BIOAZUL

WATER • ENERGY • ENVIRONMENT

WATER TREATMENT TECHNOLOGIES FOR TOURIST FACILITIES

GreenInMed Project
Water Efficiency Solutions

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1. Objectives of the report

The objective of this report is to summarize the work carried out by **BIOAZUL SL** for the Spanish Chamber of Commerce within the GreenInMed project.

We can synthesize the work in the following points:

- Analysis of the document “Water and Energy Saving Technologies” and its “Catalogue of solutions available for the hospitality industry”, which includes the water technology factsheets.
- Analysis of the water saving and reuse technologies collected by the project partners and analysis of the Spanish hotel industry.
- Addition of new water saving and reuse technologies applicable in the Mediterranean hotel industry.
- Identification of best practices in Spain for technologies included in the benchmark analysis.
- Identification of relevant sources of information or publications, as well as suppliers of technologies.

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2. Methodology

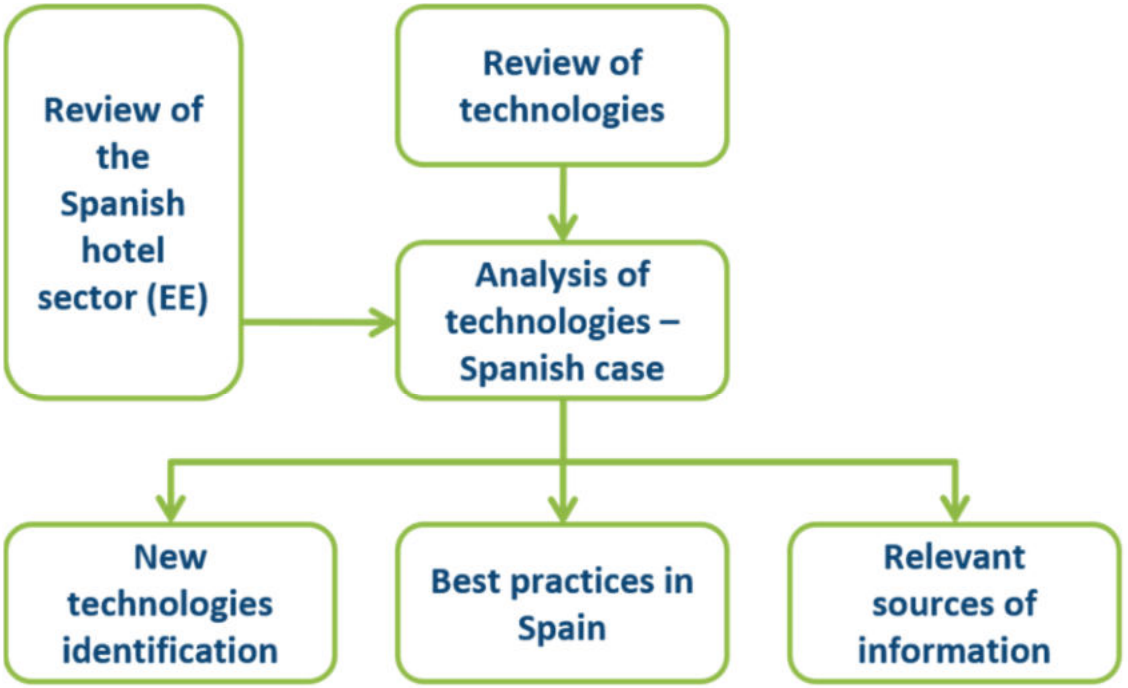
The figure shows the steps and methodology followed by **BIOAZUL SL**. based in the same scheme of the energy saving technologies

Firstly, a review of the 45 water reuse technologies was carried out based on the information included in the factsheets.

Secondly, a revision of the current situation in the Spanish tourist sector was performed, identifying specific reports and official figures suitable for the objectives of the project.

Thirdly, an evaluation and ranking of the technologies was performed with these two inputs in mind.

Finally, additional water technologies were identified and described in a factsheet-format, as well as a set of best practices (cases studies) per technology in Spain, while a number of relevant references and sources of information were also included.



Source: BIOAZUL based on AIDIMME

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3. Definition of the analysis parameters

The parameters used in the analysis of the water technologies are classified in two types:

- Classical decision parameters used by managers to take decisions regarding water use and water efficiency projects.
- Parameters identified as relevant and differentiating for the Spanish case, which identify some of the technologies as more appropriate than others.

Classical decision parameters

(1) Operation & Maintenance simplicity
(2) Water saving potential

Spanish case – parameters to consider

(3) Location: coast vs interior
(4) Hotel category / size

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3. Definition of the analysis parameters

Classical decision parameters

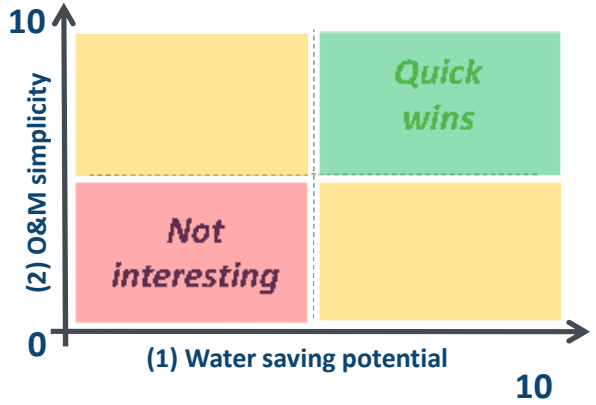
There are two classical parameters used by managers to decide whether the implenentation of a technology to sabe and/or reuse water is convenient. With this two parameters it is possible to represent all of the options in a decision matrix where it is easier to identify the “quick wins” solutions and the “not interesting” options.

(1) **Water saving potential** represents the capacity of a technology to save water resources compared to a conventional system or to the absence of such technology. High values represent technologies with a high potential to save water while low values reflect a minimal capacity to save water.

(2) **Operation & Maintenance simplicity** indicates how easy or simple it is to operate and maintain a technology after installation. The situation is considered positive when values are high, meaning the technology is easy and affordable to operate and maintain. On the contrary, low values translate into more complex technologies to operate as well as more requirements for maintenance.

Classical decision parameters

(1) Water saving potential
(2) O&M simplicity



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3. Definition of the analysis parameters

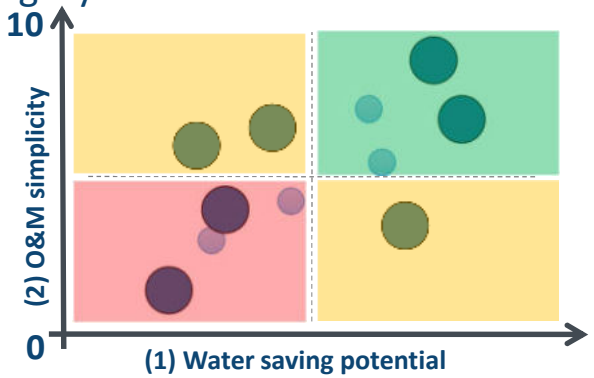
Spanish case - parameters to consider

Two additional parameters have been identified to differentiate the Spanish context from other European countries. The analysis of these parameters, in combination with the previous classical decision parameters, allows for the identification of the most suitable technologies for Spanish hotels.

3) **Location.** The consumption of freshwater might be affected by the availability of water resources in the region where the hotel is located. In this sense, we have differentiated between coastal and interior areas, as hotels are more numerous in the coast and water technologies will be have a major impact in areas with droughts and water shortages episodes which are more common in the coast.
4) **Hotel category / size**. Hotels with four or more stars consume larger volumes of water as they usually offer more services intensive in water consumption (e.g. swimming pool, spa, jacuzzi, etc.), include more capacity to accommodate guests, and might be able to implement technologies having large footprints. Consequently, there is a difference in water consumption based on the category of the hotel.

Spanish case – parameters to consider

(3) Location: coast vs interior.
(4) Hotel category / size.



