LIFE Integrated Projects 2016
Optimising the implementation of the 2nd RBMP in the Malta River Basin District
LIFE 16 IPE MT 000008

Action A.2

Deliverable 1: One report outlining the market infiltration rates of water efficient technologies in the Maltese islands and outlining potential alternative technologies which might be considered/supported to enhance their future infiltration in the market

EWA/CFT/6/2018 – MARKET RESEARCH ON WATER DEMAND MANAGEMENT TECHNOLOGIES

Final Draft

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1. Glossary of Acronyms

˚C	Degrees Celsius
€	Euro
DIY	Do it Yourself
GPF	Gallons per Flush
GPM	Gallons per Minute
GDP	Gross Domestic Product
LPF	Litres per Flush
LPM	Litres per Minute
MBB	Malta Business Bureau
MBR	Membrane BioReactor
NFT	Nutrient Film Technique
PE	Polyethylene
RHS	Rainwater Harvesting System
RO	Reverse Osmosis

2. Executive Summary

2.1 The context

This report presents the findings relating to Activity 1 – Assess current market penetration that forms an integral part of the Tender for market research on water demand management technologies. (Reference number EWA/CFT/6/2018).

An integral part of this assessment comprised the identification of 20 different items/devices/appliances which are applicable for water demand management and efficient water use amongst the main water using stakeholders, with the tender specifically identifying the 4 sectors to be reviewed, namely:

I. Residential
II. Agriculture
III. Tourism and
IV. Businesses.

Below is a brief on the 20 technologies identified - Water demand management/saving technologies currently available locally.

2.2 The identified technologies

Ref.	Technology	Tourism	Commercial	Agriculture	Residential
1	Restrictor for shower				
2	Water saving shower head				
3	Flushing toilets with manual stop				
4	Dual flush toilets				
5	Technologies the displace water in the flushing system				
6	Hydroponics				
7	Industrial water saving dishwashers				
8	Industrial Water Saving Washing Machines				
9	Kitchen Tap Aerators				
10	Reuse water that is discarded from domestic RO system				
11	Soil Moisture Controller				
12	Rain Sensor				
13	Pressure regulators				
14	Reducing evaporation from swimming pools				
15	Grey water recycling				
16	Ecotimer				
17	Collection of air-conditioner condensate for landscaping/toilet flushing				
18	Rain water harvesting				
19	Selecting water-efficient varieties of crops				
20	Use of low-salinity New Water				

	Indicates that such technology may be adopted by the sector
	Indicates that in our report the technology in question has been placed under that respective sector

Overleaf is a brief description of each of the above identified technologies, with the main document incorporating more details on each.

Technology 1
Restrictors for showers
This is a commercially available, low-cost device which can be fitted to most shower mixers and which reduces the flow of water through a shower while still giving a feel of 'pressure' - Showers being a main consumer of water in households. A 15-minute shower, issuing 10 litres per minute will result in the use of 150 litres, which is more than the average consumption of water per person in Malta. An advantage of this technology is that it is DIY and it does not affect the style of the sanitary ware in the bathroom.


Technology 2
Water saving shower head
There are now numerous water saving shower heads on the market – which can be used as retrofit solutions or installed in new bathrooms. They are available in various styles and some have the facility to adjust the flow pattern (e.g. massage, rain etc.). A good water saving shower head can reduce the flow coming out of the shower by more than 50% (depends on original flow, water pressure etc.). Savings in showers also results in savings in hot water, and therefore in electricity bills.
 

Technology 3

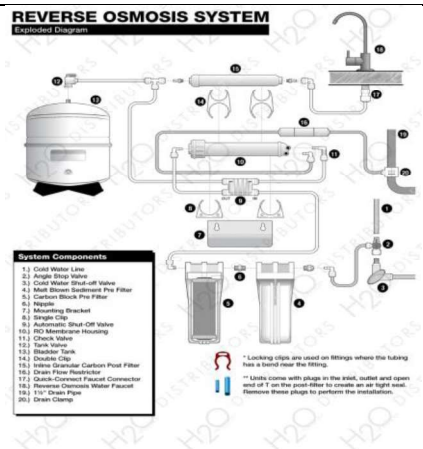
Kitchen tap aerators

Kitchen taps are used primarily for the washing of plates and the rinsing of food products. A standard kitchen tap can issue as much as 15 litres per minute, given that it is connected directly to the mains water supply. A low-cost low-maintenance kitchen tap aerator can result in water savings of more than 50%.

