demEAUmed

Funded under the Water and Innovation Action of the 7th Framework programme of RTD-D of the European Union

Overview of 42 months for water reuse in touristic installations

Gianluigi Buttiglieri
ICRA

demEAUmed Final Conference
Barcelona
18th May 2017

demEAUmed: the challenge

- the importance of **the tourism economy** and its high water demand
- the **water scarcity** characteristic of the **Mediterranean area**

demEAUmed as a critical platform for promoting of **sustainable** and **innovative technologies** in Euro-Mediterranean tourist facilities in the **global tourism market**

demEAUmed: objectives

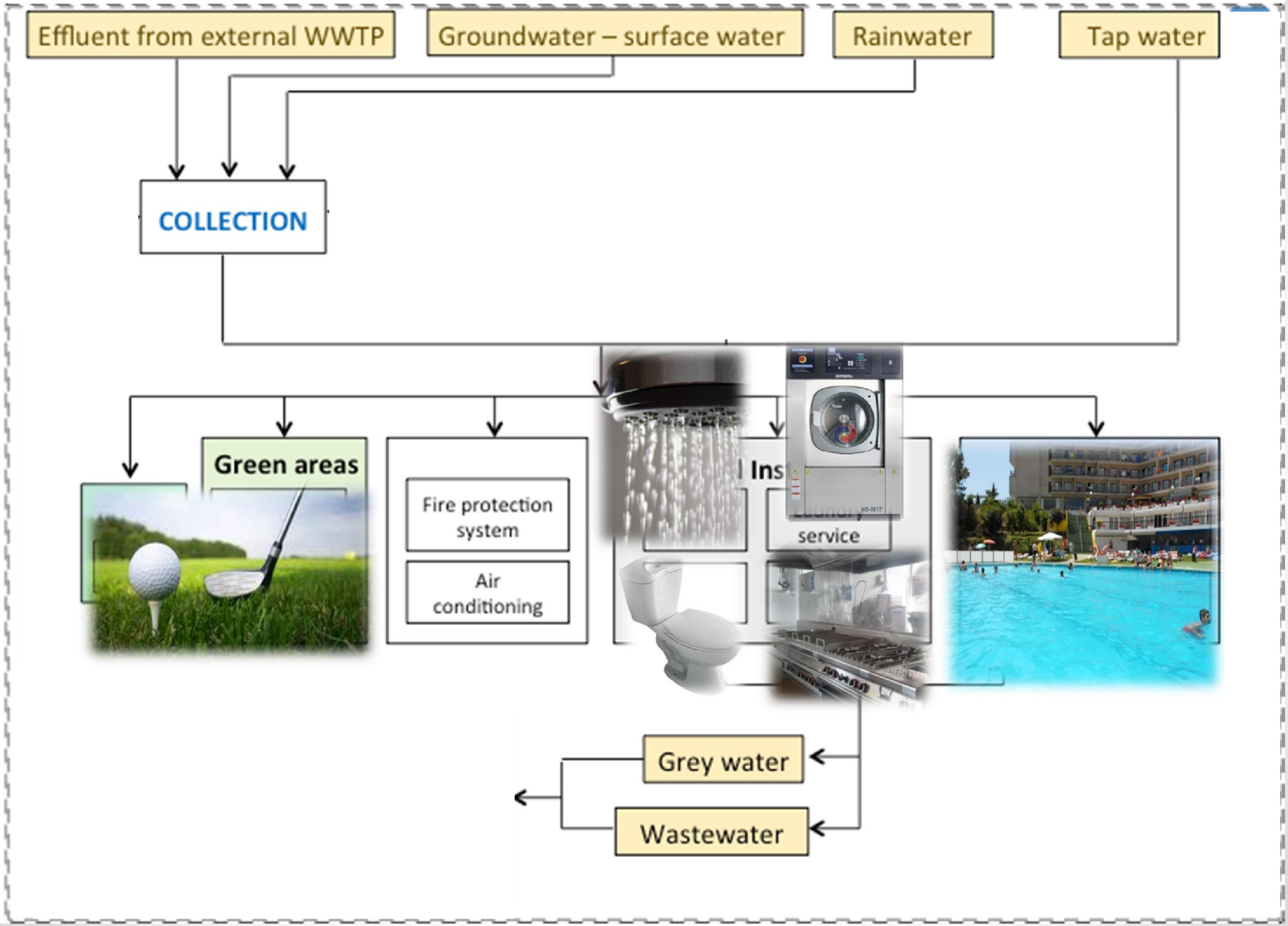
Demonstrate and promote:

- The possibility of reduction of water consumption
  - Identify maximum use of water and their quality
  - Water cycle monitoring, control, DSS, LCA, environmental, socio and economical assessment for water management

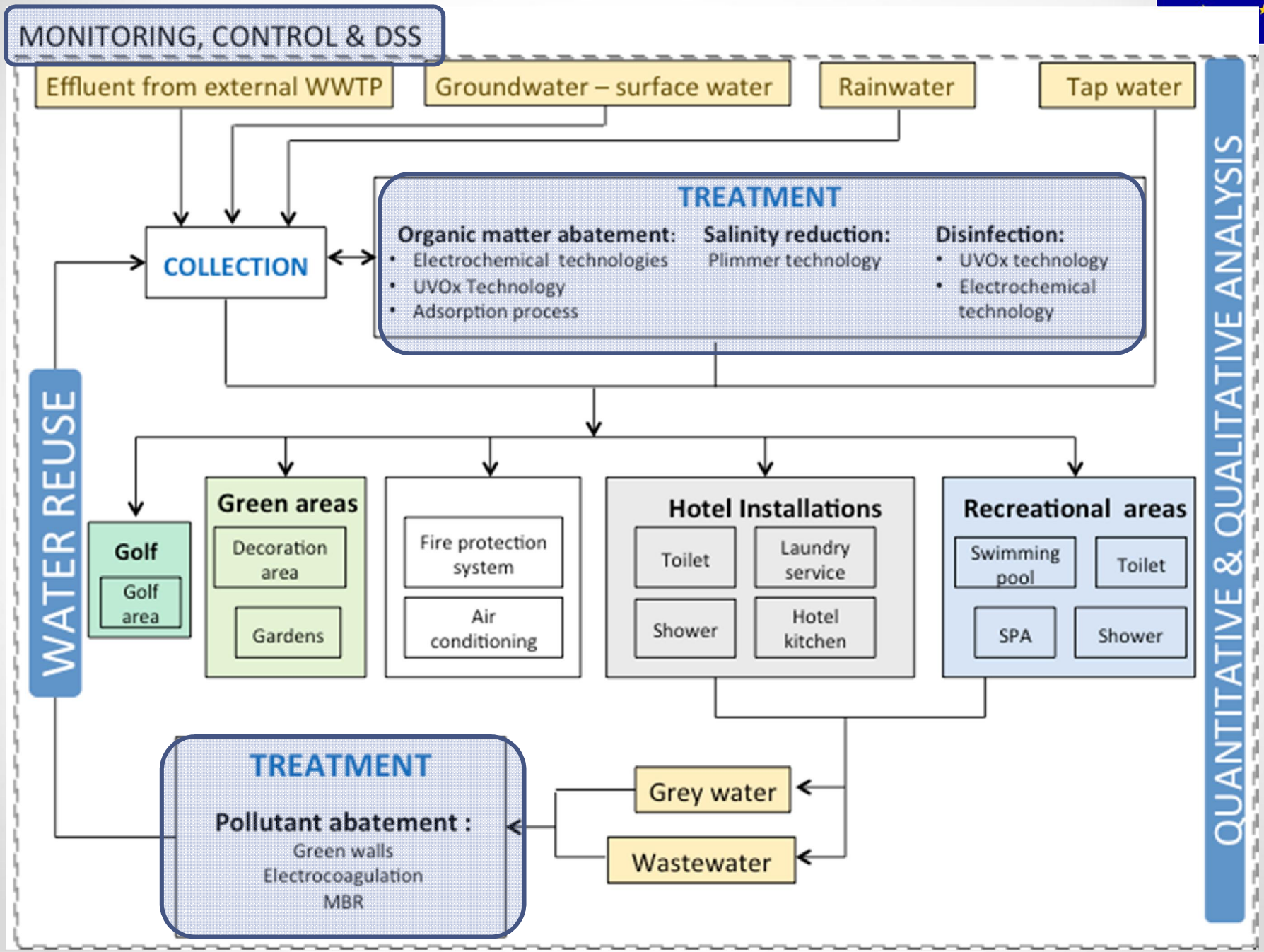
- Integration of innovative technologies for an optimal and safe closed water cycle in Mediterranean tourist facilities
- Dissemination to other Euro-Mediterranean tourist facilities with a view to also global tourist market and MARKET UPTAKE