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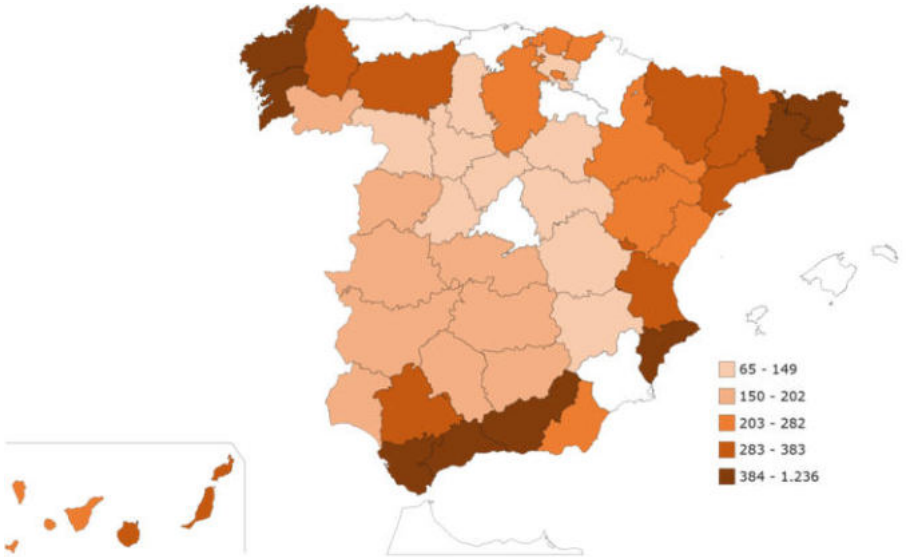
3. Definition of the analysis parameters

Spanish case - parameters to consider

(3) Location: coast vs interior

- From all tourist establishments available in Spain, tourists spent in 2018 almost 73% of their total nights in **hotels**. According to the National Institute of Spain [1], most of the hotels in the country are located in coastal areas or near the coast.



Number of hotels by regional area in Spain
Source: INE (National Statistics Institute of Spain) [1]

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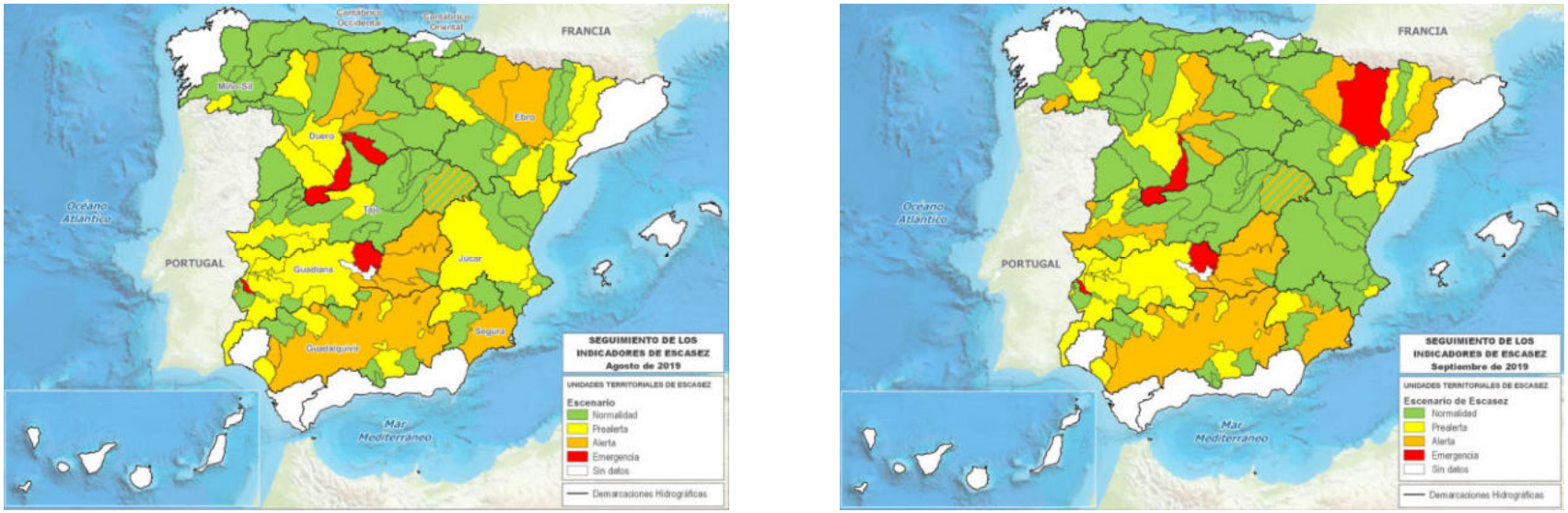
3. Definition of the analysis parameters

Spanish case - parameters to consider

(3) Location: coast vs interior

- During summer and autumn seasons, coastal and interior regions usually suffer from water scarcity and water shortages episodes. Water scarcity is an increasingly frequent and worrying phenomenon, and Spain is currently using up to 20% of its total long-term freshwater resources every year (European Commission, 2010) [9].



Water scarcity indicators in Spain *(left: August 2019; right: October 2019)*
(green=normal, yellow=pre-alert, orange= alert, red=emergency)
Source: MITECO (Ministry for Ecological Transition and Demographic Challenge) [2]

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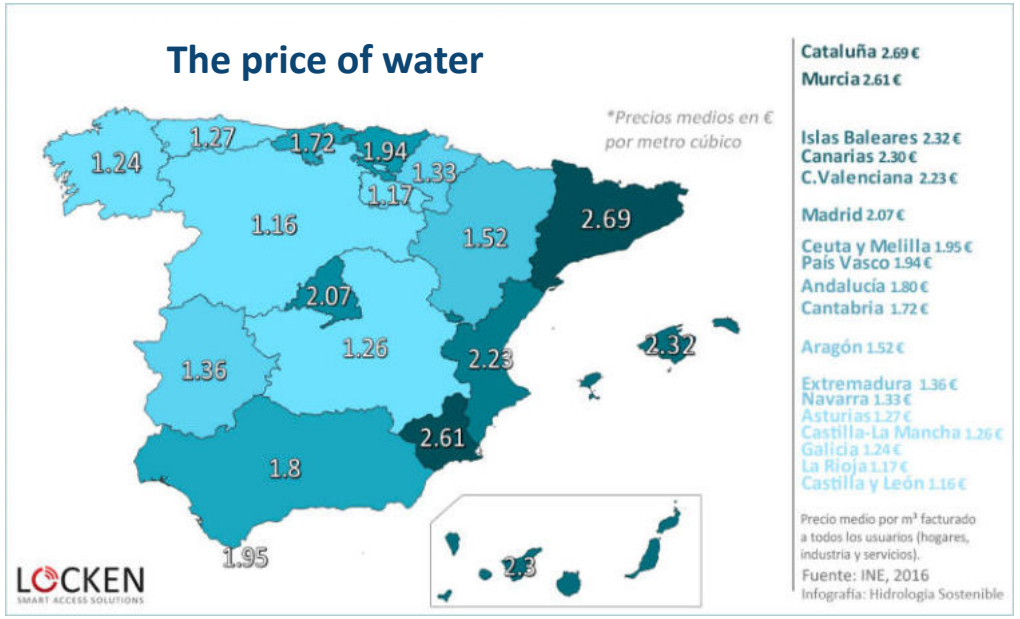
3. Definition of the analysis parameters

Spanish case - parameters to consider

(3) Location: coast vs interior

- The average price of freshwater (EUR/m^3) charged to final users (including households, industry and services) in coastal areas of Spain (e.g. Catalonia, Murcia, Valencian Community and Analusia) is generally higher than in interior regions.



Average price charged to all users (households, industry and services) in EUR per m^3

Source: INE (National Statistics Institute of Spain) obtained from iagua magazine [1]

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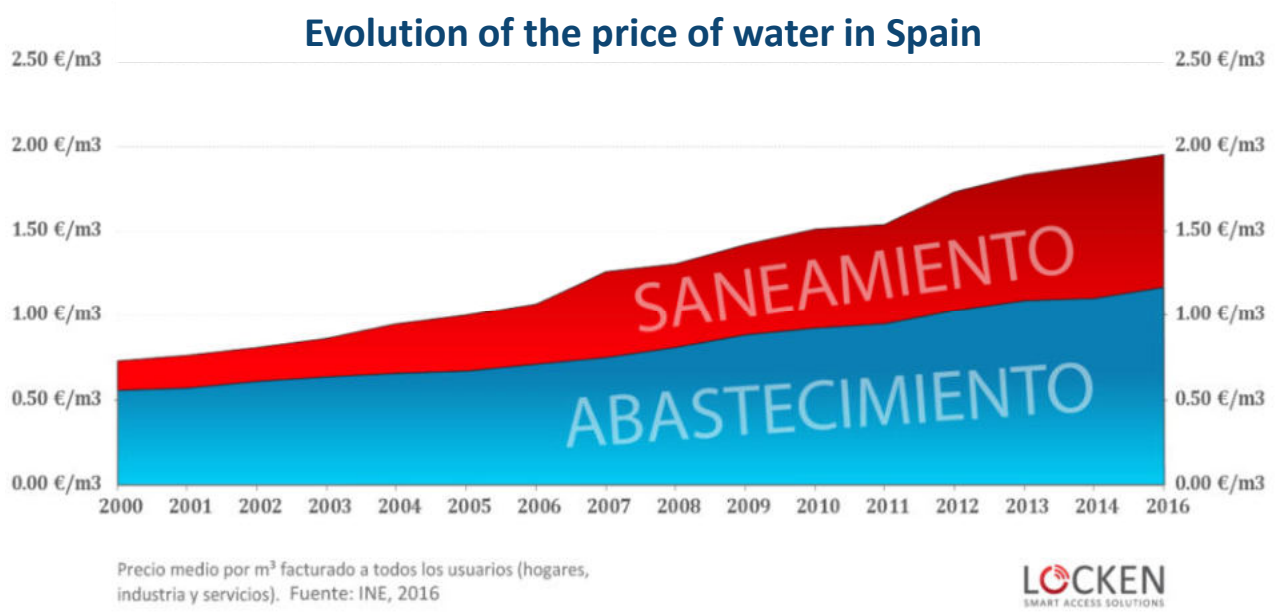
3. Definition of the analysis parameters

Spanish case - parameters to consider

(3) Location: coast vs interior

- Moreover, the water price charged to users has been steadily increasing for the last 20 years.



