



# Water efficiency in buildings. The Portuguese approach

# Introduction

In a global manner, demographics and economic growth have mobilized increasing volumes of fresh water, and it is expected that in 2025 mankind will use 75% of total available freshwater, creating growing problems of stress and scarcity, exacerbated by climate change.



# Introduction



But it is not easy to be convincing to the lay person as we talk about the need for water efficiency in buildings, when we know that two thirds of our planet are constituted by water, and when we see that this water runs in our taps with a simple gesture.

# Introduction

Many say that citizens will only become aware of the importance of water efficiency when the drinking water in their taps stops running.

But things will not happen like this, possibly... The growing lack of availability of the resource will force the water authorities to look for new sources, which will be more and more distant and will imply stricter treatment requirements, whose effect for the consumer will not result in a lack of the resource, but in a progressive and exponential increase in its price.

# Introduction



This requires that the water authorities change their paradigm of management from a logic of offer to a combined logic of supply-and-demand, as often, in situations of scarcity, water efficiency measures in buildings have lower costs than seeking for new sources and enhance treatments for increased availability.

# Introduction



It should be remembered that water efficiency in buildings does not apply only to reducing consumption, but also to proper management of the differing quality of the origins, depending on the necessary uses.

Indeed, the keywords are quality versus availability.

# Introduction

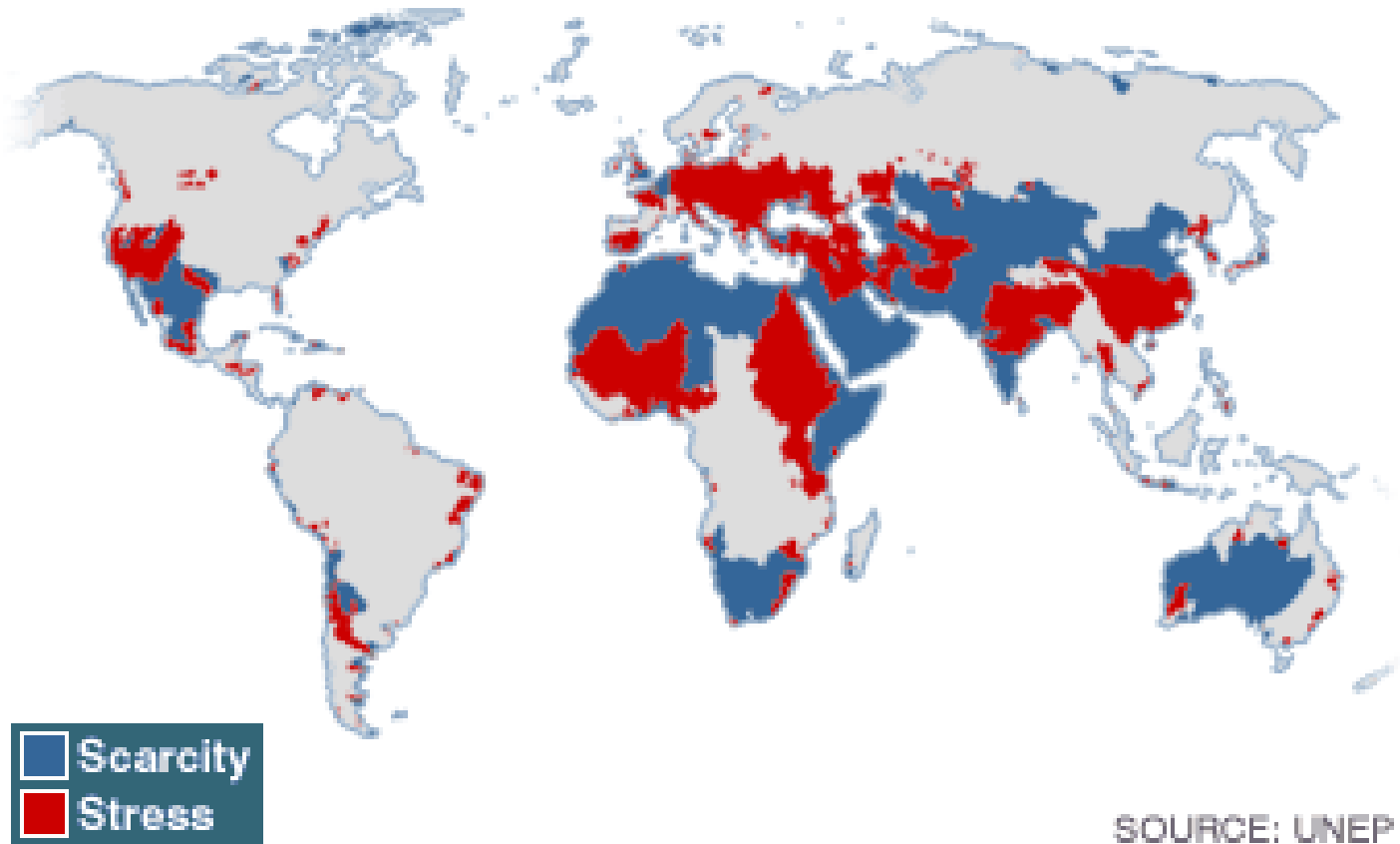


Let me now propose for you the Portuguese Path in this field.

The Portuguese situation is actually the condition of a region of the world with a unique climate, the Mediterranean climate, which is characterized by the availability of water resources in the cold season and long dry periods in the hot season, and where predictions arising from climate changes point to serious situations of water stress or water scarcity, within the coming decade.

# Introduction

## Predicted water scarcity and stress in 2025





# Introduction



Certainly you will imagine that all of the governments of Mediterranean countries have already advanced with ample prevention policies against this scenario.

But no...

The reasons are diverse, such as lack of awareness of the problem among policy makers, lobbies in the water market, economic crises, political crises, etc., etc.