demEAUmed strategy

demEAUmed strategy



demEAUmed strategy

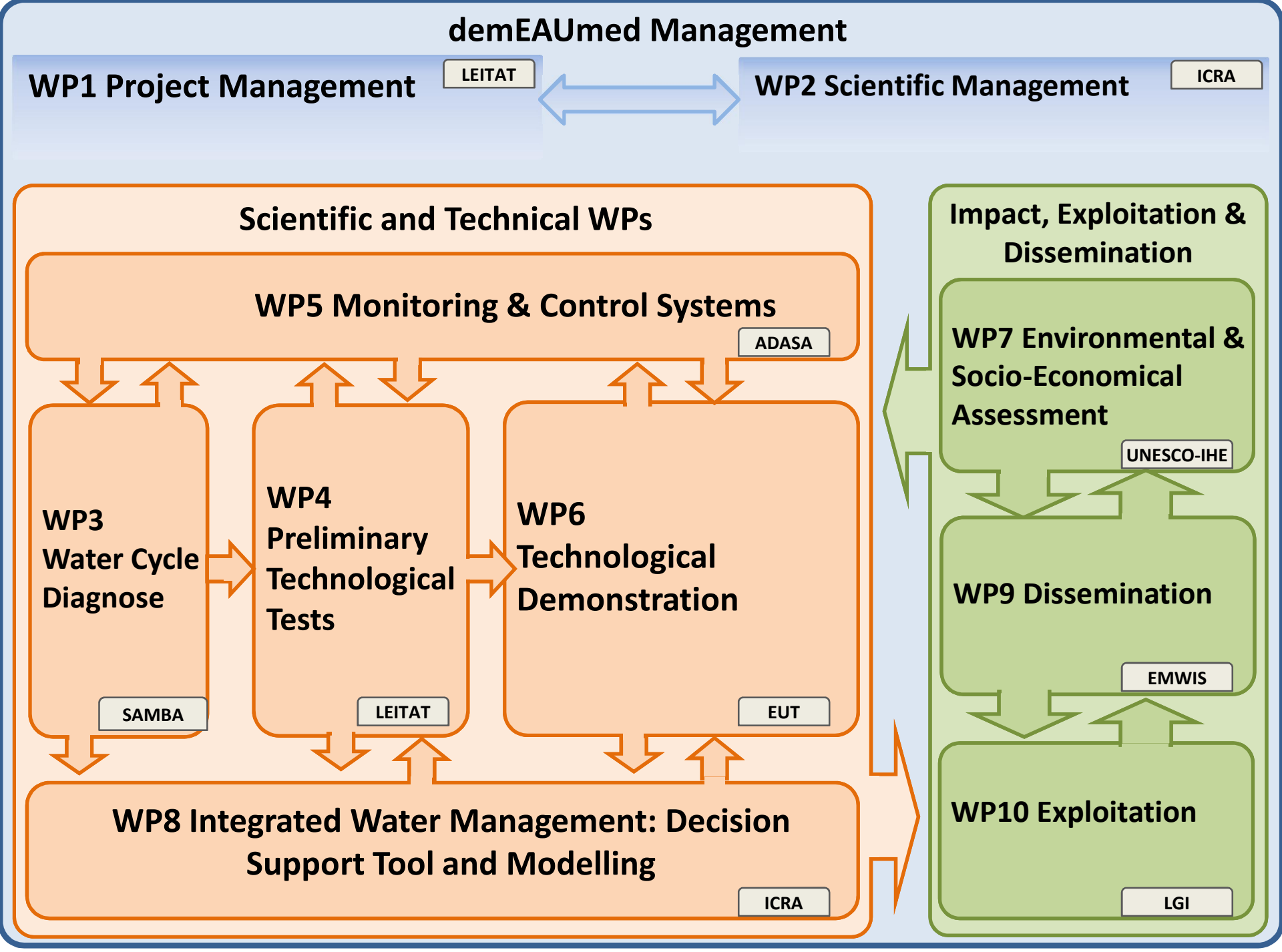


demEAUmed: the strategy

1. preliminary stage with study of the water cycle and tests of technologies and adaptation to the needs of the DEMO site
2. a main demonstration stage with technologies installed, integrated, optimized and validated

demEAUmed technologies have never been jointly applied in a unique and optimized water management system.

demEAUmed activities


demEAUmed Management
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LEITAT
WP2 Scientific Management
ICRA
Scientific and Technical WPs
WP5 Monitoring & Control Systems
ADASA
WP3
Water Cycle
Diagnose
SAMBA
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Preliminary
Technological
Tests
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Demonstration
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ICRA
Impact, Exploitation & Dissemination
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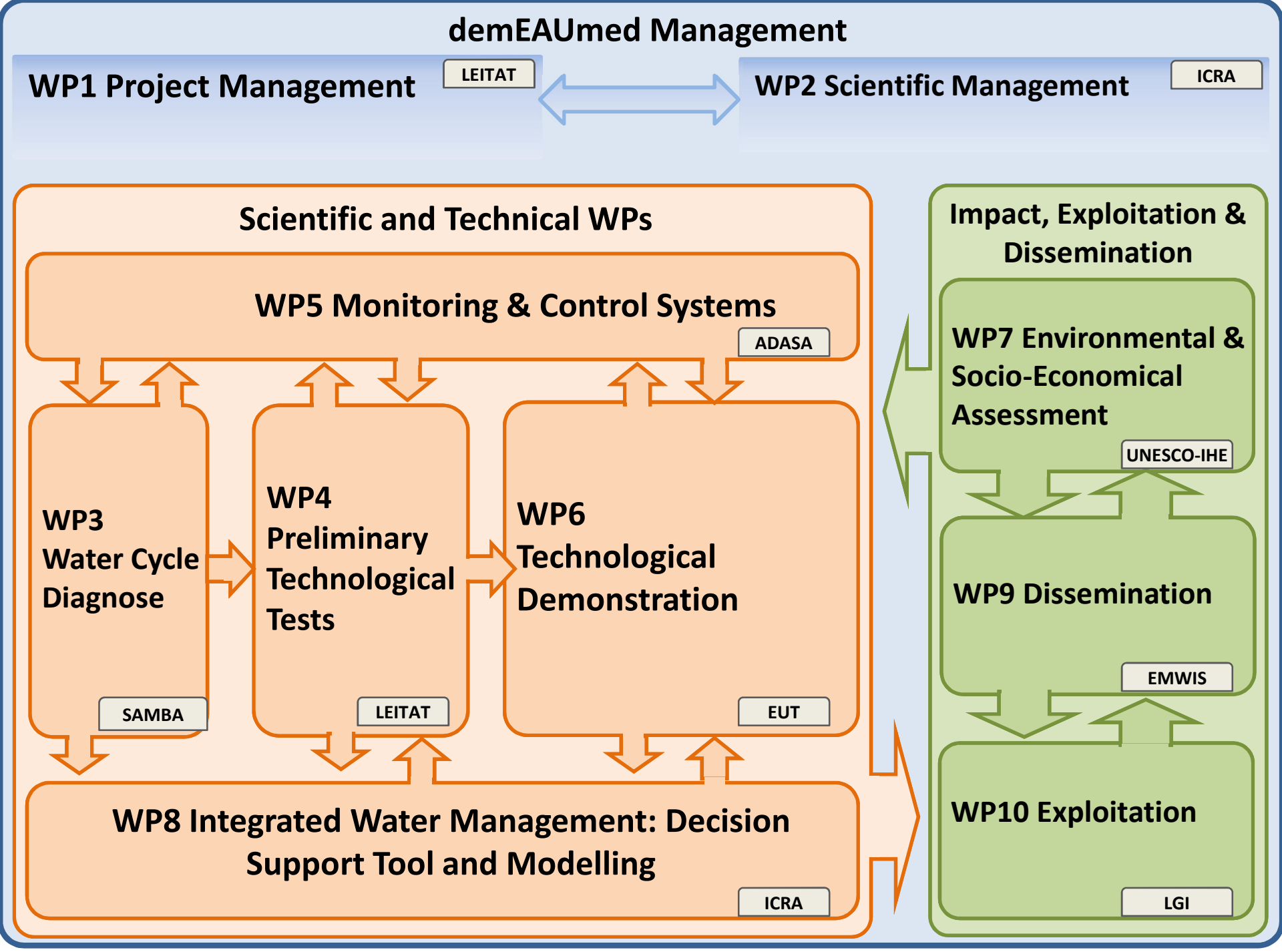
UNESCO-IHE
WP9 Dissemination
EMWIS
WP10 Exploitation
LGI