Technology 4

Re-using brine from domestic ROs

A number of houses in Malta source their drinking water from a domestic Reverse Osmosis unit, which is usually fitted in the kitchen, with the drinking water being served through a faucet. It is believed that there are thousands of such units installed. However, it is not a widely known fact that domestic Reverse Osmosis units use 5 times as much water as they produce[1] (as drinking water) in the form of brine, which is normally run to drain. It is therefore being proposed that the brine will be run to the roof tank (where it is diluted with town water and reused) .All this involves is an extension of the brine line (a small diameter plastic tube) to the roof tank . There is no need of a separate pump. It is believed that the household can save as much as 200 litres of water a week through the recovery of this water.

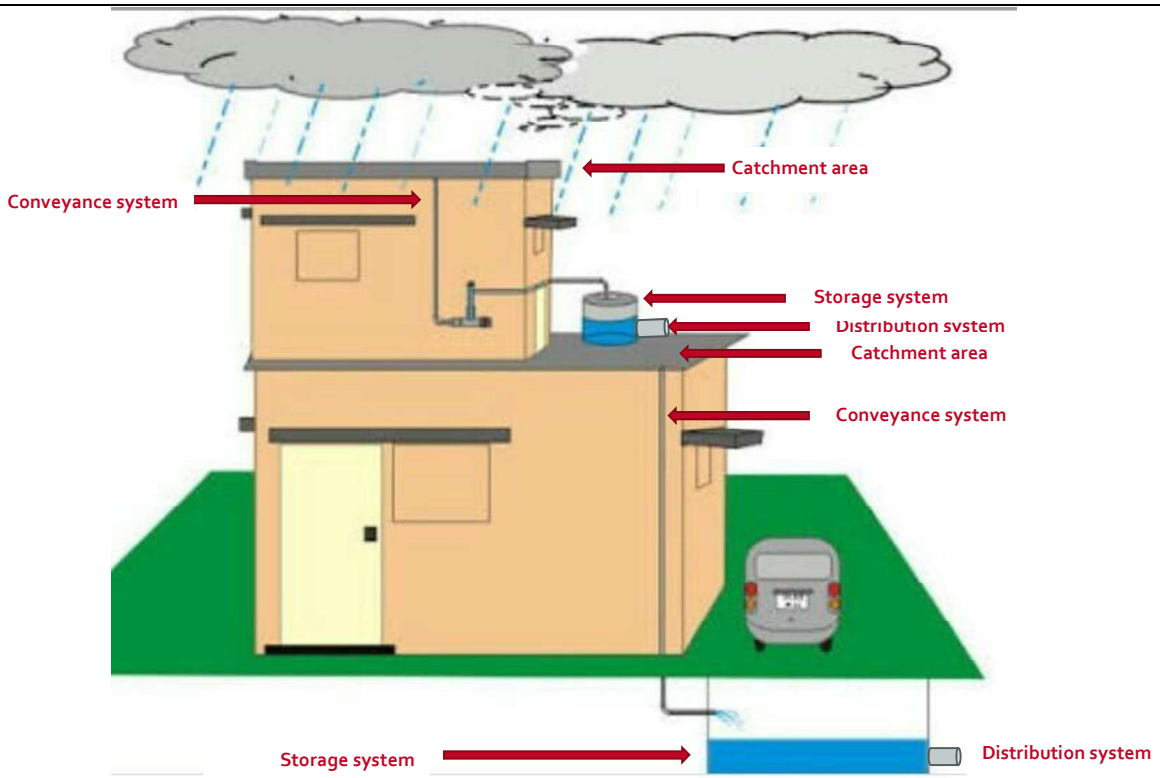


[1] https://www.quora.com/Which-reverse-osmosis-system-wastes-the-least-amount-of-water - "Most single element RO membranes are 17% efficient. They will make 83 gallons of reject, and 17 gallons of product for every 100 gallons of water sent to the machine. This is not very efficient. "