# Introduction



In Portugal, the government has taken faltering steps, perhaps due in part to a combination of all of the causes I have just enumerated. In 2001, a national program for the efficient use of water was drawn up – the PNUEA.

This is an excellent document applicable to all sectors - urban, agricultural, and industrial - but, 15 years later it has not yet been officially implemented.

# Introduction



Aware of the problem, it was civil society, led by universities and companies, that decided to lead the implementation of some of the measures provided in the PNUEA, through a technical and scientific association in the building installations sector, ANQIP – the National Association for Quality in Building Installations, founded in 2007.

# Introduction



With about 200 members, including universities, business firms, water authorities, and individual technicians, ANQIP has developed several initiatives in Portugal, some of which unprecedented at the international level, with a view to developing policies for the efficient use of water in buildings.

# Introduction



Of course, it is not the same thing to be the government or a non-profit civil organization developing these measures. Funding shortages, or the impossibility of establishing mandatory measures, are some of the limitations.

But, as we shall see in the next slides, ANQIP is on the right track, and has already made its way with some success...

# Water efficiency in buildings.

## The 5R principle

- In Portugal, the approach to the problem of water efficiency in buildings has been made based on the principle of the 5R:

# Water efficiency in buildings.

## The 5R principle

- - *REDUCE CONSUMPTIONS*
- - *REDUCE LOSSES AND WASTE*
- - *REUSE WATER*
- - *RECYCLE WATER*
- - *RESORT TO ALTERNATIVE SOURCES*

**WATER  
EFFICIENCY IN  
BUILDINGS**

# Water efficiency in buildings.

## The 5R principle

- The first R - Reduce consumption, passes through the adoption of efficient products or fixtures, notwithstanding other non-technical measures (like economic and behavioural awareness measures).



# Water efficiency in buildings.

## The 5R principle

- The second R - Reduce losses and waste, may involve interventions, for example, of control of losses in flushing cisterns or in watering systems in the gardens or the installation of circuits of circulation of sanitary hot water.

# Water efficiency in buildings.

## The 5R principle

- The reuse and recycling of water, whose difference is to consider uses in "series" or the reintroduction of water at the start of the circuit (after treatment), have been under development over the last few years in several countries, particularly in regard to the use of grey water.

