Two days training on the operation and management of WWTPs

9-10 September, Murcia

International Recommendations for Wastewater Reuse

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BACKGROUND

- Wastewater use is extensive worldwide, and increasing
- 10% of the world's population is thought to consume wastewater irrigated foods.
- 20 million hectares in 50 countries are irrigated with raw or partially treated wastewater.
- Increasingly used for agriculture in both developing and industrialized countries, principal driving forces are:
  - Increasing water scarcity and stress, and degradation of freshwater resources from improper disposal of wastewater.
  - Population increase
  - Growing recognition of the resource value of wastewater and the nutrients it contains.
  - Millennium Development Goals: ensuring environmental sustainability and eliminating poverty and hunger.
- Wastewater can be an excellent resource…

GLOBAL WASTEWATER REUSE

❖ Nowadays are more than 3300 reclaimed water facilities around the world, with different types of treatment precesses for different uses: agriculture, urban services, recreational, industry,indirect potable drinking water production, like recharge of aquifers.

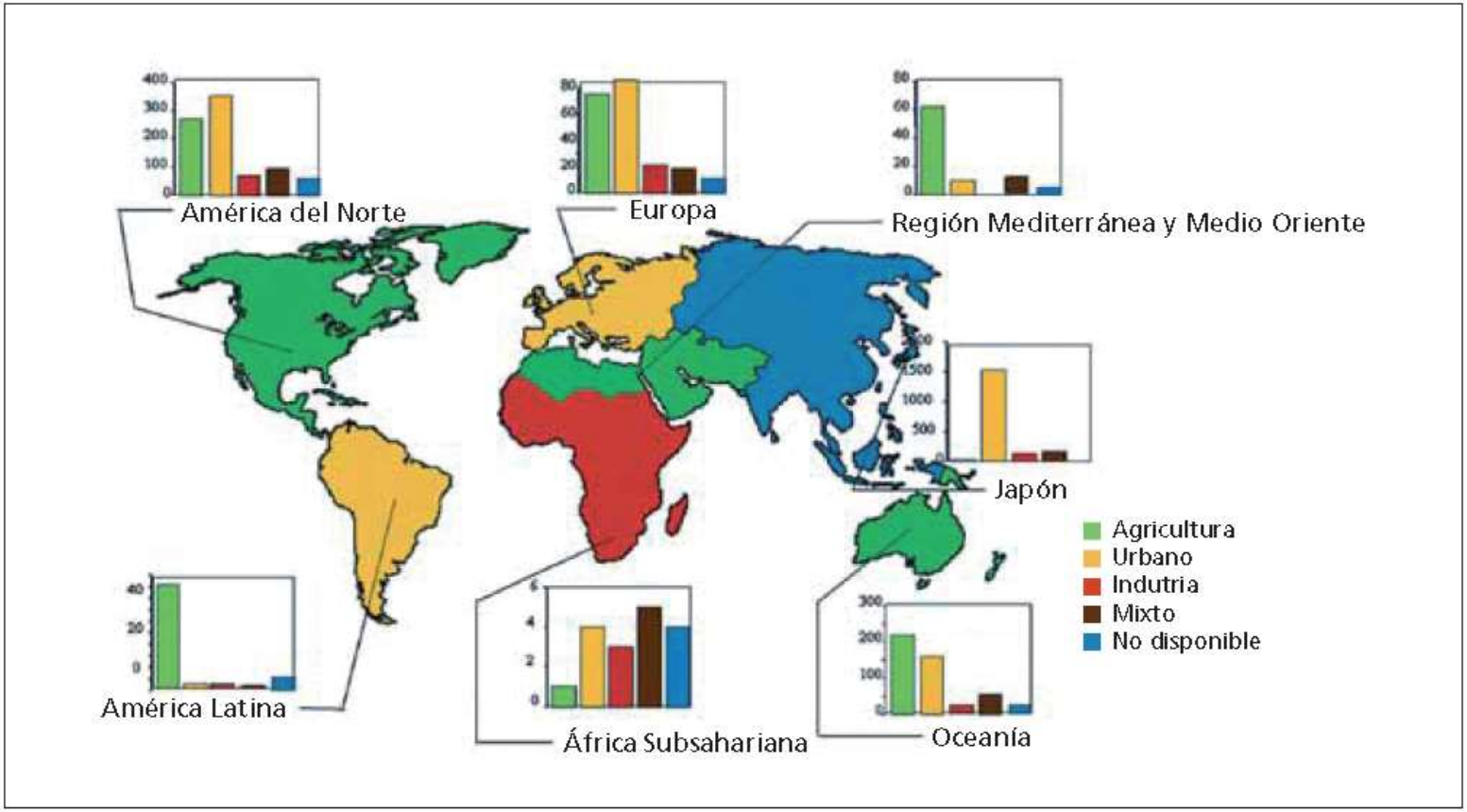
- ✓Most of them in Japan (near1800) and US (near 800)
- ✓Australia (450)
- ✓EU (230)
- ✓Mediterranean zone and Middle East (100)
- ✓Latinamerica (50)
- ✓Sub-Saharian Africa (20)

