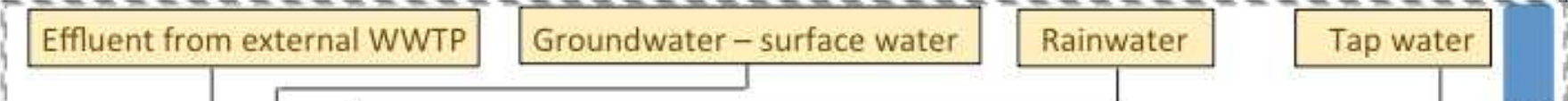


■ SME ■ RTD ■ HE ■ LARGE ■ Public Body ■ Other

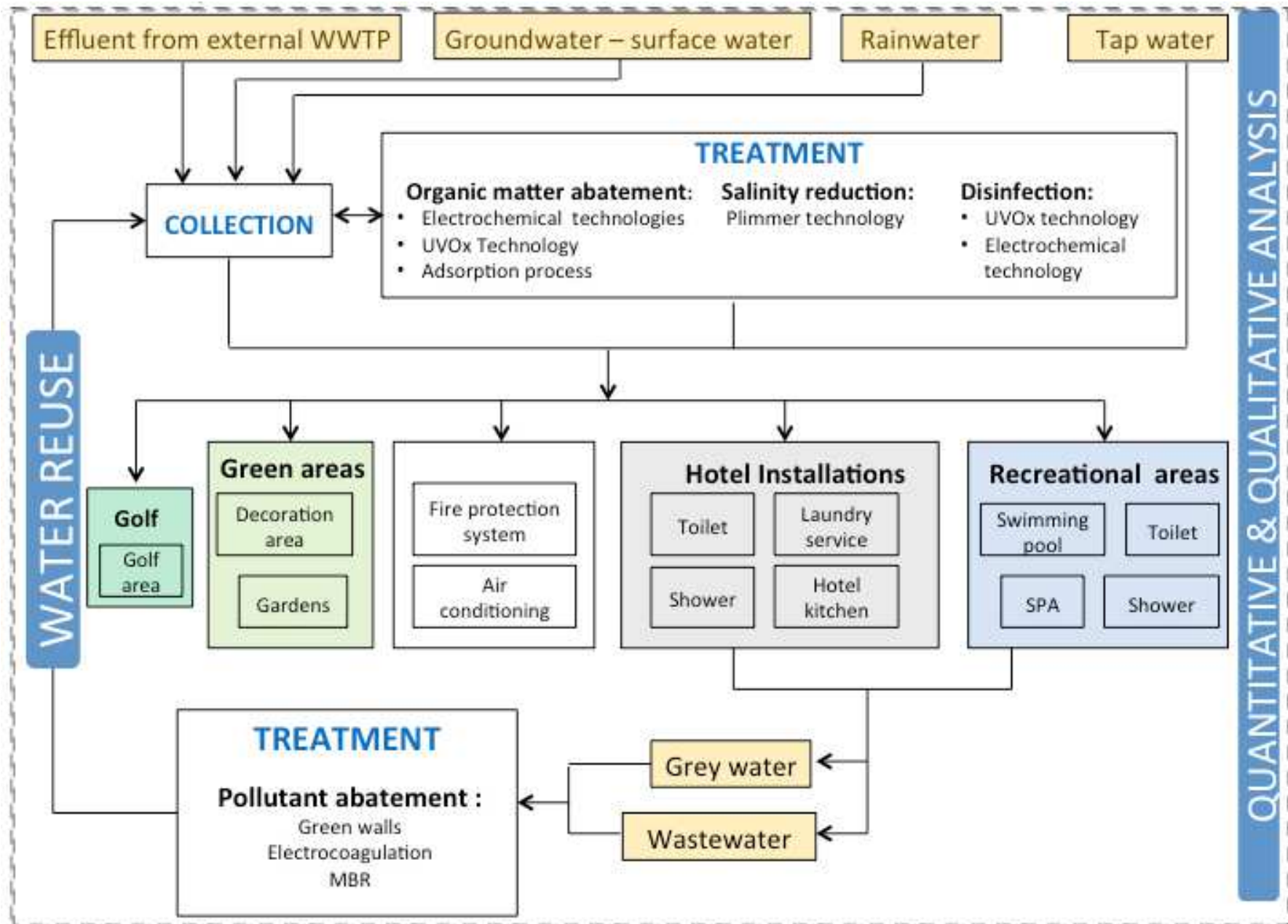


demEAUmed strategy

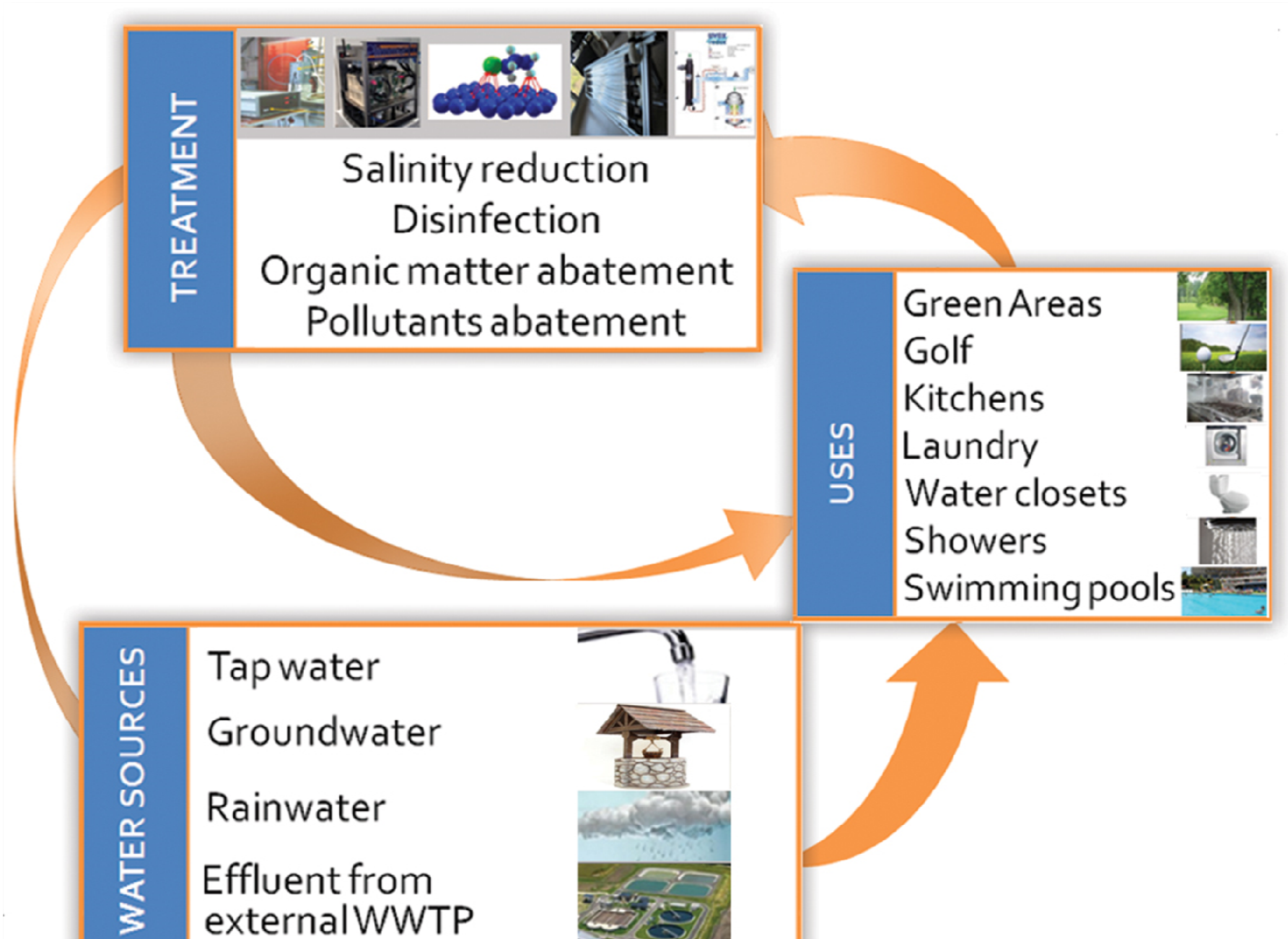
MONITORING, CONTROL & DSS



demEAUmed strategy



demEAUmed strategy



demEAUmed technologies

1. ELECTROCHEMICAL OZONATION (Fraunhofer)



Responsible partner: **Fraunhofer** Gesellschaft zur Förderung der Angewandten Forschung E.V. (Germany)

Partner: **Eilenburger Elektrolyse- und Umwelttechnik** GmbH (Germany)

2. UV 172 nm (Sico)

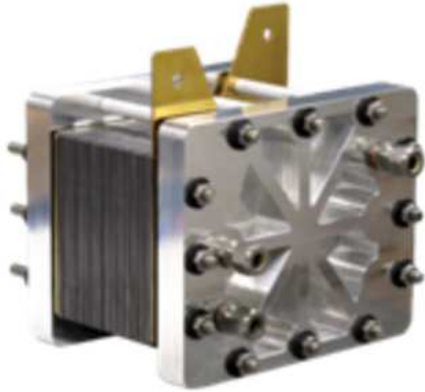


Responsible partner: **Fraunhofer** Gesellschaft zur Förderung der Angewandten Forschung E.V. (Germany)

Partner: **SICO** Technology GmbH (Austria)

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3. Solar photoelectroFenton process (LEITAT)



Responsible partner:

Acondicionamiento Tarrasense Association

LEITAT (Spain)

4. Electrocoagulation flotation (LEITAT)



Responsible partner:

Acondicionamiento Tarrasense Association

LEITAT (Spain)

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5. UVOX technology (Wapure)



Responsible partner: Stitching IHE Delft
(**UNESCO-IHE**) (Netherlands)

Partner: Wapure International gmbh (**UVOX**)
(Germany)

6. Plimmer water deionisation (Idropan)



Responsible partner:

Idropan dell Orto Depuratori SRL (**IDROPAN**)
(Italy)

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7. Smart Air-MBR (ICRA)



Responsible partner:

Catalan Institute of Water Research (**ICRA**),
Girona (Spain)