# Water efficiency in buildings.

## The 5R principle

- Finally, the use of alternative sources may involve the rainwater harvesting or the use of ground water or even salt water.
- That was considered that the risks of water stress in Portugal and the high level of inefficiency in the water use in buildings require the immediate implementation of various measures, particularly the promotion of the use of efficient products (1st R).

# Reducing consumption (1st R).

## Water efficiency certification and labeling in Portugal

- With this objective in view, ANQIP launched in 2008 a voluntary certification and labelling system for products.
- As already mentioned, ANQIP is an independent, non-profit association, whose members are several stakeholders of the sector (universities, companies, water authorities, etc.)

# Reducing consumption.

## Water efficiency certification and labeling in Portugal

- ANQIP has opted for labels based on letters (as in the energy certification), because ANQIP believes that citizens are familiar with such kind of labels and more easily understand the message.

# Reducing consumption.

## Water efficiency certification and labeling in Portugal

- However, several studies conducted by ANQIP, with the support of their universities and companies, showed a significant difference in relation to energy efficiency: very low flow rates or volumes can lead to performance problems in the building networks, public health problems or even higher consumption at the end, for reasons of comfort in the uses.

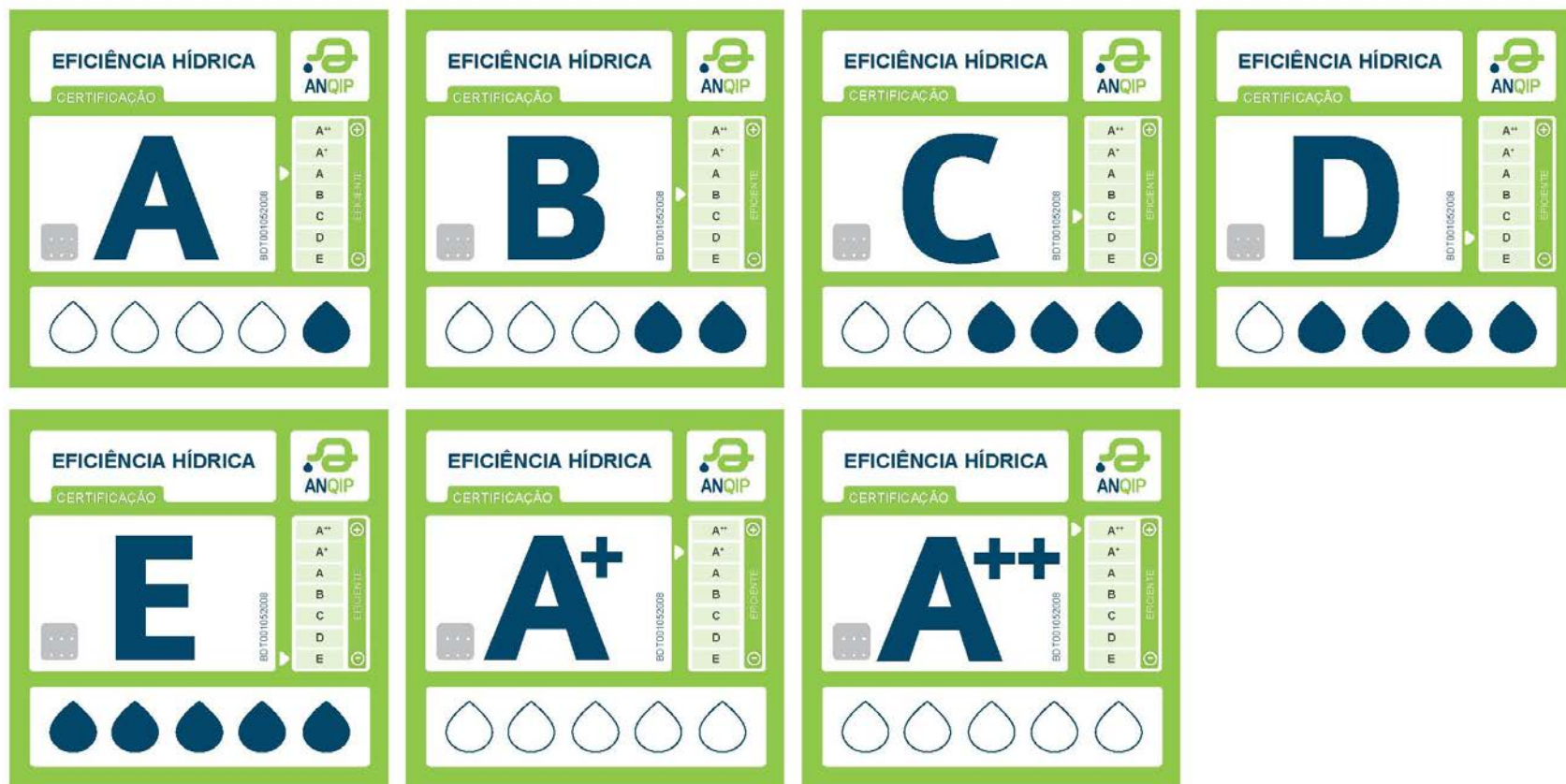
# Reducing consumption.