Technology 5

Rainwater Harvesting

A time-proven practice, a rainwater harvesting system can save a family as much as 50,000 litres a year (based on a roof area of 100 m^2 and 553mm of rainfall a year), equating to 50% of the annual water consumption for a family of 3. Rainwater collected from the roof is run into an underground cistern (well) where it is stored. It can then be pumped to a roof tank which then delivers water to toilets, washing machine, and taps for gardening, washing floors, cars and filling swimming pools, or directly to these utilities. The quality of clean rainwater is ideal for these applications as it is free from salt and hardness.



Technology 6

Industrial Water Saving Dishwashers and Pre-Rinse Spray Valve

Commercial dishwashers are considered to be one of the largest water (and energy) consumers in kitchens of restaurants and hotels, often accounting for more than two-thirds of the overall water use. Water usage across commercial dishwashers does not appear to be directly related to the size of the machine. A typical commercial dishwasher consumes approximately 15 litres per rack (rack usually having 18 plates), but water efficient dishwashers can bring this figure down to 1.5 litres per rack. Moreover, a lot of water is used in the manual pre-rinse – the water used in the pre-rinsing operation is often twice the volume of water used by the dishwashing equipment. The most cost-effective water conservation measure in a commercial food service operation is the improving of the efficiency of the pre-rinse spray valve. A traditional PRSV uses between 7 to 19 litres per minute. A high-efficiency PRSV uses less than 5 litres per minute (and removes food residue faster than the traditional PRSV, by virtue of the higher water velocity).

Technology 7

Saving water in Industrial Washing Machines

A large hotel may need to wash 2500 items (bedsheets, towels) a day, and this inevitably results in a huge consumption of water in the laundry – whether the laundry is part of the hotel, or the laundry services are subcontracted out. On-site facilities dedicated to washing fabrics used at the location are referred to as On Premises Laundry (OPL). Small to medium sized laundries mostly rely on equipment referred to as washer-extractors. These look and operate somewhat similar to residential front-loading clothes washers, except washer-extractors are 3 to 30 times larger. There are water-efficient models of washer-extractors. While a regular washer-extractor requires 25 – 35 litres of water per kilogramme of fabric cleaned, a good water-efficient washer-extractor needs only 15 litres per kilogramme.

Technology 8

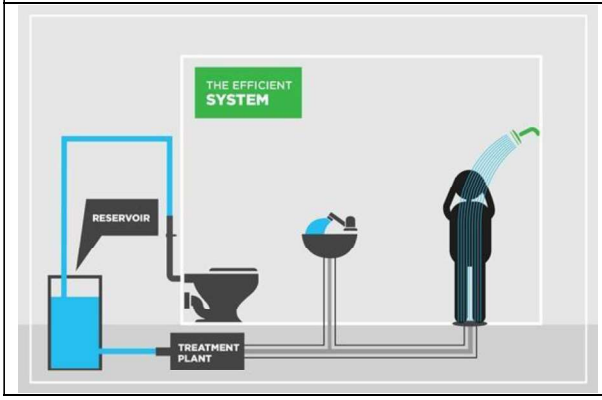
Pressure Regulators

Most of the water used in hotels is used in the guestrooms in showers and wash hand basins. The volume of water being issued from the showers and the wash hand basin taps depends on the delivery pressure of the water supply system, at the room. Most hotels nowadays are in the form of high-rise buildings with a number of rooms at different storeys, with the result that the water pressure in the guest rooms at the bottom level being significantly higher than the water pressure being delivered at the uppermost level. Given that building services engineers normally design the water pumping station to deliver adequate pressure at the upper levels, there is over-pressure and therefore high water flow rates at the lower levels. A technology that can be used to equalize the pressure in all guest rooms at all levels is the pressure regulating valve. By installing a pressure regulating valve on the water system at each level, the hotel engineer can regulate the water delivery pressure for each level individually and optimise the flow rates in the showers and wash hand basins in the guest rooms.