… and growing!!

Source: FAO 2013

GLOBAL WASTEWATER REUSE

Reuse wastewater system for field application



Source: FAO 2013

REGULATION IN WATER SECTOR

Wastewater reuse needs to be perceived as a measure towards three fundamental objectives within a perspective of integrated water resources management:

Environmental sustainability – reduction of emission of pollutants and their discharge into receiving water bodies, and the improvement of the quantitative and qualitative status of those water bodies (surface-water, groundwater and coastal waters) and the soils.

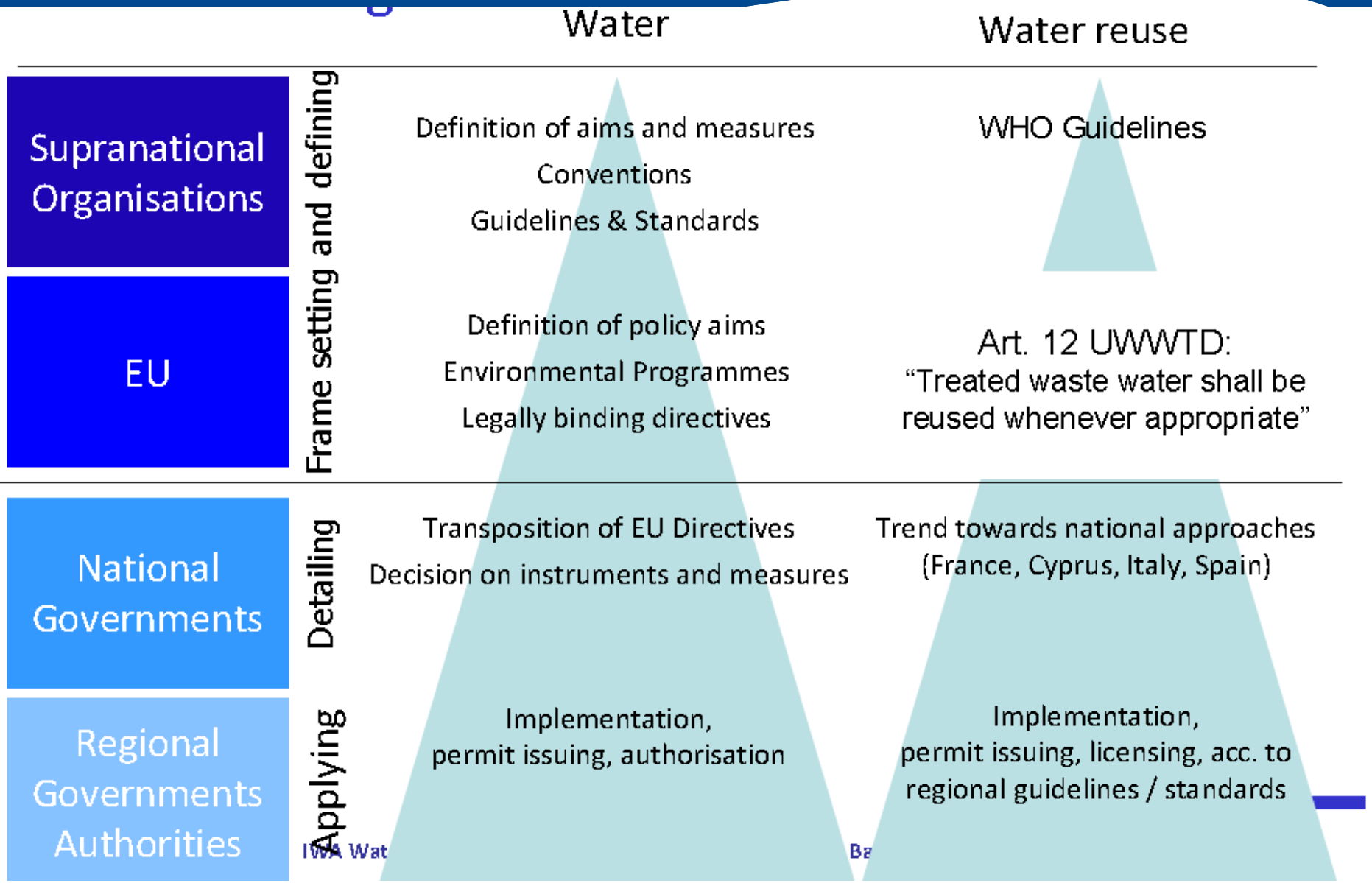
Economic efficiency – alleviating scarcity by promoting water efficiency, improving conservation, reducing wastage and balancing long term water demand and water supply.