## Water efficiency certification and labeling in Portugal

- The conclusion is that a "water label" may not be a "water efficiency label"...
- Therefore, ANQIP decided to establish a category of reference, the letter "A", and devices with smaller volumes or flow rates, although labelled with letters A+ or A++, would always be accompanied by warnings about the conditions under which it would be possible (or should be made) its installation or use.

# Reducing consumption.

## Water efficiency certification and labeling in Portugal





# Reducing consumption.

## Water efficiency certification and labeling in Portugal

- ANQIP has drawn up Technical Specifications (ETA) for different products so as to create and establish the necessary benchmark values to be assigned to each letter.
- These Technical Specifications also establish the certification testing conditions (ETA 0802 to ETA 0809 can be freely accessed on the Internet).

# Reducing consumption.

## Water efficiency certification and labeling in Portugal

- Firms signing up for the system will sign a protocol with ANQIP which will define the conditions under which they can issue and use the labels.
- ANQIP, as third party, controls the process by randomly testing labelled products on the market, from time to time. These tests are performed by accredited laboratories.

# Reducing consumption.

Water efficiency certification and labeling in Portugal

Example 1:

## THE CASE OF THE FLUSHING CISTERNS

- Flushing cisterns were regarded as a priority since toilets are one of the biggest consumers of water in buildings in Portugal.
- The following table shows the categories of labelling.

# Reducing consumption.

## Water efficiency certification and labeling in Portugal

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Nominal Volume	Type of flush	Water efficiency rating	Tolerance (max. Volume)	Tolerance (min. volume)
4.0	Dual control	<b>A++</b>	4.0 - 4.5	2.0 - 3.0
5.0	Dual control	<b>A+</b>	4.5 - 5.5	3.0 - 4.0
6.0	Dual control	<b>A</b>	6.0 - 6.5	3.0 - 4.0
7.0	Dual control	<b>B</b>	7.0 - 7.5	3.0 - 4.0
9.0	Dual control	<b>C</b>	8.5 - 9.0	3.0 - 4.5
4.0	Interruptible	<b>A+</b>	4.0 - 4.5	-
5.0	Interruptible	<b>A</b>	4.5 - 5.5	-
...	...	...	...	...
9.0	complete	<b>E</b>	8.5 - 9.0	...