Technology 9

Reducing swimming pool evaporation rates

Large commercial pools lose a lot of water through evaporation, especially in the hot summer months. While pool covers exist and are effective in reducing evaporation, they usually are only suitable for rectangular pools and are rather cumbersome to open and close. However, there are liquid products on the market which are applied to the swimming pool and work as a blanket on the surface of the pool, reducing the evaporation rate by as much as 40%. The products are safe, non-toxic, biodegradable and compatible with other sanitizing products like chlorine. In use at the Hilton Malta.

Technology 10
Grey water recycling
Hotels use a lot of water in showers and toilets. Usually, a single water supply system provides potable water to all the water using utilities in a guest room, these being primarily showers/baths, wash hand basins and toilets. However it is possible, and very ecological to use a non-potable source of water to flush toilets. And this water for toilets can be derived from the waste water from the showers and wash hand basins. Grey water systems work on the principle of collecting the used water from showers and wash hand basins separately from the used water from toilets; the former is filtered and treated to produce a 2nd class quality of water which can be used for the flushing of toilets, and for landscaping. It is estimated that as much as 30 – 40% of the water used in a hotel can be saved when using this technology. Installations at the George Hotel, Paradise Bay Hotel and Milano Due Hotel. .
 

Technology 11
Flushing toilets with manual stop
The main water consumer in office premises is the toilet. A standard toilet may use as much as 10 litres of water per flush. In restrooms where there are no urinals, toilets are used for the flushing or urine and faeces; so in a building with 20 employees the water used in toilets may exceed 600 litres per day. In a standard toilet, the flushing volume is constant and is usually on the high side, designed to flush faeces and toilet paper. An improvement on this basic design are toilets which have a flushing mechanism which allows the user to stop the flushing once the bowl is clear from its contents. This results in optimum flushing volumes.

Technology 12
Dual flush toilets
A dual-flush toilet is a variation of the flush toilet that uses two buttons or a handle mechanism to flush different amounts of water. Modern dual-flush toilets use 3 litres and 6 litres per flush respectively. Dual-flush toilets are now commonly available in different styles; however they cost more than standard (single flush) toilets. For maximum effectiveness, the installation of dual-flush toilets in offices should be accompanied with an educational campaign on its proper use and the ecological benefits.

Technology 13
Technologies that displace water in the flushing cistern
A typical flushing cistern installed in buildings that are more than 10 years old may have a volume of 10 litres or more, and flushes this volume of water with every flush. It has been shown that one can get a good flush with as much as 6 litres. However, one would be reluctant to replace an old but fully functional toilet in a tiled bathroom with a new water-efficient toilet. A solution is the installation of water-displacing devices (usually specialised plastic bags) that displace a volume of water in the cistern (usually between 1 – 2.5 litres) so that the flushing volume is reduced from the original volume. These displacement devices are very cheap, do not require any maintenance, and have been shown to last for years.

Technology 14
Eco-timer for faucets on wash hand basins
This technology is a device which is installed on wash hand basin faucets (instead of the standard strainer) and saves water in two ways 1. It acts as a restrictor, which reduces water delivery (flow) while increasing the velocity of the water for good hands washing and 2. It has a mechanical timer with a pre-set setting, which stops the flow of water automatically. Additional flow will require re-activation.

Technology 15
Collection of air-conditioner condensate for landscaping/toilet flushing
Air conditioners operated in cooling mode cools the indoor air but also reduces humidity by absorbing moisture from the room. The air conditioner's cooling coil (or evaporator) cools water vapour which collects on cold surfaces in the air conditioning unit in a way that is similar to the condensation that collects on an iced drink. An office premises may have tens of split-type air conditioners or a smaller number of large air conditioners. On a summer day in a hot, humid climate, a small air conditioner may collect and drain up to 8 litres of water a day; a larger central air conditioning system as much as 75 litres a day. It is sensible to run the air-conditioning drains pipes into a tank to conserve and reuse this water – which can be used for landscaping or for the flushing of toilets. The system requires a pump which would deliver the water on demand. An improvement on this system would be to also run roof drains into the same tank, so as to have a hybrid condensate and rainwater harvesting system.