GOOD NEWS!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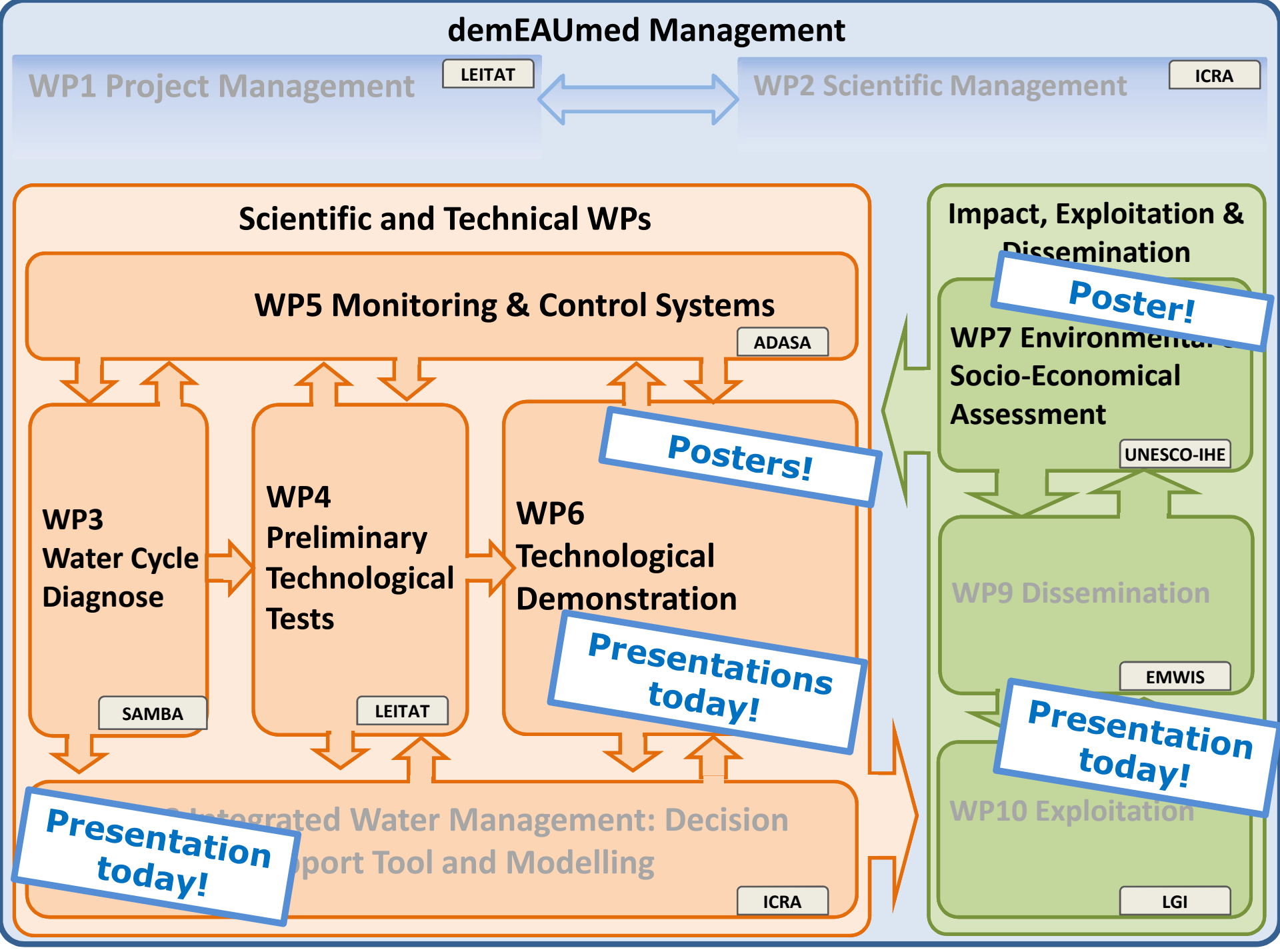
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Posters!
Presentations today!
Integrated Water Management: Decision
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Presentation today!
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Poster!
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DEMO site water cycle diagnose

DEMO site water cycle diagnose

Samba Hotel

- Water use from 25,000 to 34,000 m^3/year (100 to 135 L/person/day)
- Grey water system for water closets