# Reducing consumption.

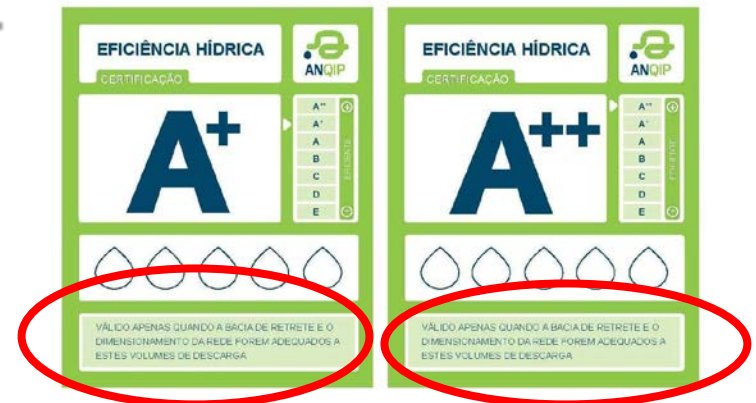
## Water efficiency certification and labeling in Portugal

- As stated before, the minimum recommended volume or flow rates in the products are limited for reasons linked to performance, user-friendliness and public health.
- The use of 4-litre flushing cisterns, for example, has led to problems in the flushing of solids in Portugal. Their usage requires an alteration of the usual criteria of the design of the drainage system.

# Reducing consumption.

## Water efficiency certification and labeling in Portugal

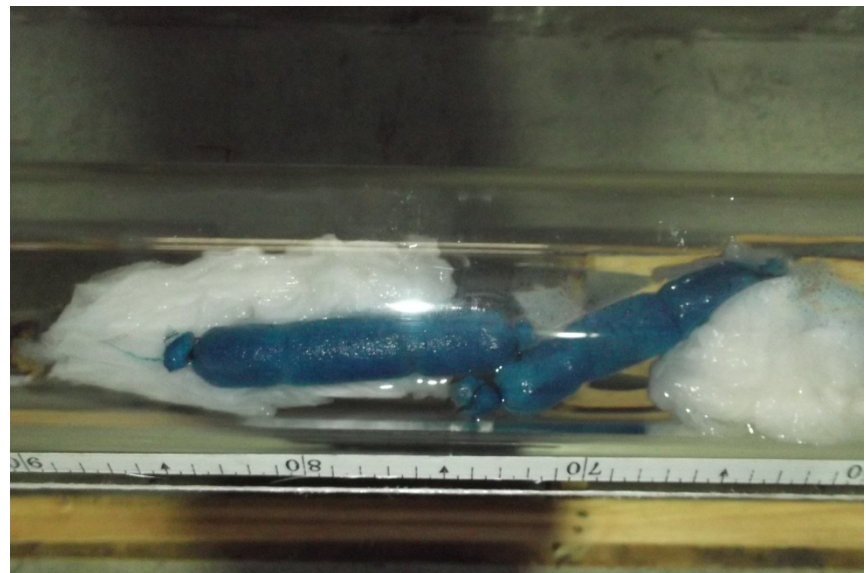
- Based on these facts, ANQIP accepted low volume flushing cisterns belonging to water efficiency categories A+ or A++, but with the obligation that the label should include the warning “valid only when the toilet bowl and the design of the building drainage are appropriated to these discharge volumes”.



# Reducing consumption.

## Water efficiency certification and labeling in Portugal

- ANQIP developed research to establish the conditions under which these low-volume flushing cisterns can be used in Portugal and makes this information available to engineers and consumers.



# Reducing consumption.

Water efficiency certification and labeling in Portugal





# Reducing consumption.

## Water efficiency certification and labeling in Portugal

### Example 2:

#### THE CASE OF THE SHOWERS

- Shower systems and showers represent over 30% of the daily average domestic water consumption volume in Portugal.
- At this level, efficiency reduces both water consumption and the consumption of energy required for the production of hot water.