Technology 16
Hydroponics
Hydroponics is a relatively innovative technology by which (some) crops are grown in water, instead of soil. The water saving features of this technology arise from the fact that the only water used is the water taken up from the plants. That is, there is no waste through evaporation which accounts for the largest proportion of water used in traditional irrigation. A hydroponics installation includes rows and columns of plastic pipes through which a water solution (water + nutrients) is circulated. Crops are placed in perforations in the pipes, with the roots of the plants in direct contact with the circulating water. The installation is placed in a greenhouse for protection from the wind and the elements. Hydroponics has taken off in Malta with at least 3 farms already using such systems. A wide variety of herbs, salad products and vegetables have been cultivated successfully in hydroponics systems in Malta and the list is growing.

Technology 17
Soil Moisture Controller
This technology allows for automatic and optimised irrigation and can be used for drip irrigation systems and others. It is an improvement on irrigation timers, as the determining factor for irrigation is shifted from time to soil moisture deficit (i,e, the actual need for irrigation). Given that rainfall is unpredictable, timers have the disadvantage of activating irrigation even when it's raining. The soil moisture controller offsets this disadvantage; a sensor is placed in a patch of land in the field which is representative of the whole field. It takes readings of soil moisture every few minutes. When the sensor detects dry conditions prior to the normal watering cycle, that cycle is allowed. When the soil moisture is above the set moisture threshold, the watering cycle is suspended to avoid water. Water savings (over timer-only irrigation systems) are 40% or more.

Technology 18
Rain sensor
Rain sensors are similar to the soil moisture sensor described previously but is a simpler and more affordable device. These systems come in both wireless and hard-wired versions, most employing hygroscopic disks that swell in the presence of rain and shrink back down again as they dry out (mimicking soil) - an electrical switch is in turn depressed or released by the hygroscopic disk stack, and the rate of drying is typically adjusted by controlling the ventilation reaching the stack. Wireless and wired versions both use similar mechanisms to temporarily suspend watering by the irrigation controller — specifically they are connected to the irrigation controller's sensor terminals, or are installed in series with the solenoid valve common circuit such that they prevent the opening of any valves when rain has been sensed. Water savings of more than 25% are reported, though this depends on climatological conditions.

Technology 19
Use of New Water
New Water is the name given to polished water derived from wastewater. It is a low salinity renewable source of water which is being produced by the Water Services Corporation and is being given for free to farmers for use in irrigation. Distribution networks are being constructed to make this water available in the north of Malta, in Gozo and in the south-east of Malta. It is a known fact that irrigating with saline (brackish) borehole water requires large volumes in order to obtain a decent crop. It is anticipated that the use of New Water will result in an overall requirement for water, simply through source substitution. It will also protect groundwater which is being over-abstracted, leading to salinization of the aquifer.

Technology 20
Using water-efficient varieties of crops
While it is desirable for Maltese farmers to replace traditional water-hungry crops with drought-tolerant crops, farmers (and to a certain extent consumers) will be somewhat reluctant to do this. One solution is to cultivate the same crops, but switch to water-efficient varieties. It is understood that these varieties are already available in the market, but so far there has been little demand from Maltese farmers. A switch from water-hungry varieties of crops to water-efficient varieties will go a long way in saving significant volumes of water, while delivering the same product/service, and without necessitating a major overhaul in farmers' practices and infrastructure. Seeds available from local stockists on demand.

3. Rationale

Malta is a country with very limited natural water resources with the current demand for water estimated to stand at around 60 million m^3 per year, roughly equivalent to two times the volume of water which can be sustainably sourced from our natural water resources. Such figures emphasise the need to increase the efficiency and effectiveness in the utilisation of water at a sectoral and national level and in so doing ensure the sustainability of this scarce resource.