For some countries, contribution to **food security** – growing more food and reducing the need for chemical fertilisers through treated wastewater reuse.

In addition to these objectives, the **public health perspective** should be considered.

The most common quality standards which are followed are those by World Health Organisation (WHO) the US-EPA standards, and a few others being applied in some countries.

REGULATION IN WATER SECTOR



WHO GUIDELINES (2006)

Guidelines for the safe use of wastewater, excreta and greywater

Four volumes to better reach different target audiences

Volume 1: Policy and regulatory aspects

Volume 2: Wastewater use in agriculture

Volume 3: Wastewater and excreta use in aquaculture

Volume 4: Excreta and greywater use in agriculture

http://www.who.int

WHO GUIDELINES (3RD Edition)

Objective:

Maximize the ***protection of human health*** and the ***beneficial use*** of important resources

Target Audience:

- Policy makers
- People who develop and enforce standards and regulations
- Environmental and public health scientists
- Educators
- Researchers and engineers

WHO GUIDELINES (3RD Edition)

What are the Guidelines?

Guidelines provide an ***integrated preventive management framework*** for maximizing public health and environmental benefits of wastewater use.

The Guidelines are built around a health component and an implementation component. Health protection is dependent on both elements.

Health components:
Define a level of health protection as health-based targets.
Identify health protection measures to achieve the health-based target.

Implementation components:
Establish monitoring and system assessment procedures.
Define institutional and oversight responsibilities.
Requires:
System documentation; and confirmation by independent surveillance.

WHO GUIDELINES (3RD Edition)
Vol. 1 - Regulation

Ensuring safety in the use of wastewater through the use of a comprehensive risk assessment and risk management approach that encompasses all steps from waste generation, treatment and use to product use and consumption.