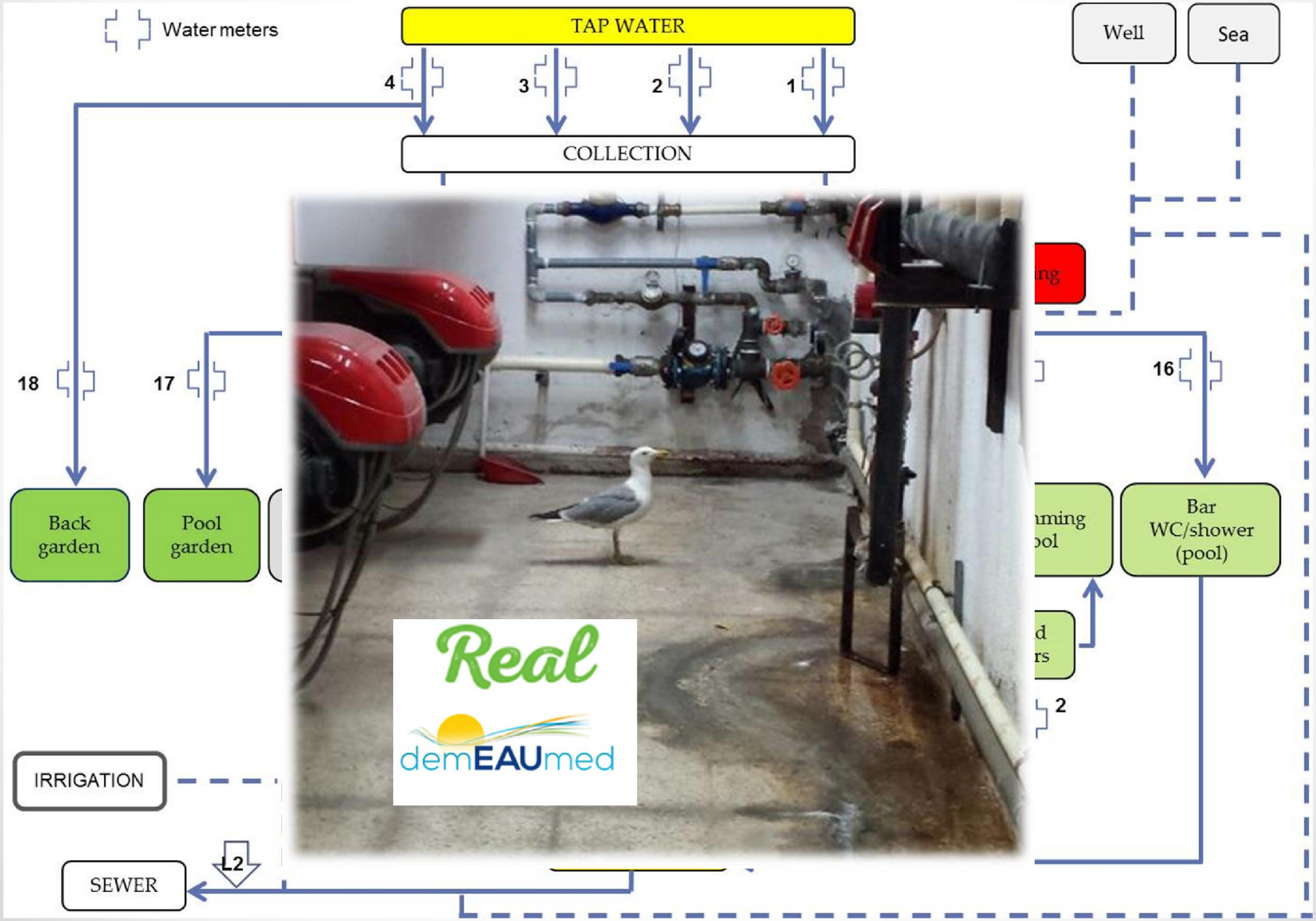
Water cycle diagnose

Sampling campaigns high and low touristic seasons:

- ✓ **water quantity**
- ✓ **water quality**

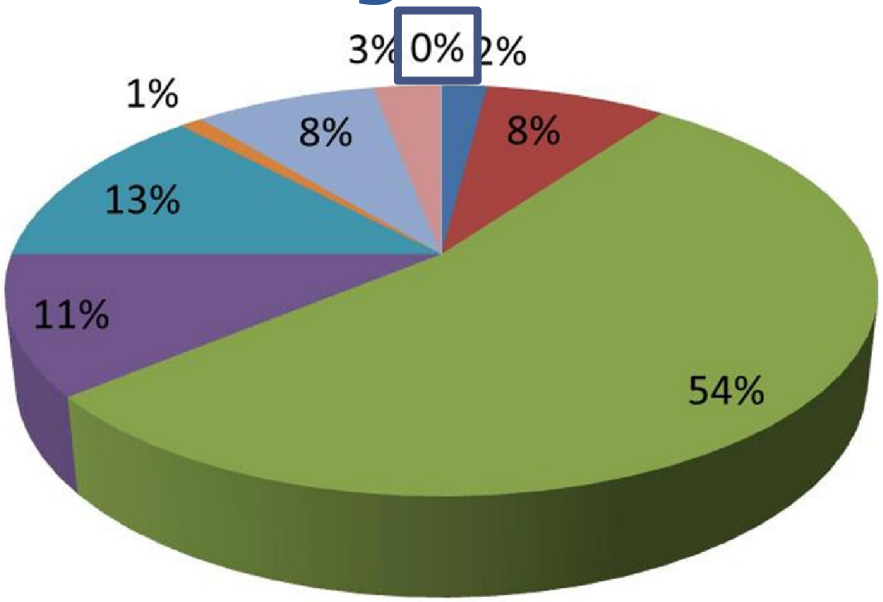
Hotel – water cycle diagnose

in terms of quantity: water meters

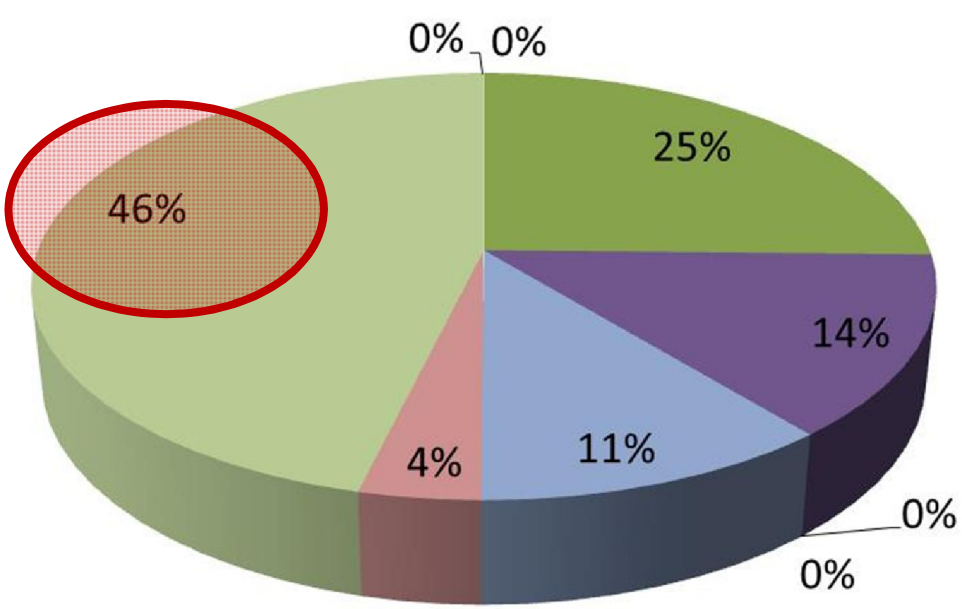


Water use sampling campaign

High season



Low season



Back garden | Pool garden | Shower
Basement | Pool | Pool bar
Kitchen | Laundry | Toilet flushing

- Extremely dynamic system in terms of flows… but also in terms of quality

Hotel – water cycle diagnose in terms of quality: sampling

Hotel – water cycle diagnose

Real

Analyses

Standard **chemical analyses**

- Alcalinity, COD, BOD, TOC, conductivity, pH, TSS, VSS, N-NO_2^-, N-NO_3^- P-PO_4^{3-}, Cl, Br^-, F^-, S-SO_4^-, Cl-ClO_2^-, Cl-ClO_3^-, Na^+, N-NH_4^+, TKN, K^+, Mg^{2+}, Ca^{2+}, etc.
- Metal content, Urea, THMs, HAAs, bromate, bromide, etc.

Microbiological indicators

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

Micropollutants content:

- Pharmaceutical compounds (PhACs)
- EDCs, flame retardants (EDCs)

Why micropollutants in tourist facilities?

Expected matrix and concentrations similar to domestic grey- and waste-waters but the purpose is..

- To estimate load of micropollutants and **tourism contributions** to total contamination
- To evaluate **seasonal variations**
- To evaluate if and what kind of **technologies** for **decentralized treatments in water scarcity scenarios**:
  - **Possible recalcitrant** (micro)pollutants **accumulation** needs to be carefully addressed

DIFFERENCES IN MICROPOLLUTANTS LOADS

GREYWATER

	HIGH SEASON			
	DAY 1	DAY 2	DAY 3	AV.
ng/day	8325	3034	3635	4826
ng/person/day	8.7	3.0	5.1	5.4

	LOW SEASON			
	DAY 1	DAY 2	DAY 3	AV.
ng/day	2444	2117	611	1757
ng/person/day	4.8	5.9	2.3	4.7

WASTEWATER

	HIGH SEASON			
	DAY 1	DAY 2	DAY 3	AV.
ng/day	7286	11090	24985	14235
ng/person/day	7.6	11.0	35.3	16.0

	LOW SEASON			
	DAY 1	DAY 2	DAY 3	AV.
ng/day	12024	22955	12837	17171
ng/person/day	23.5	64.3	48.8	45.5

Smaller load variability between seasons

Higher load variability between seasons

This **difference may affect strategy of treatment** (separated greywater from wastewater, seasonal variability, etc.)