Average price per m³ charged to all users (households, industry and services) *(red = sanitation; blue = freshwater supply)*
Source: INE (National Statistics Institute of Spain) obtained from iagua magazine [1]

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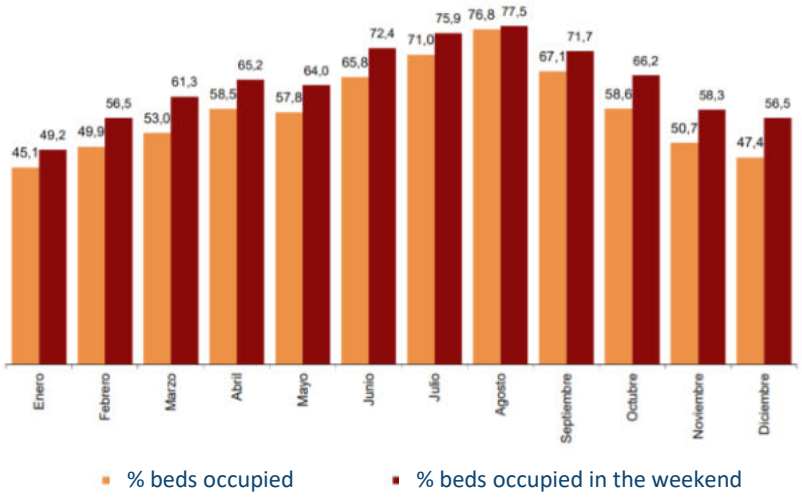
3. Definition of the analysis parameters

Spanish case - parameters to consider

(3) Location: coast vs interior

- The occupation of rooms and beds in Spain varies significantly throughout the year. There is a clear demand during spring and summer, and hotels increase their capacity in this period. The consumption of freshwater is affected and exacerbates during these months.

Hotel occupation per month in Spain (2019) (% beds occupied)



Source: INE (National Statistics Institute of Spain) [1]

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3. Definition of the analysis parameters

Spanish case - parameters to consider

(3) Location: coast vs interior

- In a water-scarce country like Spain, the concentration of tourism during the summer poses an enormous pressure on water resources in a period when they is already significant pressures due to the high temperatures and low rain fall.

The use of water by tourists in Spanish hotels in 2019	
Total number of guests in hotels 2019	108,614,602
Overnight stays in hotels 2019 Spain (a)	343,084,258
Average water use in hotels per tourist per day[1] (liters) (b)	283.2
Total tourist-related water use in Spanish hotels, 2019 (Hm^3/year) (a x b)	97.16 Hm^3/year

[1] *Estimate from Gössling (2012) [3].*

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3. Definition of the analysis parameters

Spanish case - parameters to consider

(3) Location: coast vs interior

Facts regarding the Spanish case:

- The majority of the hotels in Spain are located in coastal areas.
- The capacity and occupation during hot/warm months (spring-summer-autumn) is higher than in the rest of the year. Water consumption is consequently variable (higher demand in summer).
- There is an increased demand for water in the coast, due to the warmer temperatures, as hotels need to irrigate hotel green areas and gardens, pool maintenance, etc.
- Depending on geographical location, environmental and/or climate conditions (coast vs interior), the main water-consuming factors are irrigated gardens, swimming pools, spa and wellness facilities, as well as golf courses, followed by cooling towers (where used), laundry and cleaning, guest rooms and kitchens.

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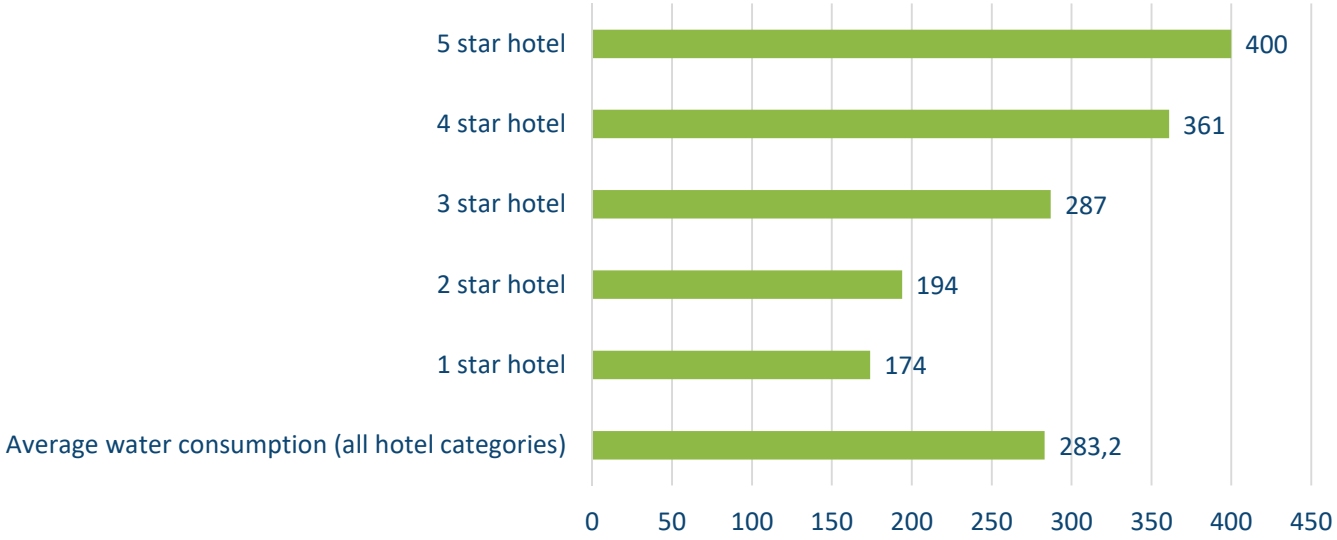
3. Definition of the analysis parameters

Spanish case - parameters to consider

(4) Hotel category / size

Overall, there is a tendency for higher-standard accommodation (4 star and 5 star hotels) to consume significantly higher water volumes, because of the higher number of rooms, with findings that the highest water use rates occur in hotels with spas and large or multiple swimming pools, landscaped grounds, golf courses, etc.

Average water consumption per hotel



References: Rico-Amoros (2009) [4] and WWF (2004) [5]

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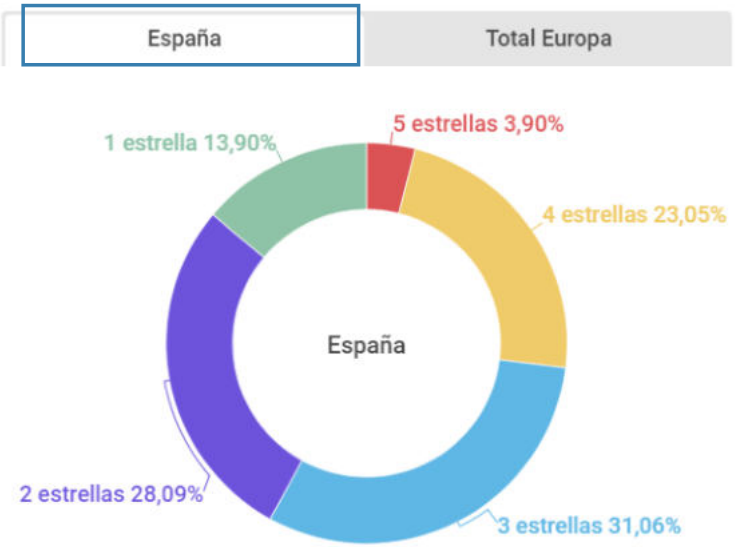
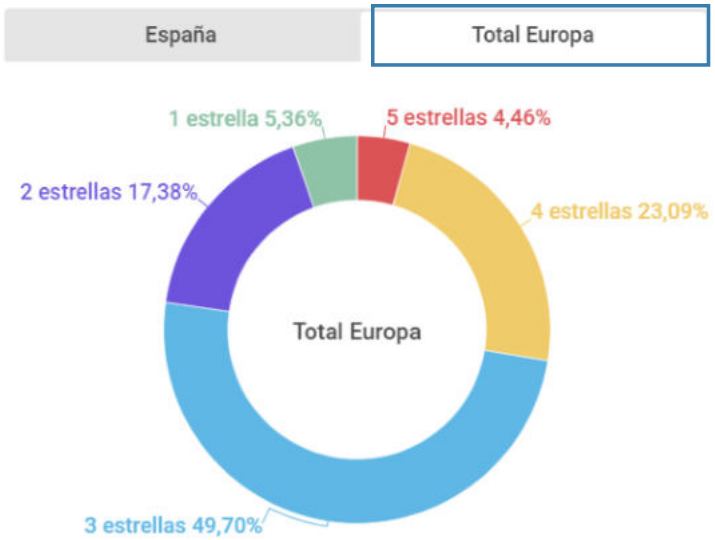
3. Definition of the analysis parameters