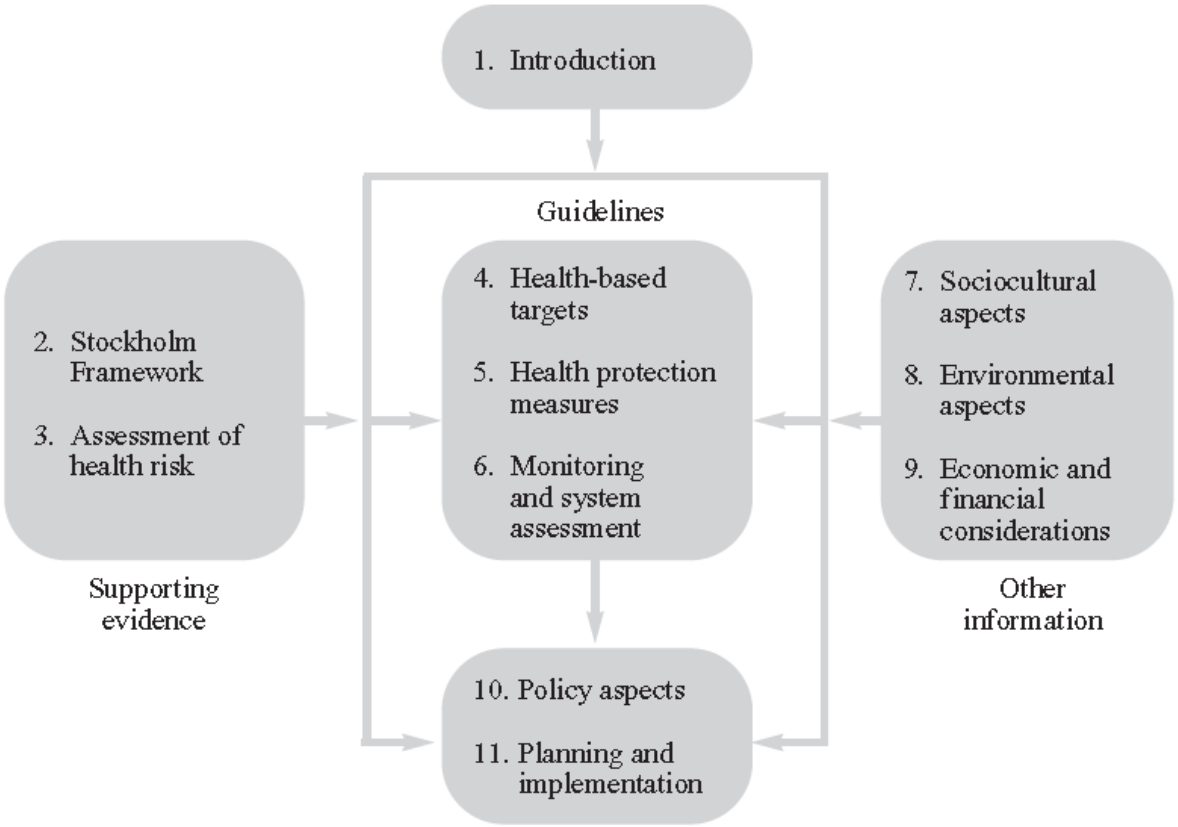
Development of a
RISK MANAGEMENT PLAN

WHO GUIDELINES (3RD Edition)
Vol. 2 - Wastewater use in agriculture

❖ Provides information on the assessment and management of risks associated with microbial hazards and toxic chemicals.

❖Explains requirements to promote the safe use of water in agriculture (including minimum procedures and specific helth-based targets).

❖Stockholm framework for development of water-related guidelines and the setting of health based targets



❖Risk analysis
❖Risk management strategies
❖Chemicals
❖Guideline implementation strategies

WHO GUIDELINES (3RD Edition)
Vol. 2 - Wastewater use in agriculture

QUALITY CRITERIA TO ACHIEVE HEALTH-BASED TARGETS

Exposure scenarios:
-**Restricted irrigation:** use of treated wastewater to grow crops that are not eaten raw by humans
-**Unrestricted irrigation:** use of treated wastewater to grow crops that are normally eaten raw
-**Localized irrigation**

Exposure scenario	Parameter	
	E. coli/100 ml	Helminth eggs/ 10 L
Restricted irrigation	≤ 100.000 (with control of human exposure) ≤ 10.000 (When children under 15 are exposed) ≤ 1.000.000 (highly mechanized agriculture)	≤ 10 ≤ 1 (When children under 15 are exposed)
Unrestricted irrigation	≤ 1.000 (leaf crops) ≤ 10.000 (root crops)	
Lozalized irrigation	No recommendations	≤ 10 (low growing crops)

WHO GUIDELINES (3RD Edition)
Vol. 2 - Wastewater use in agriculture

POLICY ASPECTS

TO HAVE INTO CONSIDERATION:

***Policy*:**
Are there clear policies on the use of wastewater?
Is wastewater use encouraged or discouraged?

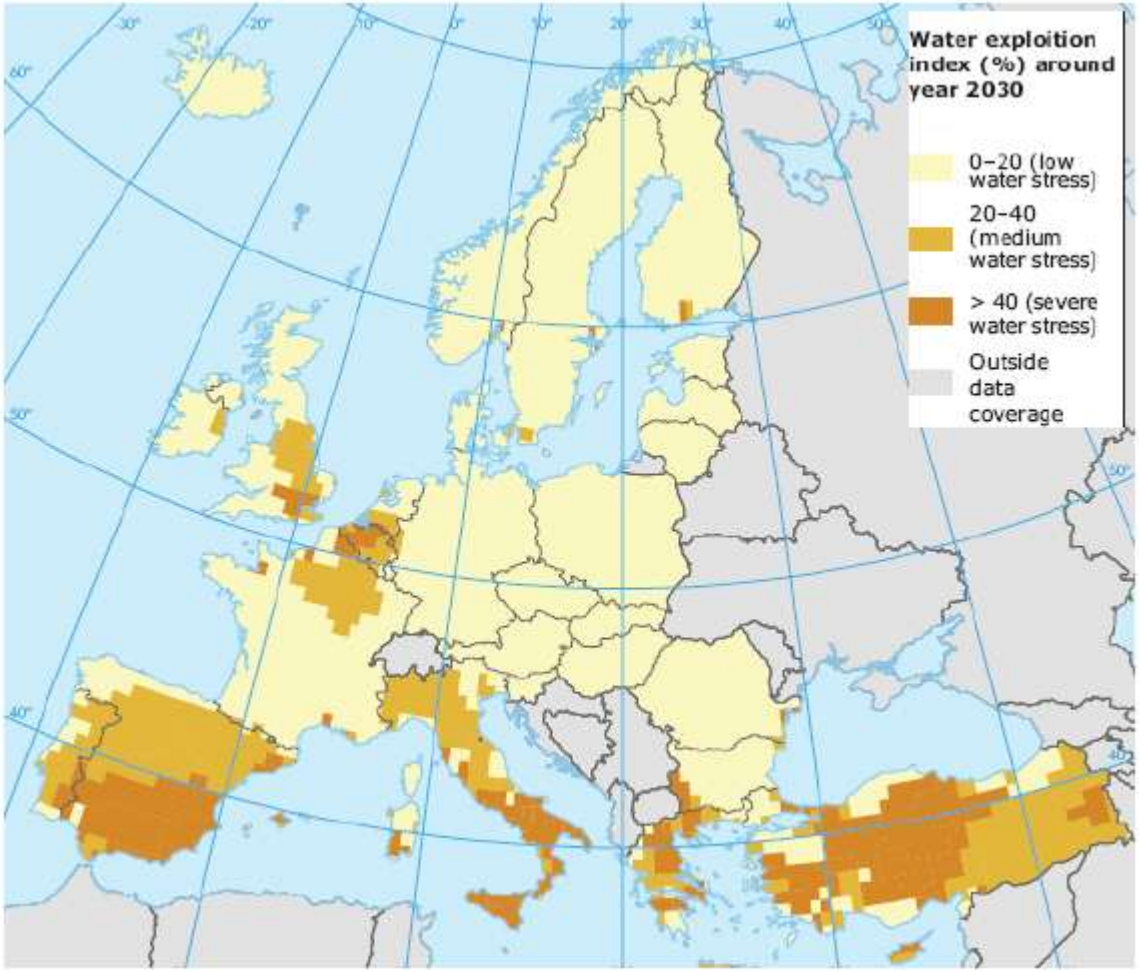
***Legislation*:**
Is the use of wastewater governed in legislation?
What are the rights and responsibilities of different stakeholders?
Does a defined jurisdiction exist on the use of wastewater?

***Institutional framework*:**
Which ministry/agency, organizations, etc. have the authority to control the use of wastewater at the national level and at the district/community level?
Are the responsibilities of different ministries/agencies clear?
Which ministry/agency is responsible for developing regulations?
Which ministry/agency monitors compliance with regulations?
Which ministry/agency enforces the regulations?

***Regulations*:**
Do regulations exist?
Are the current regulations adequate (protect public health, prevent environmental damage, etc.)?
Are the current regulations being implemented?