# Reducing consumption.

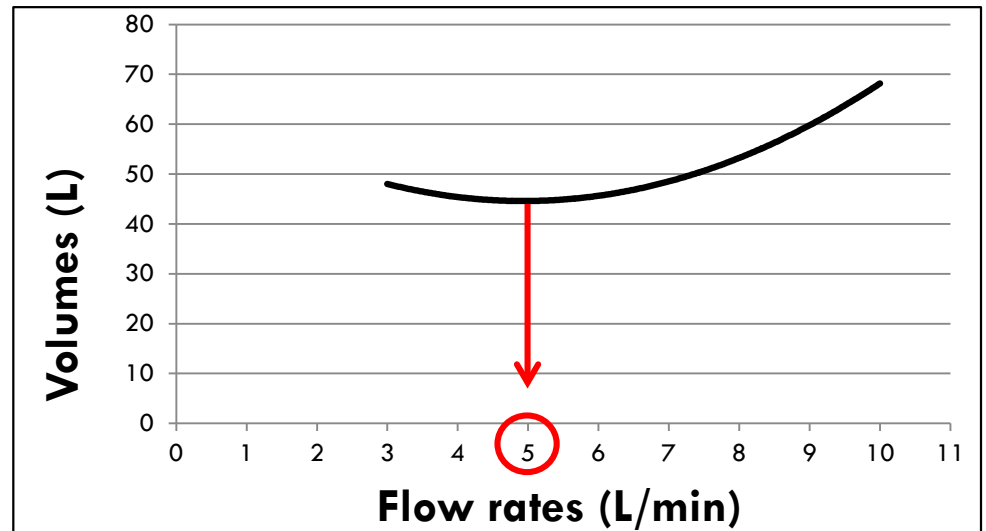
## Water efficiency certification and labeling in Portugal

- For shower systems and showers, the model implemented considers the ideal usage (letter A) to represent a water usage of between 5,0 and 7,2 litres/minute.
- The labels applied to shower heads with a discharge less than 5 l/min must bear the indication “Recommended for usage with thermostatic taps”, due to the increased risk of scalding.

# Reducing consumption.

## Water efficiency certification and labeling in Portugal

- In this case, the category "A" has been set taking into account several studies that have shown that there was a tendency to stay longer in the shower when the flow rate was very low in current devices, thereby increasing the total volume consumed.



# The use of efficient products

## Evaluation of the impact

- Numerous water efficiency studies and audits performed by ANQIP revealed possible water savings in buildings between 30% and 45% with the use of labeled products in category "A", compared to the current base scenario in Portugal.
- Taking into account the energy consumption associated with water consumption in buildings, the studies conducted by ANQIP revealed an additional potential very significant in energy efficiency and reducing emissions of greenhouse gases.

# The use of efficient products

## Evaluation of the impact

City of Aveiro Component of the urban water cycle	Annual energy savings and CO <sub>2</sub> reductions with the use of water efficient products			
	Per person (kWh)	Per person (kg of CO <sub>2</sub> )	Per family (kWh)	Per family (kg of CO <sub>2</sub> )
Building system (only sanitary hot water heating)	368	88.3	846	203.1
Public system of water supply	32	7.7	74	17.7
Public system of drainage and treatment of wastewater	23	5.5	53	12.7
<b>TOTAL</b>	<b>423</b>	<b>101.5</b>	<b>973</b>	<b>233.5</b>

# Rainwater harvesting systems

- In the context of the alternative sources, the systems of rainwater harvesting in buildings has experienced great development in several countries (Brazil, Germany, etc.), not only for reasons of rational water use, but also as a contribution to the reduction in peak flood in periods of precipitation.

# Rainwater harvesting systems



- Taking into account the impacts of climate change on urban water cycle, this will be one of the most important measures of adaptation and increasing the resilience of buildings in the future.

# Rainwater harvesting systems



- It should be noted, however, that the so-called Mediterranean climate is not ideal to rainwater harvesting systems, since the summers are typically hot and dry and the winters are cold and wet.



# Rainwater harvesting systems

- The characteristics of the Mediterranean climate, in particular the long dry period, require attention to two aspects in particular:
- a) the need to consider the diversion of the first flush, for reasons and water quality;
- b) the necessity of sizing the tank with base on a technical and economic study, admitting the possibility of a supply from the public network during the dry season.

# Rainwater harvesting systems



- For the design, sizing, construction and maintenance of these installations in Portugal, ANQIP developed a Technical Specification (ETA 0701).