Spanish case - parameters to consider

(4) Hotel category / size

In Spain, the number of 5 star hotels is a bit lower than in Europe; there is a similar percentage of 4 star hotels; less hotels with 3 stars; and considerably a larger number of 2 and 1 star hotels than in Europe.





Source: Hosteltour

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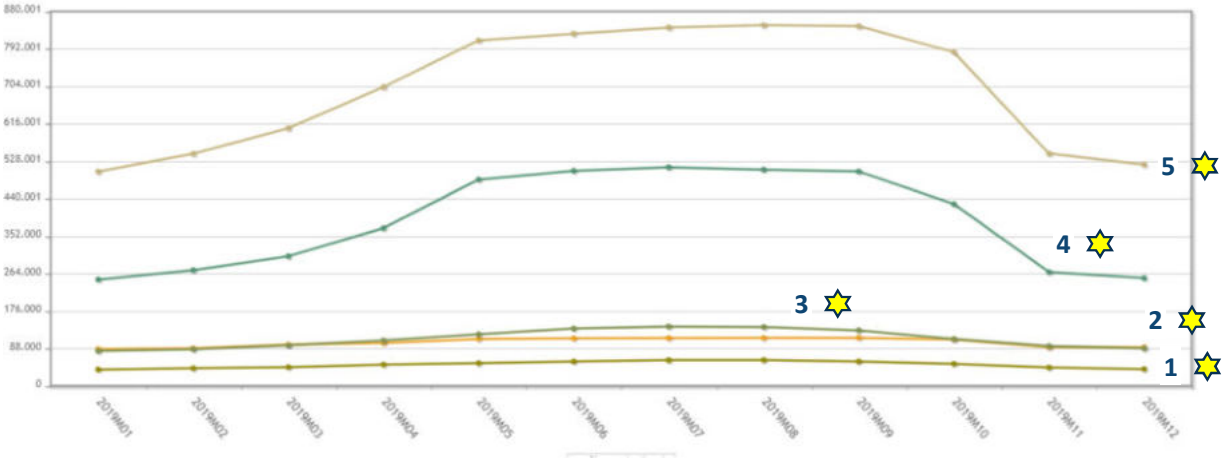
3. Definition of the analysis parameters

Spanish case - parameters to consider

(4) Hotel category / size

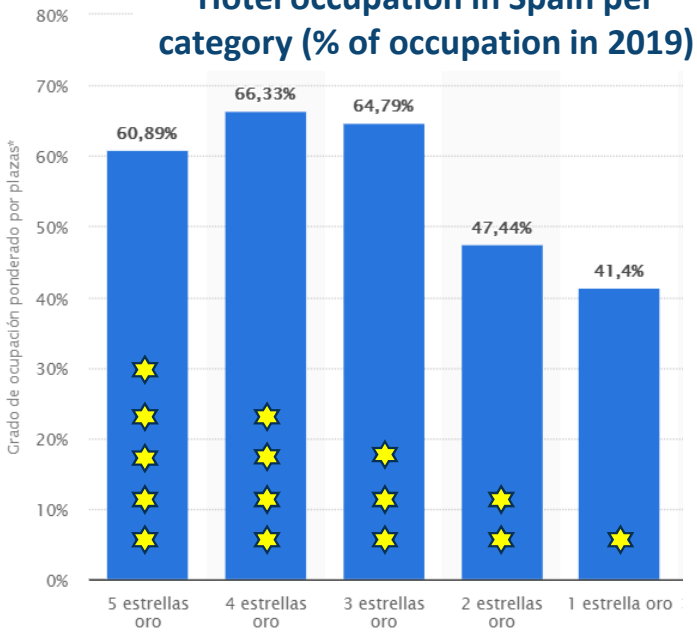
Hotels with 4 and 5 stars in Spain can adapt their capacity during the months of higher demand. Therefore, water demand is also variable and intense during the hottest months of the year. 1-3 star hotels do not change their capacity significantly during the year.

Number of beds available in Spain per month and category (no. of beds available in 2019)



Source: INE (National Statistics Instutute of Spain) [1]

Hotel occupation in Spain per category (% of occupation in 2019)



Source: Statista 2020

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3. Definition of the analysis parameters

Spanish case - parameters to consider

(4) Hotel category / size

Facts regarding the Spanish case:

- Hotels with 4 and 5 stars consume more water because of the high number of clients and the number of services they offer. If these hotels are in the coast, the effect of the location is increased by the higher water consumption in summer.
- Larger, resort-style hotels use significantly more water than smaller-medium establishments. Water intensive facilities typically have landscaped grounds requiring irrigation. Higher laundry volumes per guest per day are also more often as they use very large towels for spa facilities or beach use (Gössling, 2012).
- The percentage of 1 and 2 star hotels in Spain is higher than in Europe and, consequently the impact of water-intensive large hotels is somewhat reduced in the Spanish case as a whole.
- In Spain, as in other Mediterranean countries where tourism is a significant water user, climate change is projected to exacerbate current water demand and scarcity problems

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4. Analysis of the technology template

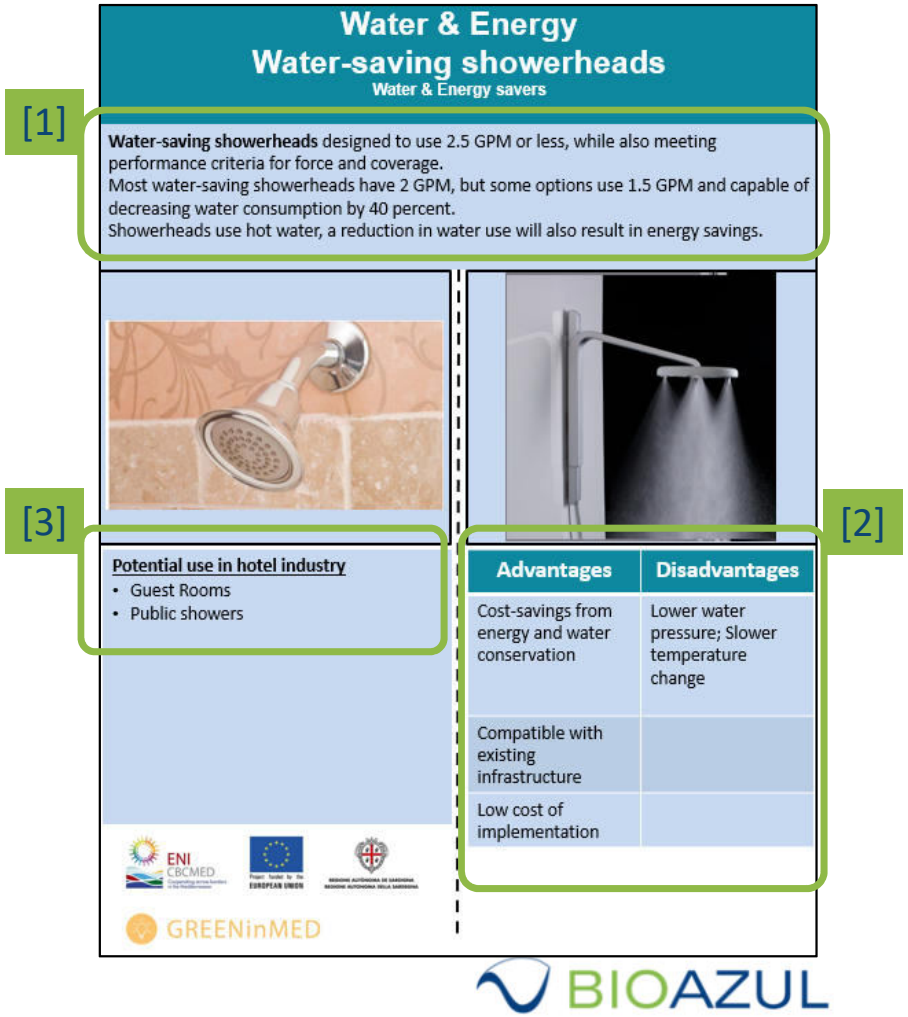
The structure of the template is adequate and facilitates a quick overview of the technology

Technology factsheets permit to evaluate (in a qualitative way) the possibilities to implement them in a hotel and compare different options to reduce water consumption.