STATUS OF WATER REUSE AND REGULATION IN EURES MEMBER STATES

Water stress across Europe → Reuse as a mitigation option

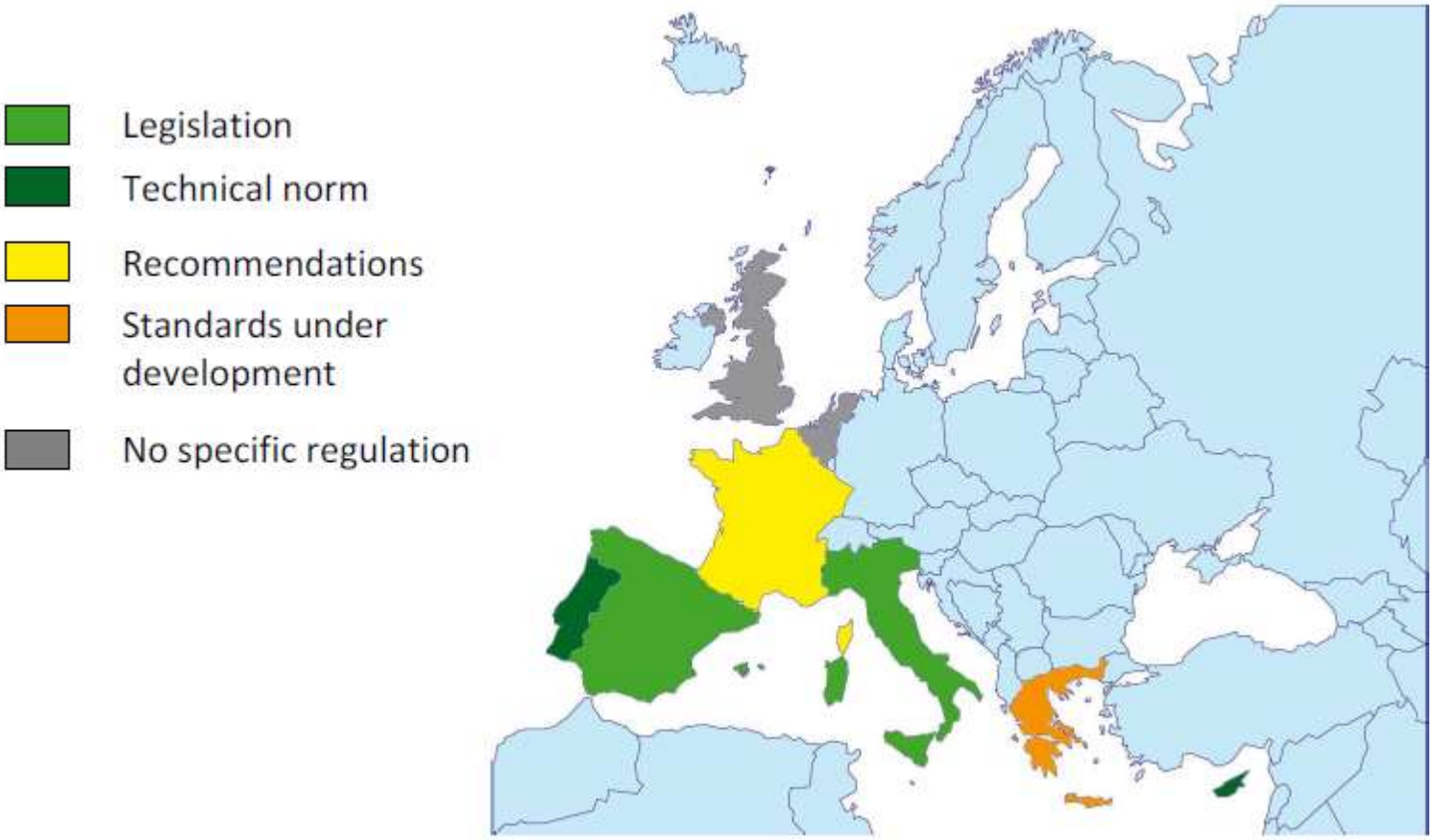


Regions in Europe under water stress (EU EEA, 2007)