8. Vertical Ecosystem (Alchemia-nova)

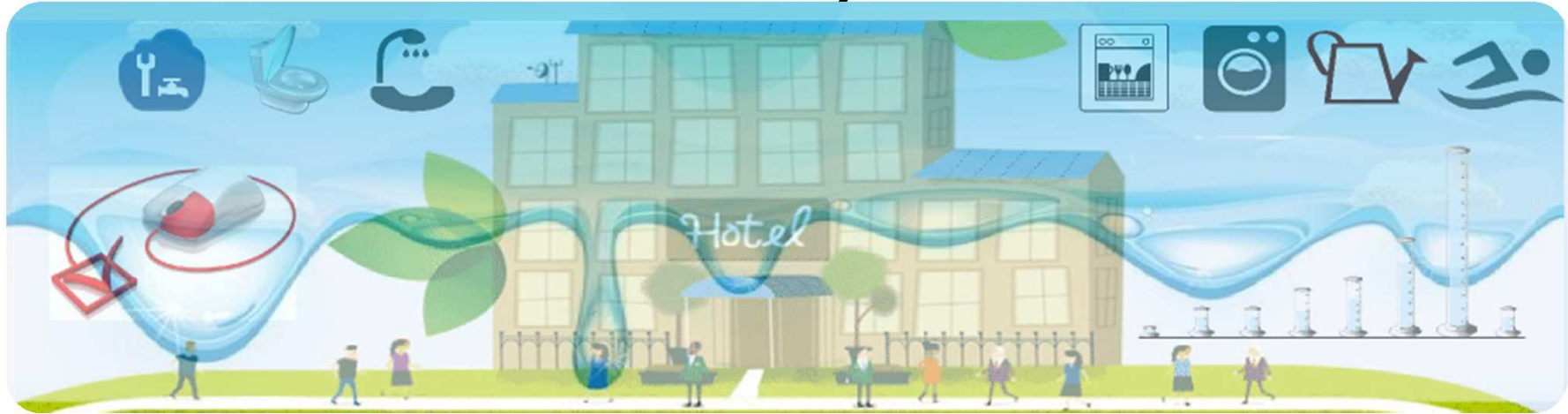


Responsible partner:

Alchemia-Nova Vienna, (Austria)

Radtke (Germany)

demEAUmed – Expected Results



- **60 – 70% reuse** of treated water
- **30 – 50% water consumption reduction** (drinking water)
- **10 – 30% of environmental impact reduction** within the Euro-Mediterranean resorts
- **60 – 80% emerging contaminants removal**
- **Treatment and reuse of greywater** *on-site* by the use of vertical ecosystems
- **75-85% conductivity reduction**
- **Microbiological charge removal**
- **Control** of water **consumption** and its **quality**
- **Decision support systems** -> Selection of the best water management alternatives

DEMONSTRATION SITE

Case study site



The Costa Brava (NE, Spain) is an important Spanish and European holiday destination (recommended destination 2012, National Geographic Traveler).

Lloret de Mar, is the largest resort on the Costa Brava, (40,000 inhabitants, up to 200,000 in summer)

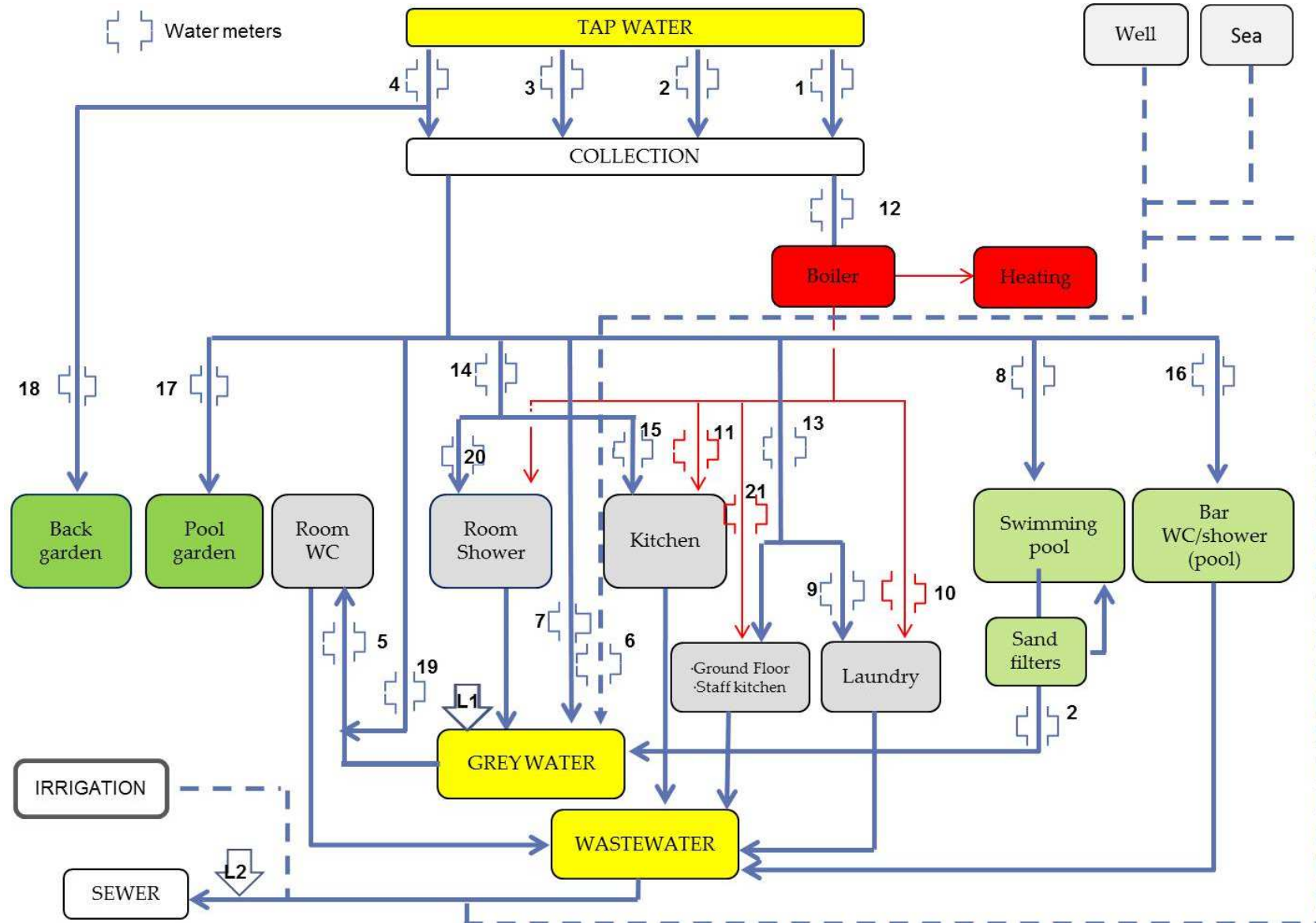
Samba Hotel is a large resort (441 rooms), green areas and exterior pools, conference room, bar and restaurant.