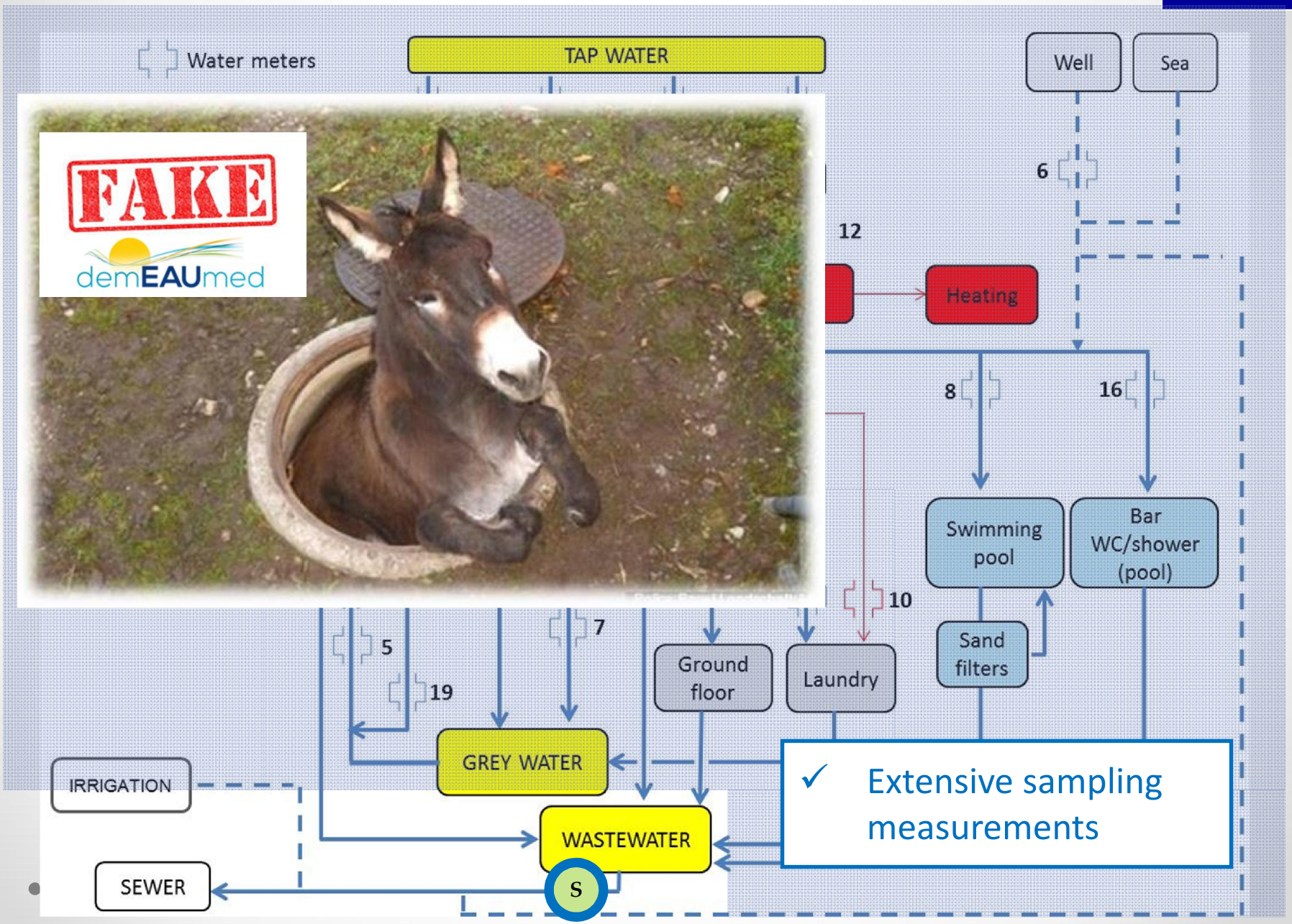
SWIMMING POOL WATER

Water meters
TAP WATER
Well
Sea
4
3
2
1
6
Heating
8
16
Swimming pool
S
Bar WC/shower (pool)
Sand filters
Backwash
GREY WATER
IRRIGATION
WASTEWATER
SEWER

GREYWATER

- ✓ Extensive sampling measurements

WASTEWATER

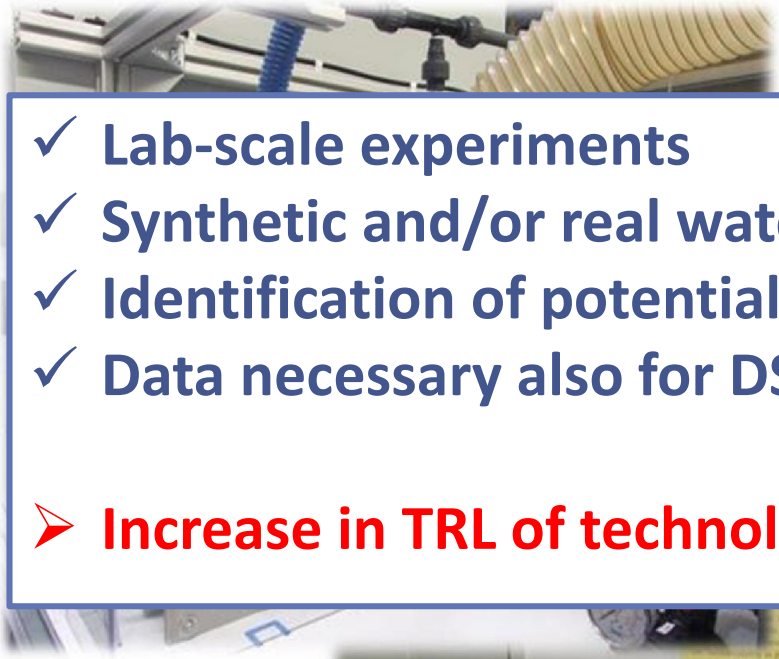

Water meters
TAP WATER
Well
Sea
6
12
Heating
8
16
Swimming pool
Bar WC/shower (pool)
10
Sand filters
5
19
7
Ground floor
Laundry
GREY WATER
IRRIGATION
WASTEWATER
SEWER
S
FAKE
demEAUmed
✓ Extensive sampling measurements