STATUS OF WATER REUSE AND REGULATION IN EURES MEMBER STATES

EUREAU
European Federation of National Associations of Water Services

Regulatory frame



STATUS OF WATER REUSE AND REGULATION IN EURES MEMBER STATES

Regulated uses

Reuse application	UK	NL	BE	FR	ES	PT	IT	GR	CY
Agricultural irrigation (AGR)									
Industrial uses (IND)									
Urban uses (URB)									
Irrigation of public greens									
Domestic uses (performed by private persons in their private homes) (DOM)									
Recreational uses (REC)									
golf course irrigation									
Environmental / ecological uses (ECO)									
Aquifer / Groundwater recharge (AQR) /GWR)									
Direct potable reuse									

EXAMPLES OF WATER REUSE PROJECTS CALIFORNIA

California - Aquifer recharge

- Since 1976, Water Factory 21 Direct Injection Project (Orange Country, California).
- Injection of reclaimed water (treatment with reverse osmosis – RO-) into the aquifer to prevent salt water intrusion and augmenting potable groundwater supply.

EXAMPLES OF WATER REUSE PROJECTS: MADRID (SPAIN)

Madrid - Landscape irrigation and urban non-potable uses

- Municipal network (141 km, 36 deposits)
- Use to irrigate 637 hs of urban parks and landscape areas
- 6 hm3/year
- Investment: 132 million €
- Potable water savings: 22.7 million m3/year

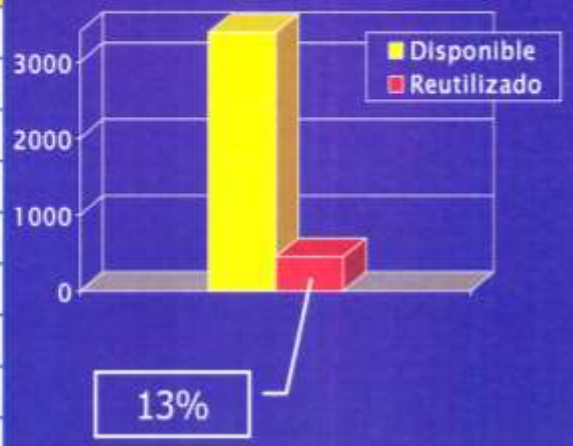
WHY WATER REUSE IN SPAIN?

Factors that have had an influence on the development of wastewater reclamation and reuse in Spain over the last 2 decades:

- ❖ Mediterranean and semi-arid climate in the east, south and south-east
- ❖ Increase in water demand – domestic, touristic, agricultural
- ❖ Periodic droughts
- ❖ Construction of biological wastewater treatment plants throughout Spain, starting by those in coastal touristic communities (Costa Brava, Costa del Sol, Valencia, Murcia, etc.)
- ❖ University scholars dealing with the subject of wastewater reclamation and reuse
- ❖ Close contact with foreign experiences, mostly from US (California, Florida), both at university and water agency levels