There is a general description, which allows to understand the technology [1].

There is a section with advantages & disadvantages, which allows to estimate , qualitatively, how easy it will be to install, operate and maintain the technology [2].

The “potential use in the hotel industry” is reflected in section [3] as it informs about applications where to use the technology in a hotel.



4. Analysis of the technology template

Section [4] is dedicated to explain the performance of the technology and provide successful case studies. This information is very useful to have a preliminary idea about the water saving potential of the technology and provide confidence to the users with existing experiences in other hotels.

The last section [5] offers some references about companies that can manufacture and implement the technology.

Water & Energy
Water-saving showerheads
Water & Energy savers

Part 2 –Performance, Case studies

[4]

Water used in hotels and other lodging facilities accounts for approximately 15% of the total water use in commercial and institutional buildings in the United States.
The installation of Water-saving showerheads guarantees a reduction of at least 20% water-usage and perform similar or better than standard models.

Since each water and energy savings program includes several upgrades of accessories, there are cases that only overall savings in water, energy, and costs can be shown and not each accessory by separate.
Case study 1 : Hilton Palacio del Rio Hotel, San Antonio, Texas - replaced 479 showerheads flowing at 2.5 gallons per minute (GPM) with 1.5 GPM models • Water Savings = 26,000,000 Gallons • Energy Savings = 480,000 kilowatt • Costs savings= $160,000. **Simple Payback Period – in less than two years.**

Case study 2 : Holiday Inn San Antonio International Airport - replaced 397 showerheads flowing at 2.5 gallons per minute (GPM) with 1.75 GPM models • Water Savings = 7,000,000 Gallons • Energy Savings = 330,000 kilowatt • Costs savings= $68,000. **Simple Payback Period – in less than two years.**

Part 3 –Companies manufacturing/implementing the technology

[5]

- American Standard, https://www.americanstandard.ca/bathroom/shower-faucets?Type=Shower%20Heads&page=1&plimit=21
- Hydraw, https://www.hydrao.com/en/

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5. Analysis of technologies for the Spanish case (I)

- Considering the information collected for the different water technologies included in the “Catalogue of solutions available for the hospitality industry” a preliminary analysis was carried out according to the two classical parameters:
    - **(1) Water saving potential**
    - **(2) Operation & Maintenance simplicity**
- Even though no quantitative or standardized data was available for most of the technologies, the information contained in the factsheets allowed for a qualitative and semi-quantitative evaluation of the 45 technologies.
- The water technologies were labelled with a specific **ID code number** to facilitate further analyses.
- Each technology was assessed against both classical parameters, assigning a value from 1 to 10 to each of them.
- This evaluation resulted in a **ranking of technologies** based on a final score, which was the average value between “water saving potential” and “O&M simplicity” parameters.

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5. Analysis of technologies for the Spanish case (I)

ID code for water technologies

ID	WATER TECHNOLOGY
1	Water Tap Aerator
2	Automatic Faucets
3	Washer Regulator/Restrictor
4	High-Efficiency Toilets
5	Encore Cistern: Environmental Condensate Recovery System
6	Water Toilet Restrictors
7	Water Fill Cycle Diverter
8	Recycling Toilets
9	Water-Saving showerhead
10	Water Consumption Monitoring
11	Water Controlled Shower
12	Water Circulation Shower
13	Rapid Hot Water Supply to Tap
14	Vertical Wastewater Heat Exchanger
15	Urinal Flushing Control
16	Waterless Urinals
17	WCMS - Water Consumptions Monitoring System
18	Wireless Leak Detection w/ Automatic Shutoff
19	Pressure Control Valves for Leaks Minimization
20	Leaks and Water Loss Minimization Water Saver

ID	WATER TECHNOLOGY
20	Leaks and Water Loss Minimization Water Saver
21	Foot-Pedal Operated Faucet
22	High-Efficiency Pre-Rinse Spray Valves
23	Rack Conveyor Dishwashers
24	Tunnel Washers
25	Washer Extractor
26	Solar Pool Covers
27	Low Backwash Filtration
28	Ultrafiltration of Swimming Pool Water
29	HVAC Condensate Recovery
30	Electro-Chemical Treatment of Cooling Tower Water and Blowdown Minimization
31	Water Drip Irrigation
32	Water Precise Irrigation
33	Smart Water Solutions for Irrigation
34	Smart Plants Selection
35	SBR - Sequential Batch Reactor
36	MBR - Membrane Bioreactor
37	MABR - Membrane Aerated Biofilm Reactor
38	MBBR - Moving Bed Biological Reactor
39	RBC - Rotating Biological Contactor
40	Trickling Filter
41	Constructed Wetland
42	Greywater Treatment by Living Wall and Green Roof Systems
43	Rainwater Harvesting
44	In-house Greywater Recycling – Complete
45	Seawater Desalination

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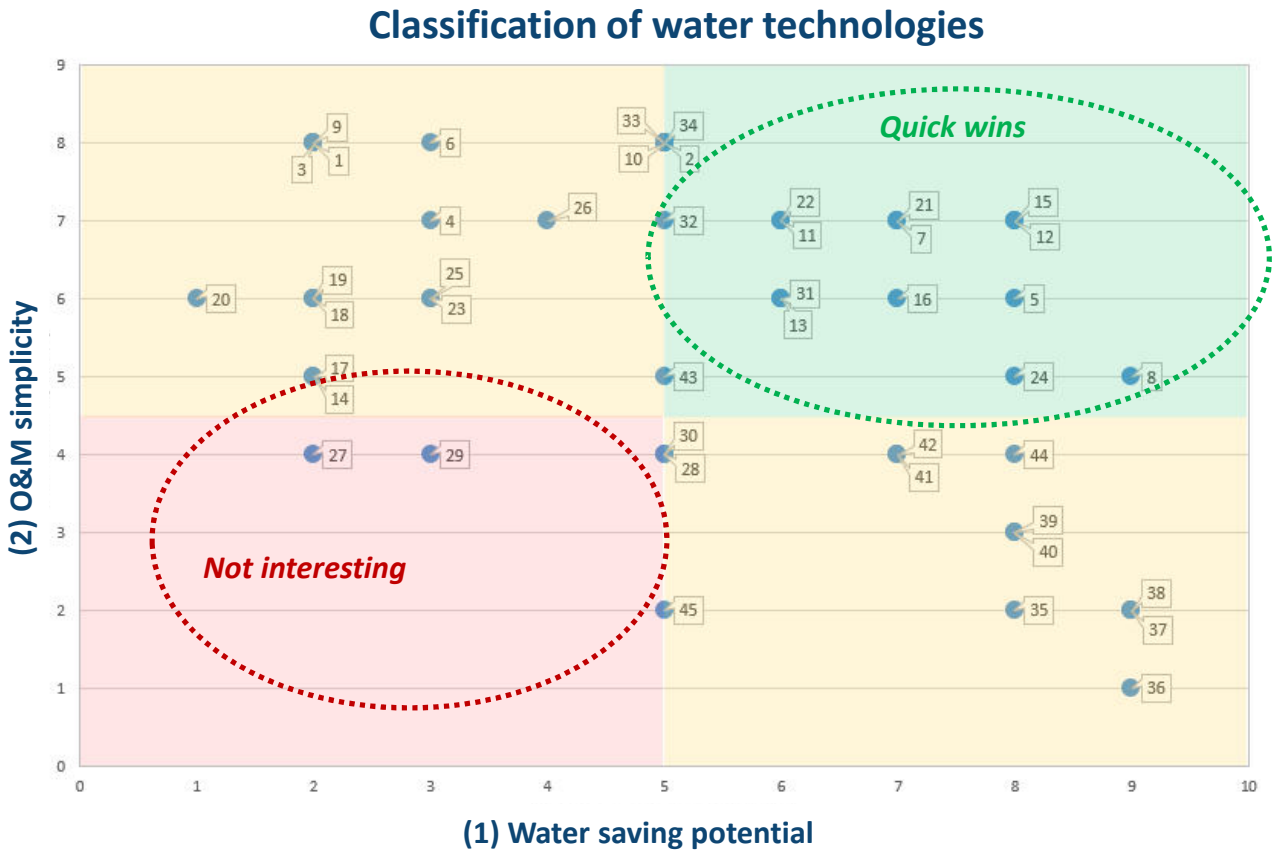
5. Analysis of technologies for the Spanish case (I)

- The ranking and representation of the 45 technologies in this graph facilitates the identification of the most suitable and attractive water technologies for hotels.