Preliminary technological tests

Preliminary technological tests

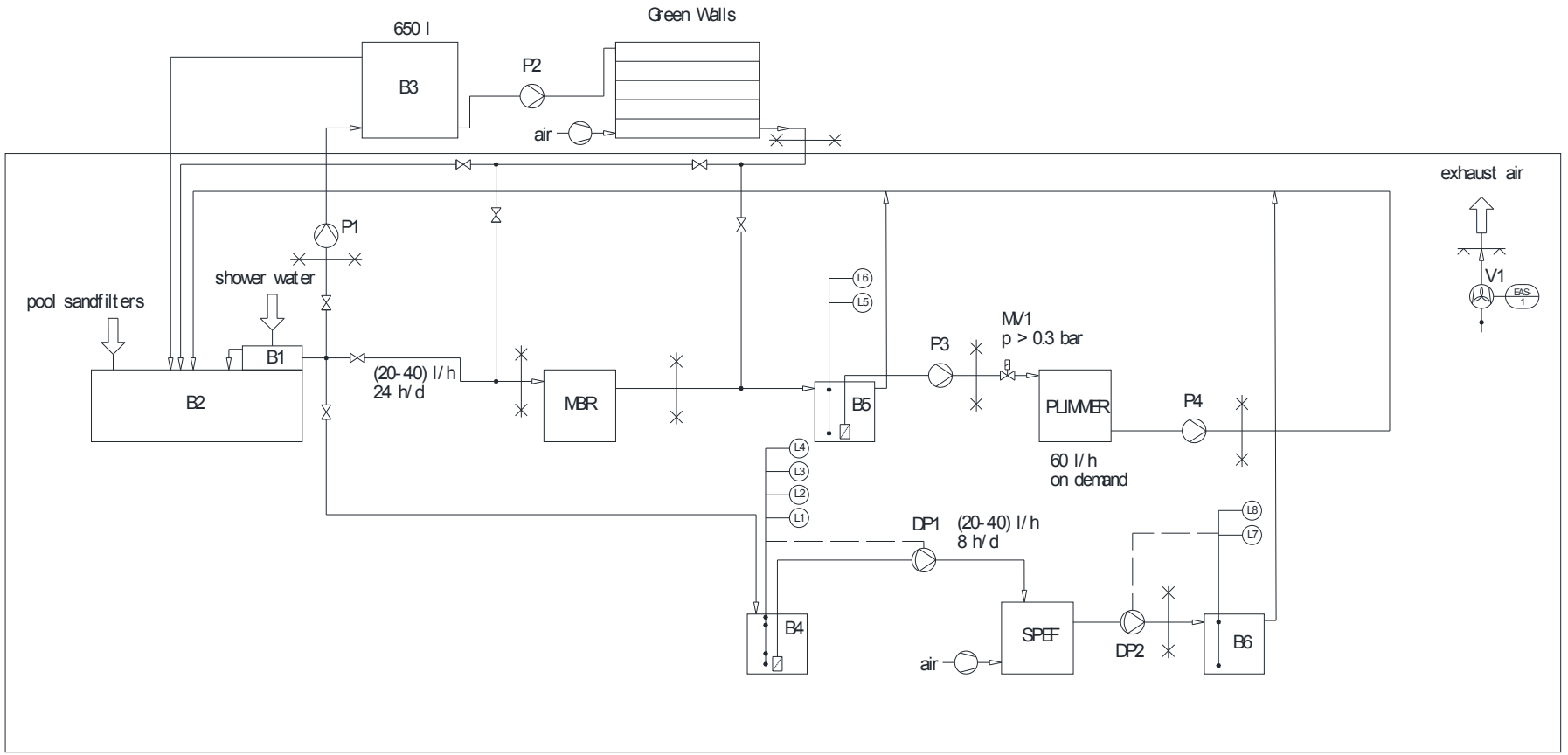
- ✓ Lab-scale experiments
- ✓ Synthetic and/or real waters
- ✓ Identification of potential reuse
- ✓ Data necessary also for DSS

- ➢ **Increase in TRL of technologies**



Demonstration of innovative technologies

Example of P&ID



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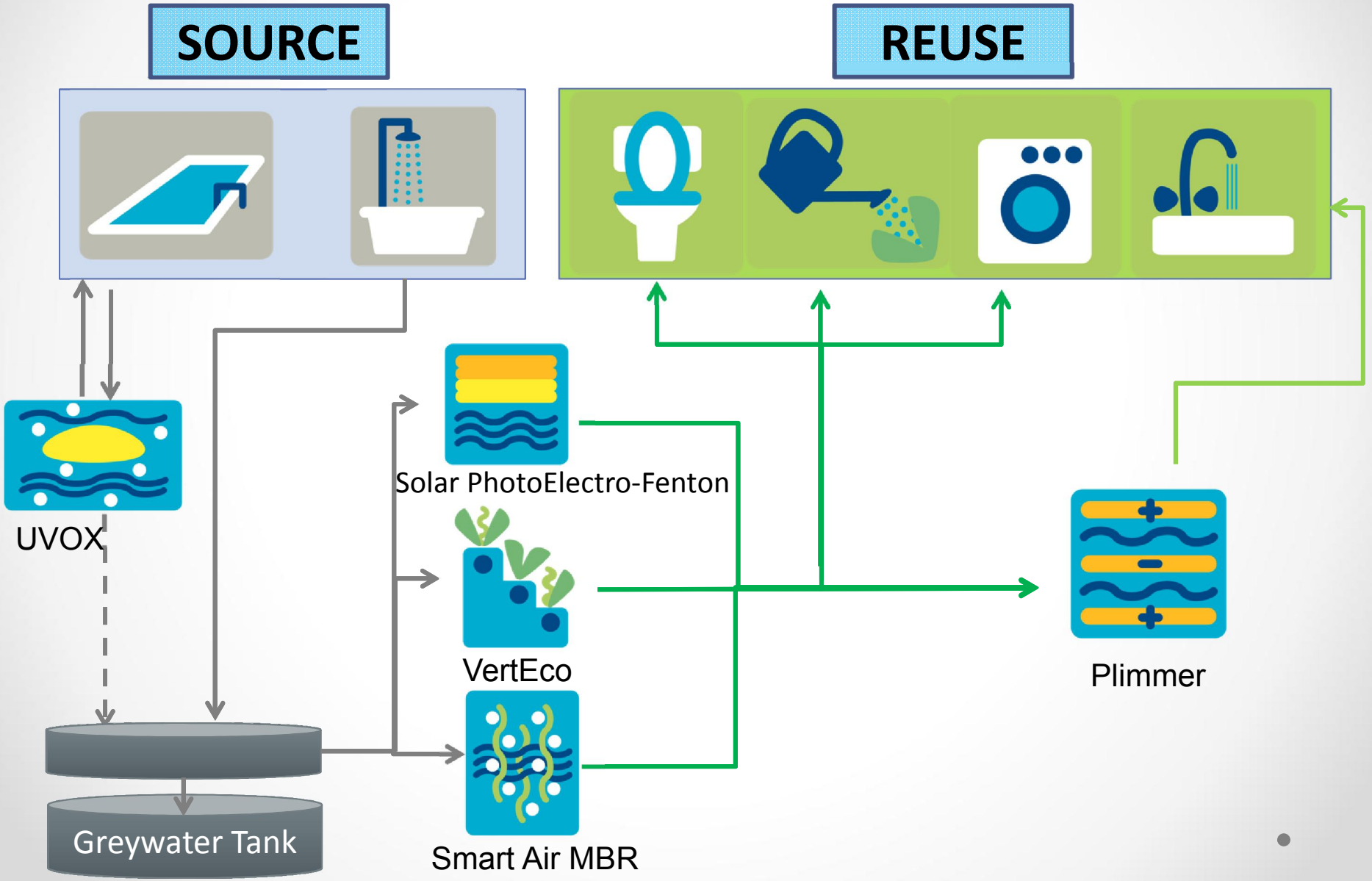
Greywater – ROADMAP