- Certified by EMAS and ISO14001
- Water use from 25,000 to 34,000 m³/year (100 to 135 L/person/day)
- Grey water system for water closets



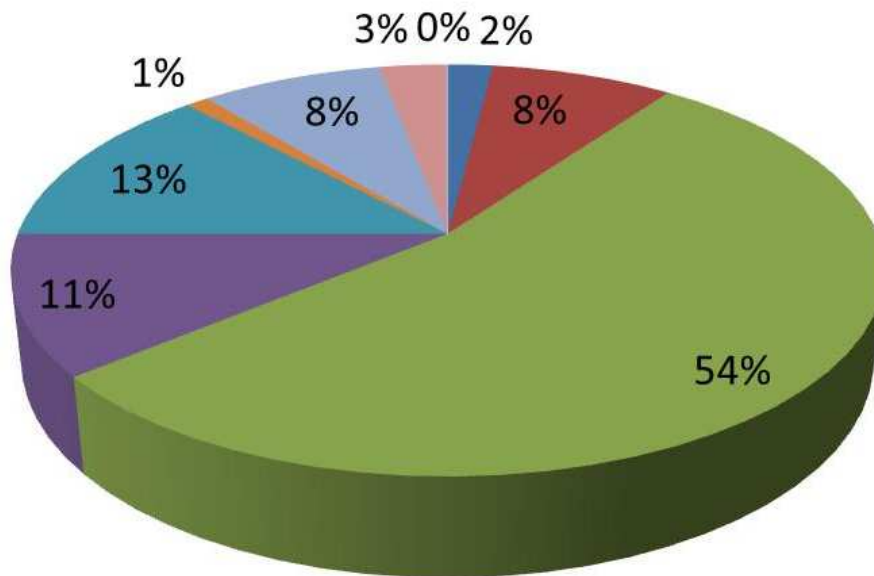
NOT the general case in hotels (and in particular of Spain)!

Hotel – water cycle diagnose in terms of quantity and quality

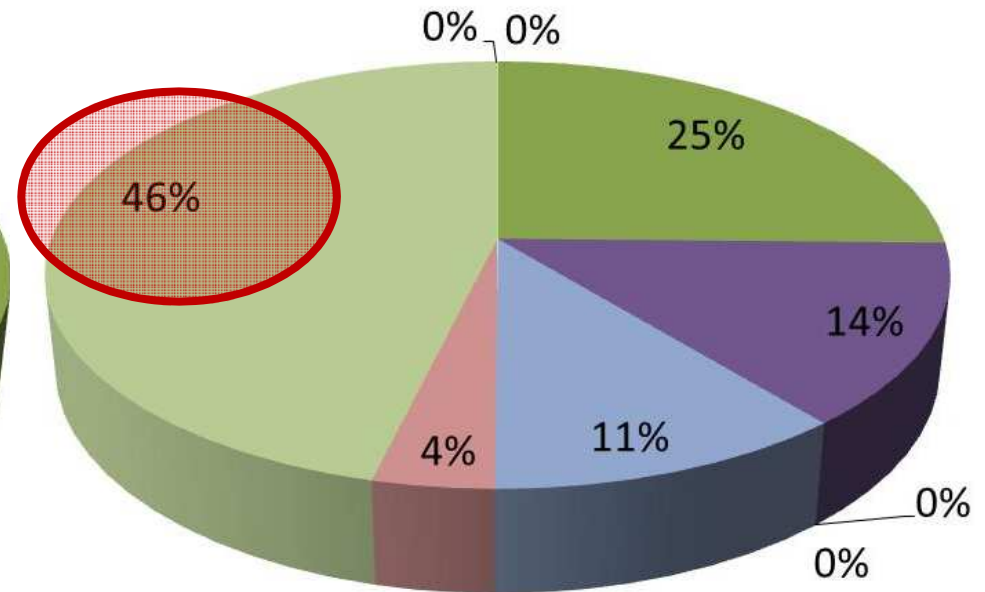


Water use sampling campaign

High season



Low season



■ Back garden
■ Basement
■ Kitchen

■ Pool garden
■ Pool
■ Laundry

■ Shower
■ Pool bar
■ Toilet flushing

- During low season high use of water for toilet
 - Most of shower water not reused: extremely dynamic system

Analyses

Standard chemical analyses

- Alkalinity, COD, BOD, TOC, conductivity, pH, TSS, VSS, N-NO₂⁻, N-NO₃⁻, P-PO₄³⁻, Cl, Br⁻, F⁻, S-SO₄⁻, Cl-CLO₂⁻, Cl-CLO₃⁻, Na⁺, N-NH₄⁺, TKN, K⁺, Mg²⁺, Ca²⁺, etc.