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5. Analysis of technologies for the Spanish case (I)

- Based on the final ranking, 18 water technologies were identified as the most suitable ones (quick wins).
- Out of them, six technologies were shortlisted as they obtained an average score of 7 or higher.

ID	Water technology
5	Encore Cistern: Environmental Condensate Recovery System
7	Water Fill Cycle Diverter
8	Recycling Toilets
12	Water Circulation Shower
15	Urinal Flushing Control
21	Foot-Pedal Operated Faucet

- After this evaluation, a further analysis was carried out considering the two specific parameters for the Spanish case.

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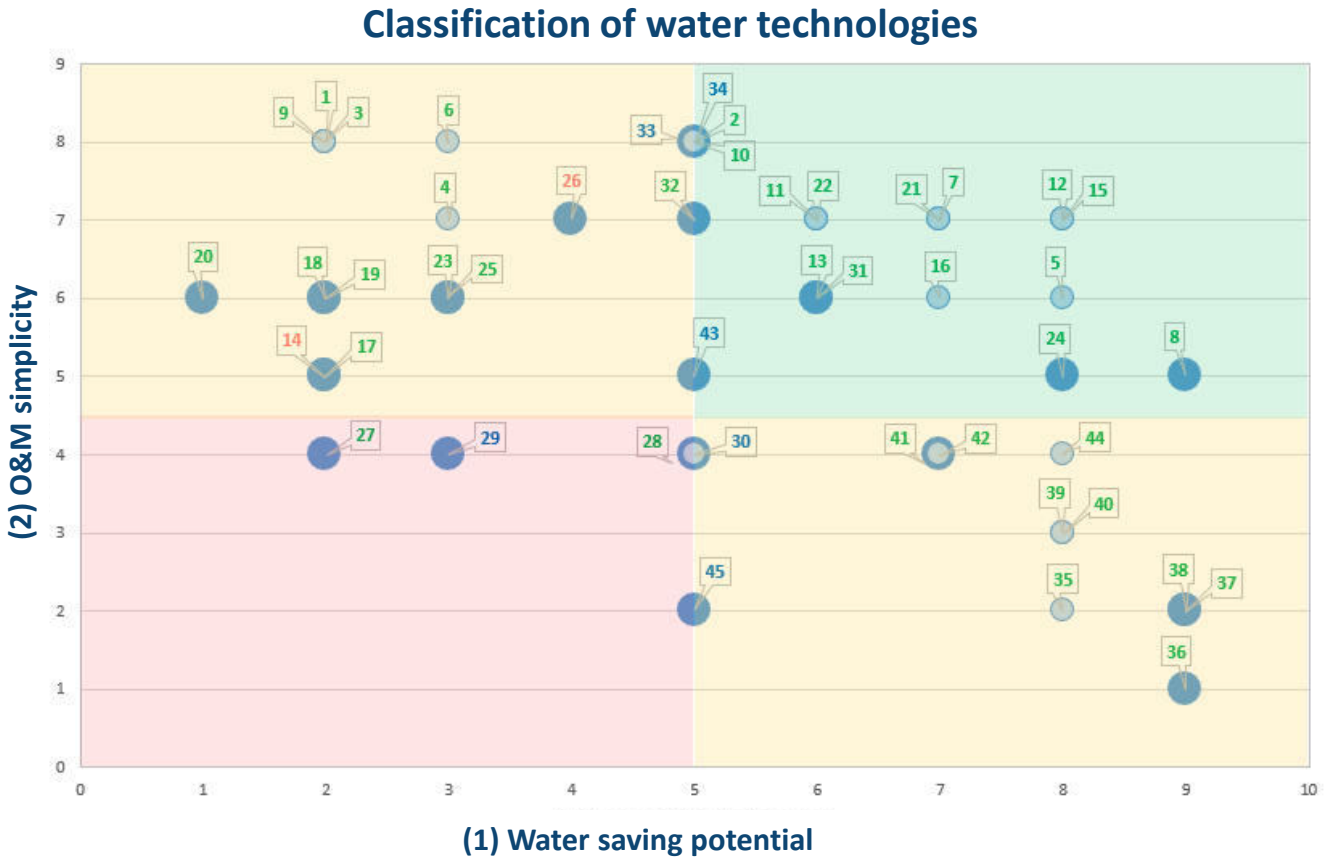
5. Analysis of technologies for the Spanish case (II)

- After a general evaluation of the 45 technologies based on (1) Water saving potential and (2) O&M simplicity, a further analysis has considered the two additional parameters specific for the Spanish case:



(3) Location: indicating which technologies are more suitable for coastal [blue ID code], interior [red ID code], or both regions [green ID code].

(4) Hotel size: indicating which technologies are more suitable for big hotels (4 and 5 stars) [large blue circles ●] and small/medium size hotels (1, 2 and 3 stars) [small light blue circles ●].

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5. Analysis of technologies for the Spanish case (II)

The 7 technologies shortlisted as the most appropriate ones (12, 15, 5, 7, 8, 21) are in general suitable for big and small/medium size hotels. However, water technology 8 (Recycling toilets) was considered to be a better option for big size hotels. Considering that the majority of hotels in Spain are small/medium size (73%), technology 8 could be discarded, having a final selection of the following technologies:

ID	Water technology
5	Encore Cistern: Environmental Condensate Recovery System
7	Water Fill Cycle Diverter
12	Water Circulation Shower
15	Urinal Flushing Control
21	Foot-Pedal Operated Faucet

All these technologies were considered suitable for hotels located in both coastal and interior regions of the country, and no limitations have been identified for their implementation due to type of location.

Water technologies 5, 12 and 15 were ranked as having the highest water saving potential (score = 8/10), while technologies 7, 12, 15 and 21 are considered to be the most simple to operate and maintain (score = 7/10).

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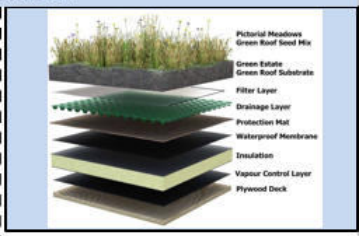
6. Identification of new technologies

Water & Energy
Green roofs
water savers

Green roofs represent an alternative water supply for hotels, as they can capture and store rainwater for later use. In addition, green roofs systems are one of the best ways to manage stormwater by reducing and delaying runoff. Thanks to these systems, water can be stored having a very good quality, in some cases cleaner than from traditional roof schemes. In any case, it is necessary to assess the stability characteristics of the roof and sub-structure, the membranes to be installed and the related maintenance requirements. Rainwater which is captured in green roofs is normally used for flushing toilets, irrigation, as well as for other non-potable purposes. Water collected from green roofs should undergo a series of filtration steps in order to reach the required quality for further use.



Potential use in hotel industry

- Irrigation of gardens and landscaping
- Toilet flushing
- Laundry and cloth washing

Advantages	Disadvantages
reduces demand on existing water supply	Weather depending
reduces run-off, erosion, life-span of roof	Require additional maintenance
Low to none energy requirements	Initial costs higher than traditional roofs
For some uses hardly needs any treatment	

GREENinMED

Water & Energy
Green roofs
water savers

Part 2 –Performance, Case studies

The Tivoli Hotel & Congress Center in Copenhagen (Denmark) has designed and implemented a 8,000 m² green roof – simulating a rugged rock island typically found along the Baltic coast. It has turned into an attraction for hotel and congress guests and tourists in the city. A professionally-installed and root-resistant waterproof membrane provided the basis for the 0°-roof area to be greened. After the protection mat was installed, the drainage and water-retention system was placed, followed by the filter system and the substrate with a top soil and mineral element at a depth of 40-75 cm. This intensive green roof at the Tivoli Congress Center with its substrate depths of up to 75 cm retains approx. 80–90 % of precipitation.