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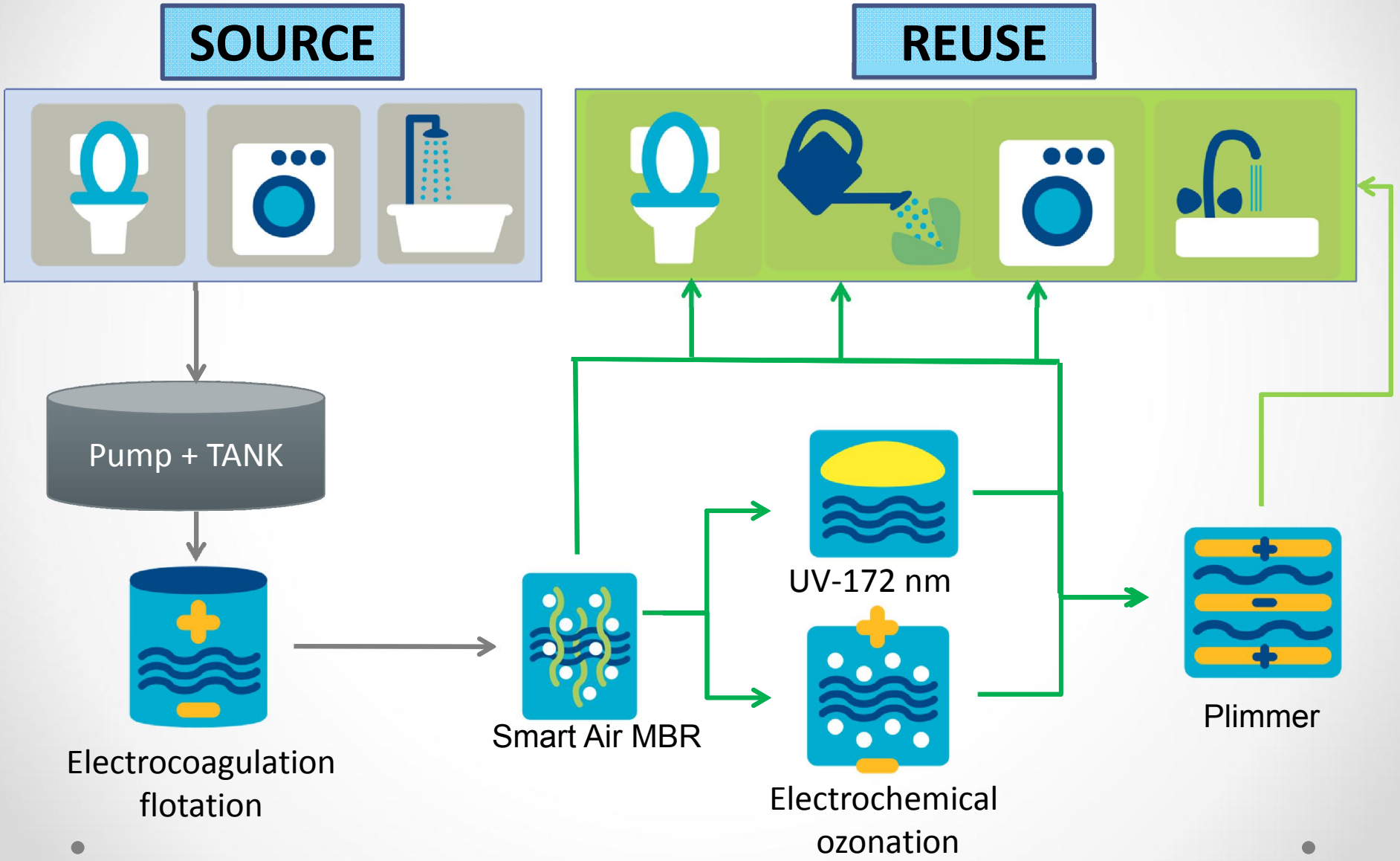
Wastewater – ROADMAP



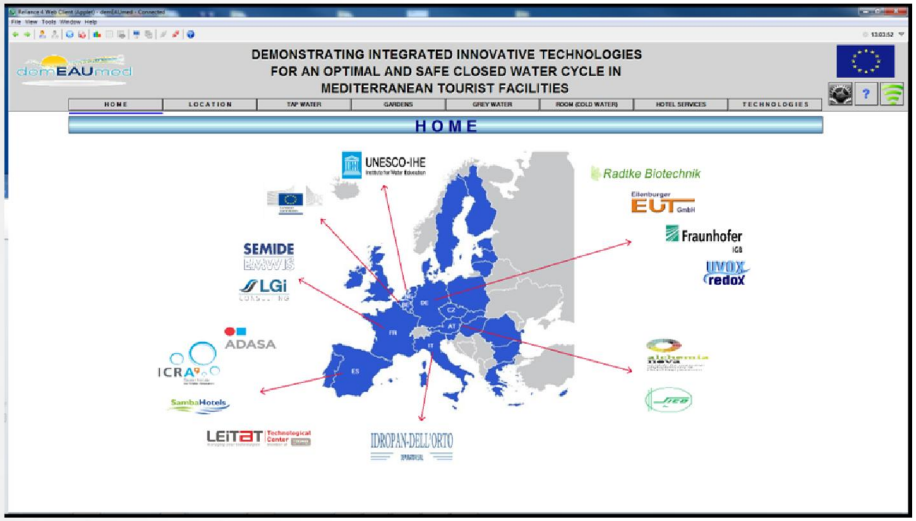
Monitoring and control systems

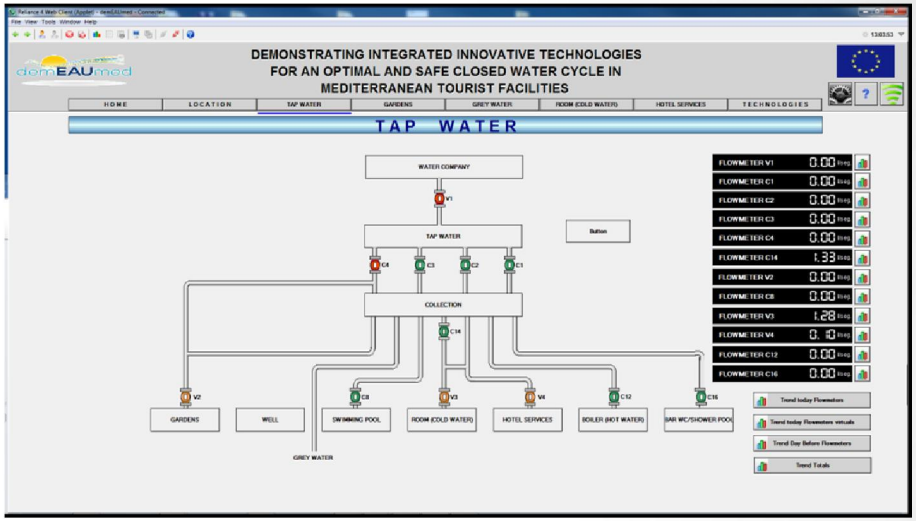
Monitoring and control systems

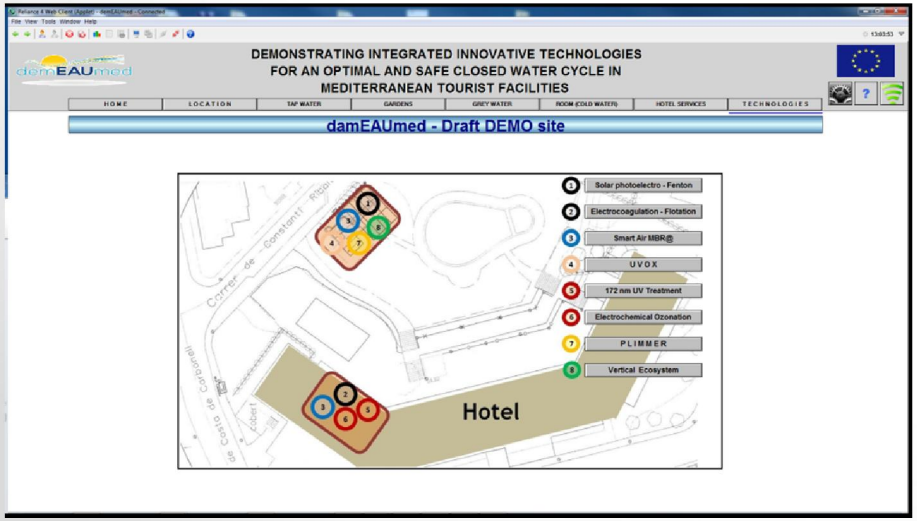
Install sensors for monitoring quantity & quality of water.