-Metal content, Urea, THMs, HAAs, bromate, bromide, etc.

Microbiological indicators

- Total count, total coliforms, escherichia coli, legionella spp, intestinal enterococci, giardia, cryptosporidium, nematodes, clostridium perfringens

Micropollutants content:

-Pharmaceutical compounds (PhACs)

-EDCs, flame retardants (EDCs)

Hotel – water cycle diagnose in terms of **quality**: sampling



Treatment strategies (demo)

Tap water use

Greywater – Wastewater

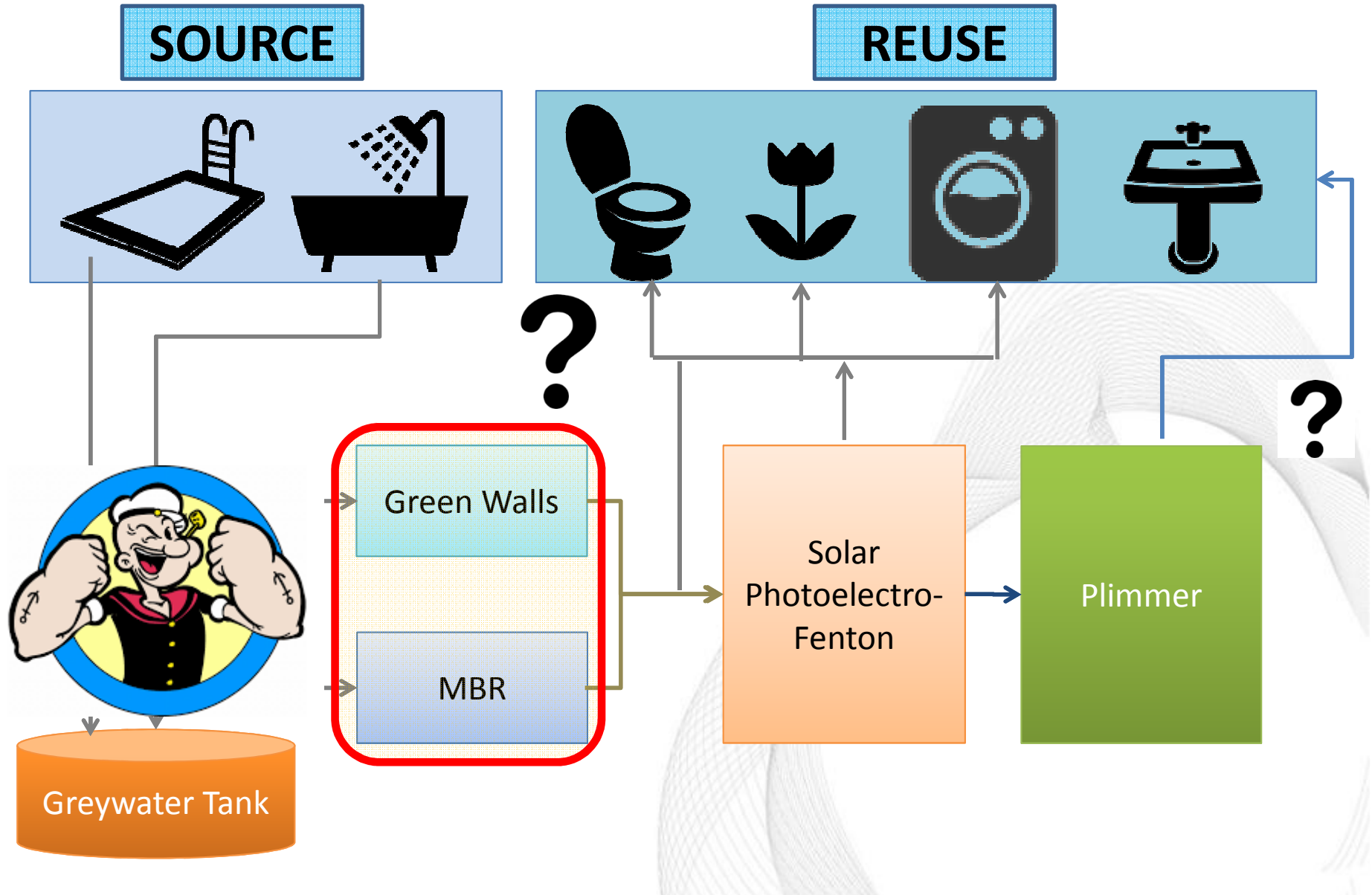
Swimming pool

Lab / In situ (demo)