Part 3 –Companies manufacturing/implementing the technology

- ZinCo, https://zinco-greenroof.co.uk/systems/roof-garden
- Texsa, http://www.texsa.com/en/systems.htm?fcat_0=96
- Grass Concrete, https://www.grasscrete.com/index.html
- Zulueta, https://zulueta.com/productos/tejados-verdes/
- ArchiGreen, http://archigreenroof.com/

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7. Best Practices

Successful use cases

ID Number	Technology	Benchmark
1	**Water Tap Aerator**	Arby's Restaurant Group, USA [10] Shari's Café and Pies, USA [11]
2	**Automatic Faucets**	Hostal Grau, Spain [30]
3	**Washer Regulator/Restrictor**	
4	**High-Efficiency Toilets**	Hilton Palacio del Rio Hotel, San Antonio, Texas, USA [12] Holiday Inn San Antonio International Airport, USA [13]
5	**Encore Cistern: Environmental Condensate Recovery System**	
6	**Water Toilet Restrictors**	Hotel ME Madrid, Spain [31]
7	**Water Fill Cycle Diverter**	
8	**Recycling Toilets**	
9	**Water-Saving showerhead**	Hilton Palacio del Rio Hotel, San Antonio, Texas, USA [12] Holiday Inn San Antonio International Airport, USA [13]

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7. Best Practices

Successful use cases

ID Number	Technology	Benchmark
10	**Water Consumption Monitoring**	Hotel vila Gale Opera, (Oct. 2016 - Dec. 2016) - Lisbon, Portugal. [14] Hotel vila gale Estoril, (July 2017 - Oct 2017) - Estoril, Portugal. [14] Hotel Pestana CR7, (July 2017 - Oct 2017) - Lisbon, Portugal. [14] Marriott Hotel Amsterdam, (Sep 2018 - Dec. 2018) - Amsterdam, Netherlands. [14]
11	**Water Controlled Shower**	
12	**Water Circulation Shower**	
13	**Rapid Hot Water Supply to Tap**	
14	**Vertical Wastewater Heat Exchanger**	Clarion Hotel Stockholm, Sweden [15]
15	**Urinal Flushing Control**	Edward Hotels Group, Ireland [16] Sandymount Hotel, Ireland [16] Great National Hotels, Ireland [16] Carlton Hotel Group, Ireland [16]
16	**Waterless Urinals**	Elementary schools [17]
17	**WCMS - Water Consumptions Monitoring System**	Town of Cádiz, Spain [18]
18	**Wireless Leak Detection w/ Automatic Shutoff**	

7. Best Practices

Successful use cases

ID Number	Technology	Benchmark
19	**Pressure Control Valves for Leaks Minimization**	Hotel Baía de Cascais, Portugal [33]
20	**Leaks and Water Loss Minimization Water Saver**	
21	**Foot-Pedal Operated Faucet**	https://metaefficient.com/bathroom-products/efficient-foot-pedal-faucet-controllers.html
22	**High-Efficiency Pre-Rinse Spray Valves**	
23	**Rack Conveyor Dishwashers**	
24	**Tunnel Washers**	
25	**Washer Extractor**	Hohenstein Institute [19]
26	**Solar Pool Covers**	The California Pool & Spa Association, the National Plasterers Council, the Independent Pool & Spa Service Association, the Association of Pool and Spa Professionals and World of Recreational Water, California, USA [20]
27	**Low Backwash Filtration**	Palmachim Desalination plant, Israel [21]

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7. Best Practices

Successful use cases

ID Number	Technology	Benchmark
28	**Ultrafiltration of Swimming Pool Water**	Disneyland Paris, France
29	**HVAC Condensate Recovery**	Rivercenter Mall, Texas, USA [22] HEB Grocery Distribution Center, Texas, USA [22] San Antonio Public Library, Texas, USA [22]
30	**Electro-Chemical Treatment of Cooling Tower Water and Blowdown Minimization**	
31	**Water Drip Irrigation**	10 of 12 of the hotels surveyed in Spain were engaged in various environmental practices related to water consumption savings, such as the use of dispensers, sprinklers, heating water taps, dual-flush water tanks and drip irrigation. [6]
32	**Water Precise Irrigation**	Hillsborought County, Florida, USA [23]
33	**Smart Water Solutions for Irrigation**	
34	**Smart Plants Selection**	
35	**SBR - Sequential Batch Reactor**	Arak municipal wastewater treatment plant, Iran [24]
36	**MBR - Membrane Bioreactor**	Hotel Samba, Lloret de Mar, Spain [32]

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7. Best Practices

Successful use cases

ID Number	Technology	Benchmark
37	**MABR - Membrane Aerated Biofilm Reactor**	Decentralized Wastewater Treatment Bordeaux, France [25]
38	**MBBR - Moving Bed Biological Reactor**	University of São Paulo, Brazil [26]
39	**RBC - Rotating Biological Contactor**	Environment Institute, Turkey[27]
40	**Trickling Filter**	
41	**Constructed Wetland**	Euro-Mediterranean hotel in Lloret de Mar [7]
42	**Greywater Treatment by Living Wall and Green Roof Systems**	
43	**Rainwater Harvesting**	Hotel Penaga Georgetown, Malaysia [28]
44	**In-house Greywater Recycling – Complete Systems**	
45	**Seawater Desalination**	Reserva Conchal Hotel Resort resort, Costa Rica [29]

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7. Best Practices

Spanish suppliers

ID Number	Technology	Other suppliers (different from those on sheets)
1	Water Tap Aerator	**GROHE -** https://www.grohe.es/es_es/ **NEOPERL** - https://www.neoperl.net/en/oem/products/aerators/productlines.html **ROCA -** https://www.roca.es/sobre-roca/sostenibilidad/tecnologias-sostenibles
2	Automatic Faucets	**GROHE -** https://www.grohe.es/es_es/
3	Washer Regulator/Restrictor	**GROHE -** https://www.grohe.es/es_es/ **NEOPERL -** https://www.neoperl.net/en/oem/products/flowregulators/linesfeatures/pcw02washer.html
4	High-Efficiency Toilets	**Dual flush conversion mechanism,** https://www.fluidmaster.com/products/toilet/flush-valves/550dfrk-dual-flush-conversion-system/ **Vacuum toilet**, https://jetsgroup.com/jets-group/the-highest-standards/vacuum-toilets
5	Encore Cistern: Environmental Condensate Recovery System	
6	Water Toilet Restrictors	**Ecologic Barna -** http://www.ecologicbarna.com/productos2.htm
7	Water Fill Cycle Diverter	
8	Recycling Toilets	**ROTH -** https://www.roth-spain.com/es/AquaServe-sistema-de-reutilizacion-de-aguas-grises-domesticas.htm
9	Water-Saving showerhead	**GROHE -** https://www.grohe.es/es_es/

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7. Best Practices

Spanish suppliers

ID Number	Technology	Other suppliers (different from those on sheets)
10	Water Consumption Monitoring	**GROHE** - https://www.grohe.es/es_es/
11	Water Controlled Shower	**GROHE** - https://www.grohe.es/es_es/para-tu-cuarto-de-bano/smartcontrol/smartcontrol-empotrado.html
12	Water Circulation Shower	
13	Rapid Hot Water Supply to Tap	**Metrica6** - https://www.metrica6.xyz/news/ **AQUARETURN** - https://www.aquareturn.com/
14	Vertical Wastewater Heat Exchanger	**Passive Shower** - https://passiveshower.com/
15	Urinal Flushing Control	**GROHE** - https://www.grohe.es/es_es/tectron-rondo-infrarrojo-eletr-nico-fluxor-para-urinario-37421000.html
16	Waterless Urinals	**URIMAT**- https://www.urimat.com/en/products/urinals **CARYOSA** - https://www.caryosa.com/higiene-medio-ambiente/urinarios-sin-agua/urinario-ecologico-falcon
17	WCMS - Water Consumptions Monitoring System	**FIBRELITE** - https://www.fibrelite.com/our-products/
18	Wireless Leak Detection w/ Automatic Shutoff	**NEC** - https://www.nec.com/en/global/solutions/waterloss-management/index.html **TI** - https://www.ti.com/solution/water-leak-detector?keyMatch=WIRELESS%20LEAK&tisearch=Search-EN-everything