SPAIN: REUSE FLOW

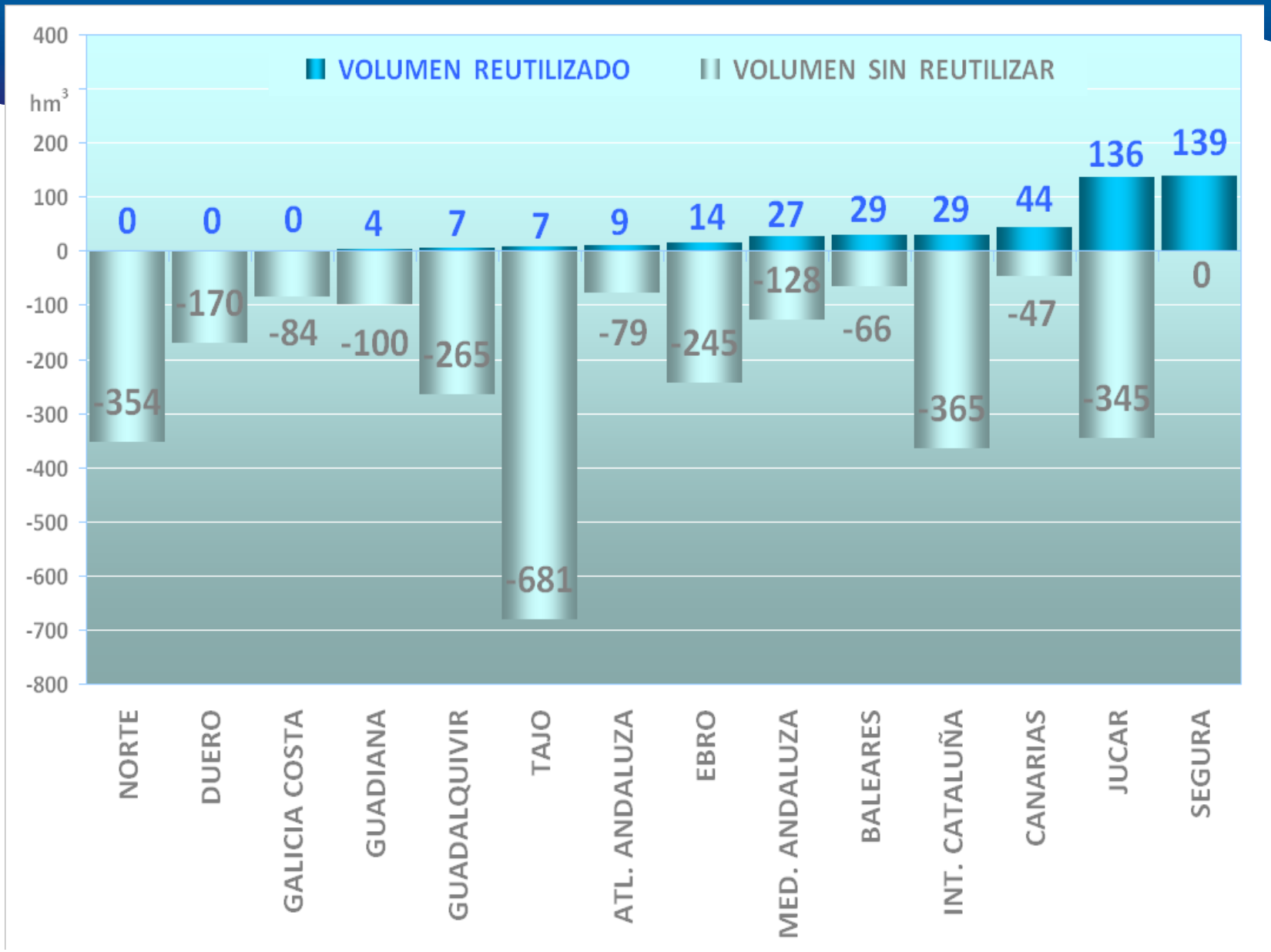
Organismo de Cuenca	Caudal disponible (hm^3/a)	Caudal de reutilización (hm^3/a)	% de reutilización
CH NORTE	353,89	0,00	0,00%
CH DUERO	170,18	0,00	0,00%
CH TAJO	688,37	7,32	1,06%
CH GUADIANA	103,57	3,63	3,51%
CH GUADALQUIVIR	272,04	6,57	2,42%
CH SEGURA	139,20	139,20	100,00%
CH JUCAR	480,99	135,89	28,25%
CH EBRO	259,18	14,48	5,59%
GALICIA COSTA	84,42	0,00	0,00%
CUENCA ATLANTICA ANDALUZA	88,10	9,38	10,65%
CUENCA MEDITERRÁ. ANDALUZA	155,02	27,35	17,64%
CUENCAS INTERNAS DE CATALUÑA	393,70	28,75	7,30%
BALEARES	94,56	28,66	30,30%
CANARIAS	91,91	44,43	48,34%
TOTAL NACIONAL	**3.375,16**	**447,34**	**13,25%**



Datos correspondientes a concesiones

Extracto de información proveniente del CEDEX y las distintas Confederaciones Hidrográficas y Organismos de Cuenca

SPAIN: REUSE FLOW



SPAIN: CONCLUSION

❖ The future of water reuse is essentially focused on the coastal areas of the Mediterranean and South-Athlantic Arc, and the Balearic and Canary Island where it is a strategic non-conventional resource.

❖ Majority use in irrigation

❖ Not an important increase in quantity, but permit a better management.

مع خالص شكري وامتناني

Thank you for your attention

Merci pour votre attention

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