# Rainwater harvesting systems

- In general, the maximum storage period considered in these systems is 3 weeks. However, this value is not convenient for Mediterranean climates, due to the prolonged droughts.
- In the ETA 0701, the recommended storage period may extend up to 90 days. This decision is supported by studies conducted by ANQIP in collaboration with national health authorities, through the monitoring of pilot installations.

# Rainwater harvesting systems

- The studies conducted by ANQIP have included research of *legionella*, especially when rainwater is used for watering.



# Rainwater harvesting systems

- However, it is observed the existence of many installations in Portugal made without the necessary technical requirements and safeguards of public health.
- As may be involved issues of public health, ANQIP also drew up a technical specification for voluntary certification of these installations (ETA 0702) and supports the implementation of compulsory certification schemes, through national legislation or European Directives.

# Rainwater harvesting systems

- The ETA 0701 considers the following possible uses:
  - flush toilets
  - Washing clothes
  - Washing floors, cars, and so on
  - Watering gardens, lawns, parks, etc.
  - Industrial uses (cooling towers, fire fighting systems, HVAC, etc.)

# Reuse and recycling of greywater

- The reuse and recycling of greywater are included in the third and fourth R, and ANQIP developed also a Technical Specification for these systems (ETA 0905).
- In residential buildings this water generally comes from the discharges of baths, sinks and showers but, in certain conditions, the discharges from washing machines or even wastewater from kitchens can also be considered.

# Reuse and recycling of greywater

- The ETA 0905 applies to centralized systems, with treatment, but is under review to include short retention time systems.
- The Specification ETA 0905 states that a Water Safety Plan must be prepared for the systems of reuse and recycling of grey water in buildings, with an initial version the installer's responsibility, but periodically updated by the user.



# Reuse and recycling of greywater

- This Safety Plan must include, at least, the following chapters:
  - Description of the installation;
  - Risk analysis;
  - Criteria for the evaluation of the conformity of the quality of regenerated water;
  - Procedures in the event of a fault or serious problem (Action Plan).

# Reuse and recycling of greywater

- For technical and public health reasons, ANQIP recommends a certification under the terms of the Technical Specification ETA 0906, which requires the prior examination of the project by ANQIP, inspections during the construction, certification of installers, as well as a Safety Plan also approved by ANQIP.
- This certification is voluntary, but ANQIP is seeking from the national health authorities to establish it as mandatory.

# Reuse and recycling of greywater

- The ETA 0905 considers the following possible uses for the regenerated greywater:
  - Flushing toilets
  - Washing clothes
  - Watering gardens, lawns, parks, etc.
  
- The washing of clothes should not be carried out at temperatures less than 55° C.

# Other measures

## Water efficiency audits and certification of buildings

- In existing buildings, water efficiency audits can lead to very significant results. With the use of flow reducers or replacement of flush toilets mechanisms, for example, can be obtained very significant water savings with relatively short payback periods.
- ANQIP has extensive experience in audits in non-residential buildings (hospitals, shopping malls, public swimming pools, schools, stadiums, etc.) with results in water savings from 10 to 55%.

# Other measures

## Water efficiency audits and certification of buildings

- However, for reasons of performance, comfort in use and public health, the products that can be applied to reduce consumption (reducers, for example) must be certified (ANQIP makes a certification to confirm the flow rates under several pressures).
- ANQIP has also developed, in conjunction with the University of Aveiro, a scheme for voluntary certification and labeling in buildings (in terms of water efficiency), but has decided to offer this model to government entities for future implementation.

# Next steps...

- After the “energy efficiency” in buildings, our concerns should turn to for “water efficiency” and to the “water-energy nexus”.
- But in a not too distant future, our concerns will certainly head into the nexus water-nutrients, due to the increasing scarcity of phosphorus, for example, and their elimination essentially through the building water cycle (urines).

# Next steps...



- So, the way forward will certainly be towards a fully sustainable building, where all the resource management will inevitably be interdependent.
- A building...
  - zero-energy,
  - zero-water
  - and zero-nutrients...

Thank you very much for your attention

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