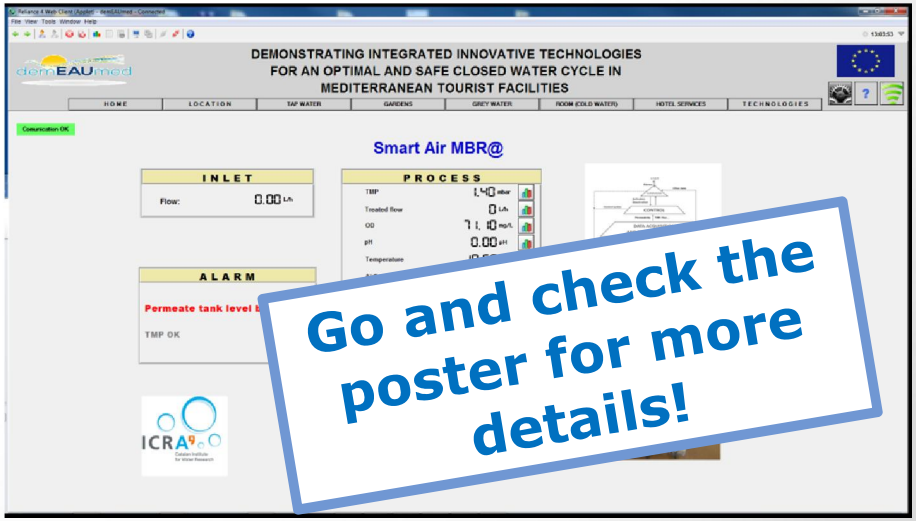
Monitoring and control systems

Integrate data in a processing system and create a Central Acquisition System for store and extract real time and historic data







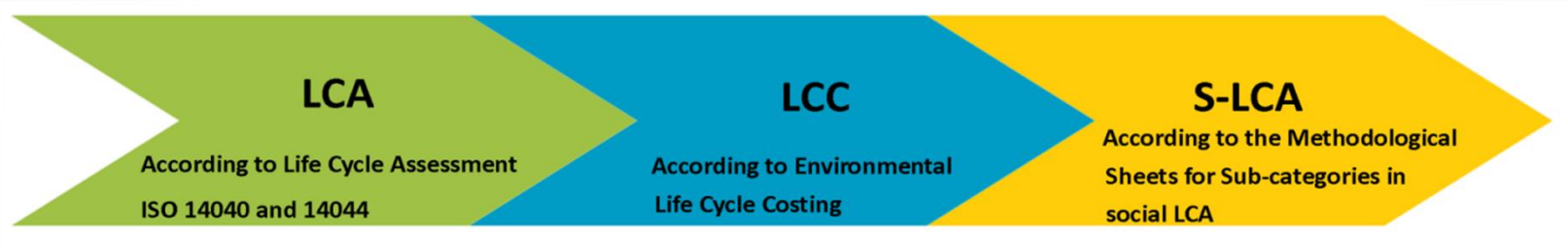


Environmental & Socio-Economical Assessment

Sustainability assessment

Objectives

- Calculate sustainability benefits of **demEAUmed solution compared with non closed-loop water systems**
- Identify **environmentally friendly improvements**
- Provide recommendations in order to **reduce their potential environmental and socio-economic impacts**.



Functional unit (reference unit):
1m³ of grey water/waste water generated and treated to be reused

Data provided by partners!

Environmental assessment

Values for carbon footprint (Kg CO_2 eq.)

GREYWATER technologies (similarly for wastewater)

		Technologies				
		VertECO	MBR	SPEF	Plimmer	UVOX
Technologies	VertECO	0,16		14,49	0,98	
	MBR		1,99	16,38	2,87	
	SPEF			12,96		
	UVOX					-1,42

Water savings: maximum 730 m^3/year per configuration

= twice swimming pool garden water consumption.

Also for Life Cycle Costing (LCC)

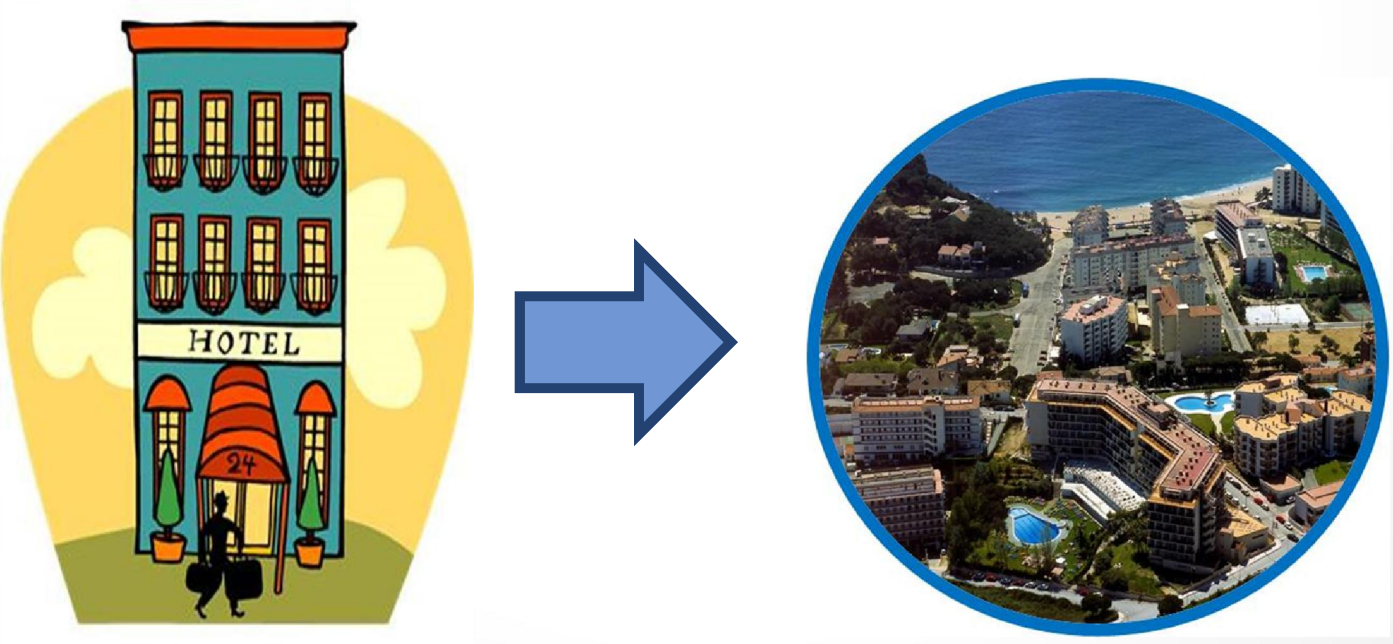
Values for €/m^3 of water treated

Economic savings: maximum 730m^3/year per configuration

= 1795.8 €/year (2.46€/m^3).

Go and check the poster for more details!

How to move back from our DEMO site to Mediterranean hotel facilities



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Survey in different Euro-Mediterranean sites

Decision Support Tool and Modelling

demEAUmed: the results

Help in getting a stronger link between the water and the tourism sectors - for the benefit of both - and enhancing of the visibility of the water sector beyond EU borders:

- **Identify and decrease water footprint (cost)**
  - ✓ Reduction of fresh water consumption
  - ✓ Incorporation of advanced monitoring, control systems and DSS
- **To optimize water management (health)**
  - ✓ Environmental and socio-economic assessment
- **To communicate to client/society (image and market uptake)**

Thank you for your attention

For further information:

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www.icra.cat

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