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7. Best Practices

Spanish suppliers

ID Number	Technology	Other suppliers (different from those on sheets)
19	**Pressure Control Valves for Leaks Minimization**	**Bermad** - https://www.bermad.com/products/buildings-constructions/potable/
20	**Leaks and Water Loss Minimization Water Saver**	
21	**Foot-Pedal Operated Faucet**	**Roca**- http://www.export.roca.com/catalogue/products/faucets/basin-faucets/self-closing/instant/foot-foot-pedal-faucet-floorstanding-505127800#!A505127800
22	**High-Efficiency Pre-Rinse Spray Valves**	**T&S**- https://www.tsbrass.com/sustainability/products **Ecolab**- https://www.ecolab.com/offerings/kitchen-equipment/dishmachine-parts-and-accessories/powerpulse-pre-rinse-spray-valve
23	**Rack Conveyor Dishwashers**	**SAMMIC-** https://www.sammic.com/catalog/ware-washing/tunnel-dishwasher **Winterhalter-** https://www.winterhalter.com/es-es/productos/trenesdelavado/?de=&cHash=823d52395f7ad6f788c6c47d13a1f537 **MEIKO-** https://www.meiko.es/es/productos/
24	**Tunnel Washers**	**Kannegiesser España -** https://www.kannegiesser.com/es/en/applications/detail/hospitality-restaurant.html **ACJ SYSTEMS-** https://www.acjsystems.com/es/milnor?view=items&catid=160 https://www.jensen-group.com/products/product-detail/senking-universal.html
25	**Washer Extractor**	**Girbau, SA. -** https://www.girbau.com/laundry-product/s/bw-series/BW-series **Speed Queen -** https://speedqueencommercial.com/es/productos/lavadora-extractora-de-montaje-rigido/
26	**Solar Pool Covers**	**KW Solar-** https://www.kw-solar.es/en/?Products/Swimming-pool-covers%2C-solar-pool-cover https://www.todoenpiscinas.com/reforced-solar-cover-pool
27	**Low Backwash Filtration**	**Filtralite-** https://www.filtralite.com/es/soluciones/filtraliter-pure# **Environmental XPRT-** https://www.environmental-expert.com/products/keyword-backwash-filter-16541/location-spain

7. Best Practices

Spanish suppliers

ID Number	Technology	Other suppliers (different from those on sheets)
28	Ultrafiltration of Swimming Pool Water	**HIDRO WATER** - https://hidro-water.com/productos/industrial/ultrafiltracion/sistemas-compactos-de-ultrafiltracion/
29	HVAC Condensate Recovery	
30	Electro-Chemical Treatment of Cooling Tower Water and Blowdown Minimization	
31	Water Drip Irrigation	**AGROPLAST** - http://www.agroplast.es/sistemas-de-riego-productos/riego-por-goteo **RAIN – BIRD** - https://www.rainbird.com/professionals/products/drip-irrigation **IRRITEC** - https://www.irritec.com/drip-irrigation/
32	Water Precise Irrigation	**ONSET** (Soil Moisture Sensors) - https://www.onsetcomp.com/products/data-loggers-sensors/soil-moisture/ **METOS by PESSL** (Irrigation management) - https://www.metos.at/es/
33	Smart Water Solutions for Irrigation	
34	Smart Plants Selection	**Arrayán Jardines** - https://arrayanjardines.es/es/
35	SBR - Sequential Batch Reactor	**Remosa** - https://www.remosa.net/es/productos/depuracion-de-aguas-residuales-2/sbrem-depuradora-secuencial-7.htm
36	MBR - Membrane Bioreactor	**BIOAZUL** - https://www.bioazul.com/en/mbr-membrane-bioreactor/

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7. Best Practices

Spanish suppliers

ID Number	Technology	Other suppliers (different from those on sheets)
37	MABR - Membrane Aerated Biofilm Reactor	**FLUENCE** - https://www.fluencecorp.com/wastewater-treatment-solutions/
38	MBBR - Moving Bed Biological Reactor	**LEMNA ENVIROMENTAL TECHNOLOGIES** - https://www.lemnatechnologies.com/moving-bed-bioreactor-process **ECOLOGIX SYSTEMS** - https://www.ecologixsystems.com/system-mbbr/
39	RBC - Rotating Biological Contactor	**EVOQUA** - https://www.evoqua.com/en/brands/Envirex/Pages/rotating-biological-contractor-systems.aspx
40	Trickling Filter	**CYCLUS** - http://www.cyclusid.com/tecnologias-aguas-residuales/tratamiento-aguas/tratamiento-secundario/lechos-bacterianos/ **GEDAR** - https://www.gedar.com/residuales/tratamiento-biologico-aerobio/filtros-percoladores.htm
41	Constructed Wetland	**IRIDRA** - http://www.iridra.eu/es/humedales-construidos.html
42	Greywater Treatment by Living Wall and Green Roof Systems	**ANSGLOBAL** - https://www.ansgroupglobal.com/ **WIILDER** - https://wiilder.com/
43	Rainwater Harvesting	**SOLICLIMA** - https://www.soliclima.es/aguas-pluviales **HIDROPLUVIALES** - https://hidropluviales.com/2018/07/05/captacion-agua-de-lluvia-2/
44	In-house Greywater Recycling – Complete Systems	**AZUD** - https://azud.com/producto/productos/tratamiento-de-aguas/tratamiento-de-aguas-grises/
45	Seawater Desalination	**TESACUA** - https://www.tesacua.es/desaladoras-agua/?gclid=CjwKCAjwltH3BRB6EiwAhj0IUDO1hHw57-ZxfofbkEG0b0GtvLwCAIhOBaYTezYF4s0wGsJOHLKkFhoCf7sQAvD_BwE **AZUD** - https://azud.com/producto/productos/tratamiento-de-aguas/desalinizacion/

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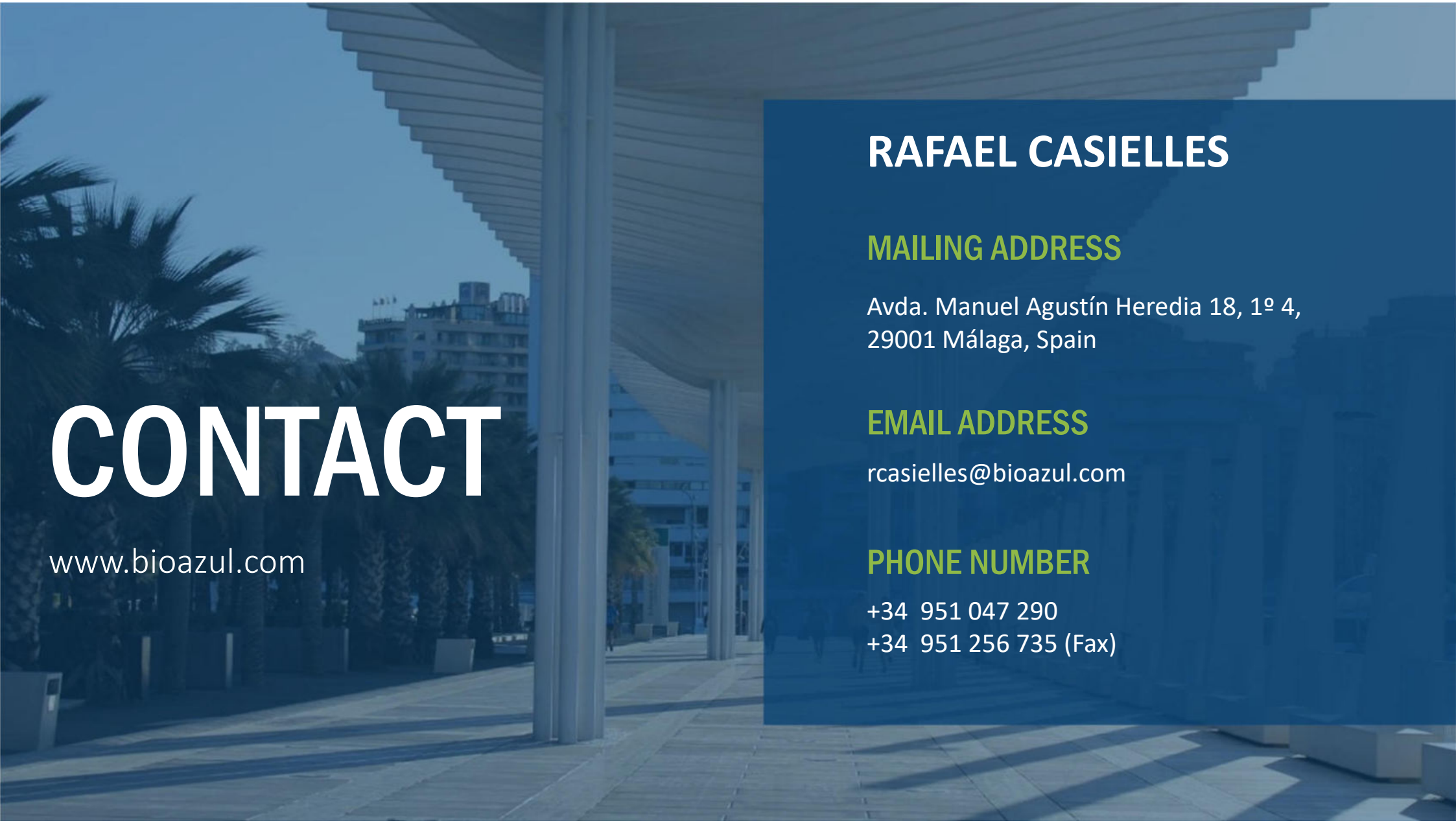

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