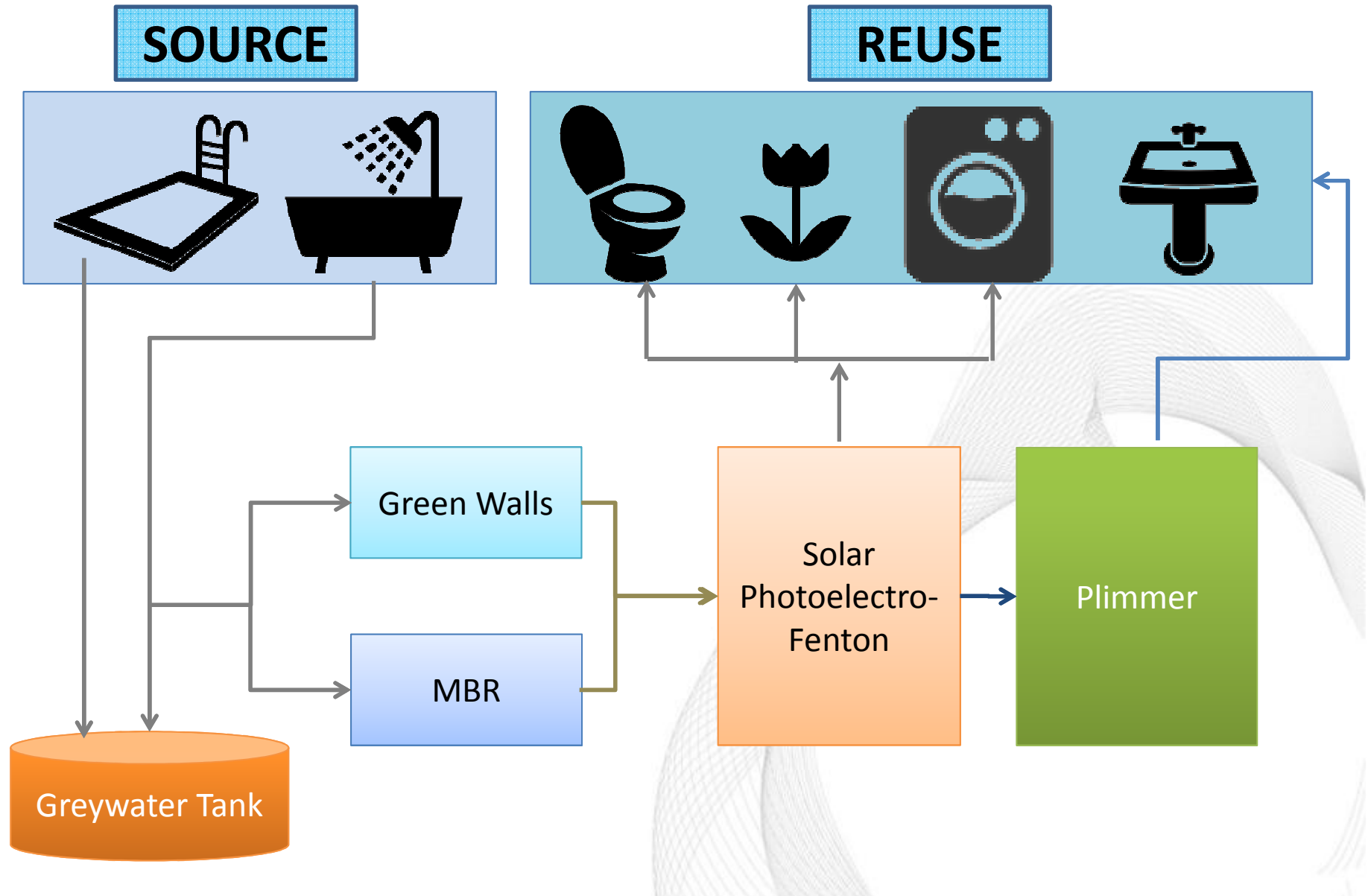
Single/combined technologies



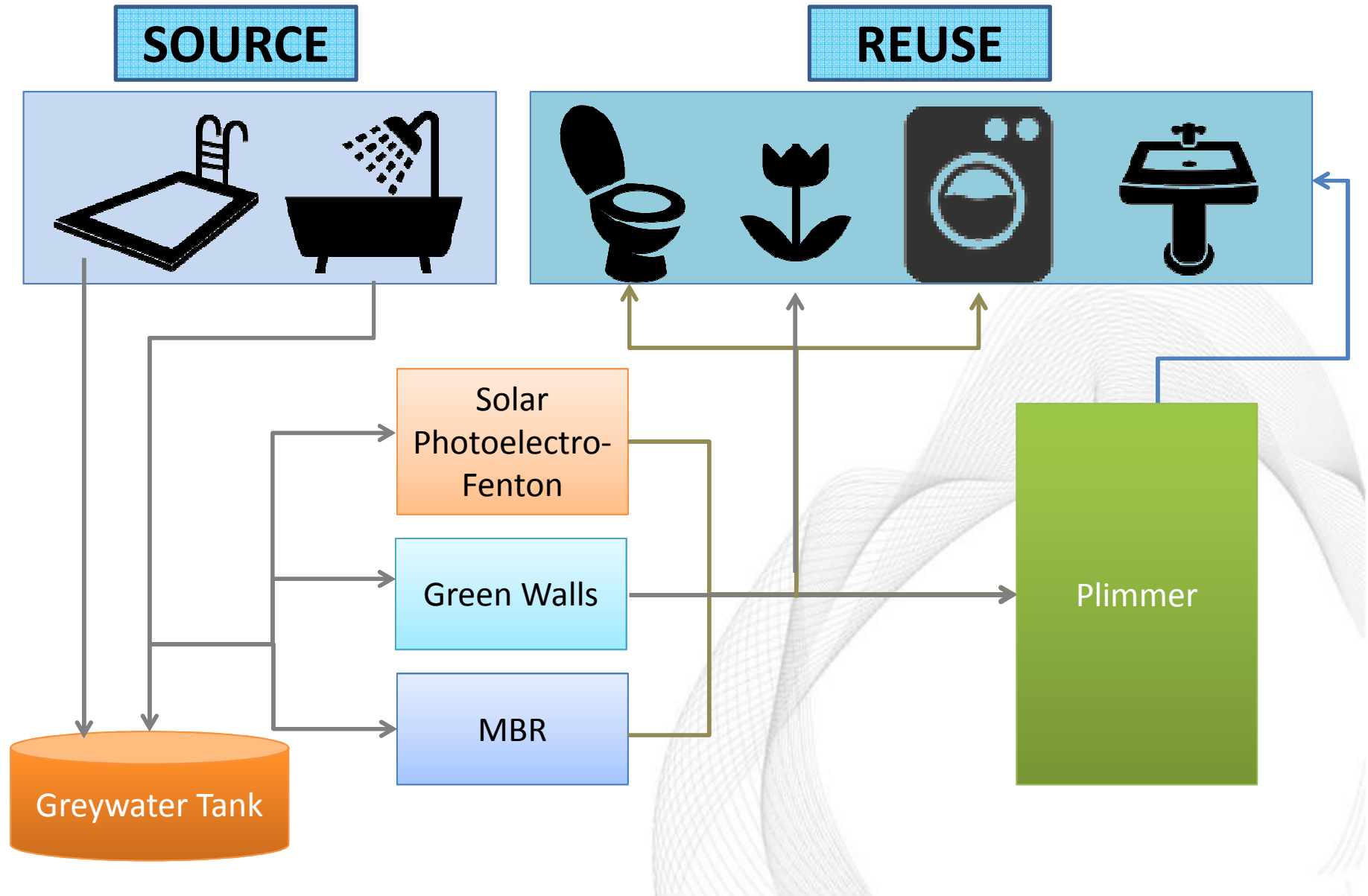
Greywater – ROADMAP 1 and 2



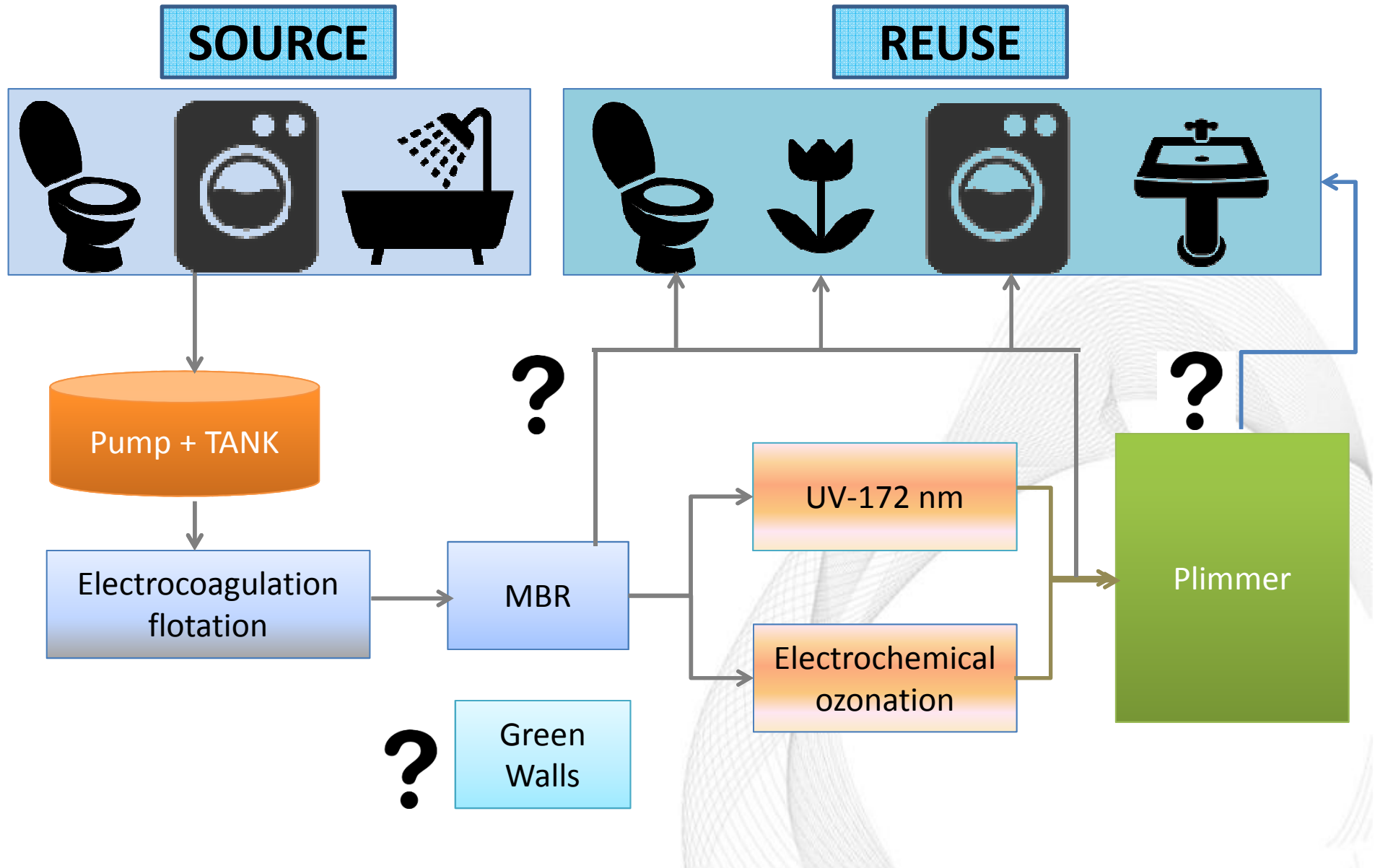
Greywater – ROADMAP 1 and 2



Greywater – ROADMAP 3



Wastewater – ROADMAP



Decision Support System

Dynamic control

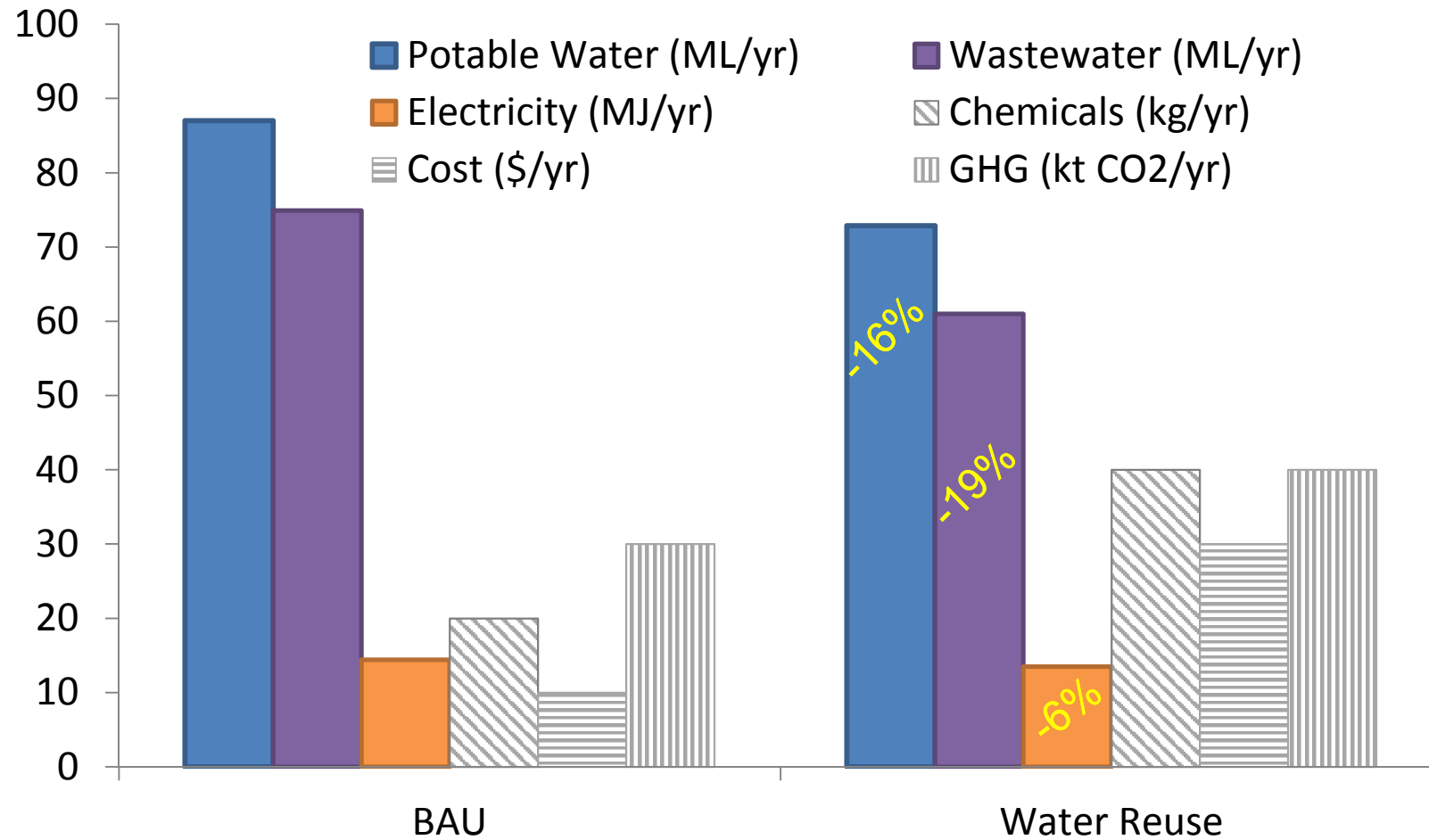
- alarms
- use and demands
- accounting

Simulation

- generalize for any hotel
- simulate different scenarios
- generate optimal solutions



RESULTS



Conclusions

Cycle can be almost closed (in touristic facilities).. but some pollutants can accumulate.

Significant seasonal variability and dynamics along the day (in quantity and in quality).

There are alternative water sources.

There are conventional/advanced treatment alternatives:

- Grey water for WC, irrigation (filtration+disinfection is not enough).

There are alternative water reuse (laundry, kitchen).. **legislation gap.**

Cost of water is not very relevant in hotels, and it can increase (capex and opex) when trying to safe water.

It is important to quantify environmental impacts (waterfootprint, LCA). Sustainable image is also important.

Social impact (hotel owners, clients, society)



Thanks for yor attention!

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