The specific objectives and results to be achieved from this Project support the implementation process of Malta's 2nd River Basin Management Plan (RBMP) that is supported by the LIFE Integrated Project, whereby, through its first phase, the project seeks to undertake a number of 'Preparatory Actions' that include actions aimed at determining current intake of sustainable technologies, along with the identification of opportune water-saving technologies that are relevant for the distinct local sectors, with the tender specifically identifying the following sectors:

I. Residential

II. Agriculture

III. Tourism, and

IV. Commercial

There are a number of factors that are deemed of relevance when one determines whether or not to opt for a new (water-saving) technology, and such factors are likely to vary depending on the sector of activity one operates in (and also dependent on whether such technology is for private or commercial purposes). Consequently, any analysis into determining the most apt water demand technology gave due importance to such distinct features and were weighted appropriately to reflect the target audience such technology/ies seek to attract. This will in turn increase the likelihood of the uptake of the proposed technologies.

In line with the above, the first activity of which this report forms an integral part, sought to take a snapshot of the current situation in terms of market penetration of water saving technologies in the Maltese islands for the four distinct sectors.

> **The final outcome of Activity 1 being the identification of potential water saving technologies that are currently available locally that could aid attain the far-reaching goal aimed at increasing water usage sustainability.**

In line with the tender document, the assessment of the current market penetration considered 20 different items/devices/appliances (five for each sector under review) which are applicable for water demand management and efficient water use amongst the main water using stakeholders.

4. Methodology

4.1 Brief

This report relates to Activity 1 of the tender – ***Tender for Market Research on water demand management technologies (Ref Number: EWA/CFT/6/2018***. In total this Project comprises 5 Activities:

- Activity 1 – Assess current market penetration
- Activity 2 – Water saving technologies
- Activity 3 – Consultation meetings
- Activity 4 – Applicability Matrix
- Activity 5 – Dissemination of Results

The aim of Activity 1 being to attain a snapshot of the current situation in terms of: available technologies, pricing, potential payback periods, market penetration, uptake and other. Ultimately, 20 different items/devices/appliances which are applicable for water demand management and efficient water use needed to be identified. To this end, EMCS took a 6 tier approach, targeting:

- Suppliers;
- Plumbers;
- Domestic dwellings
- Agriculture industry
- Tourism industry
- Commercial industry

4.2 Suppliers

EMCS sought to conduct interviews with the main suppliers. In total 10 suppliers were targeted.

To facilitate matters for the target audience, EMCS conducted such interviews at the suppliers' premises. In all cases interviews were conducted at the outlet/showroom. This enabled EMCS to ensure that the data provided by such suppliers was accurate (particularly with respect to pricing and product availability at the point of sale).

Apart from this, EMCS also designed a questionnaire that was designed and sent out to a total of 50 suppliers via email. Entities were identified from the Yellow Pages and all those that had an email were forwarded the questionnaire. Feedback from the distribution of the questionnaire was not

forthcoming. This notwithstanding the target audience having the option that EMCS conduct the survey with them utilising CATI (computer assisted telephone interviews). A printed version was also available should the target audience have indicated to prefer this medium.

4.3 Plumbers

EMCS sought to conduct face to face interviews with 20 plumbers/water fitters. This proved to be problematic with the majority indicating to be too busy to find time to accommodate us. This notwithstanding that the researchers were extremely flexible in their approach and offered to meet such target audience when most convenient for them (irrespective of the day and time of day).

To mitigate this shortcoming, EMCS was successful in conducting 5 telephone surveys with the target audience. Furthermore, EMCS designed a questionnaire specifically for this target audience, and enticed such individuals to participate by giving them extended time frames within which to complete the online questionnaire. In total EMCS collated 5 questionnaires through this method (though most were incomplete).

EMCS also sought to target 10 engineers/ architects (a total of 10) who are involved in a number of large-scale construction projects. Following chasing, and extensions to the time frames, a total of 6 engineers provided feedback.

4.4 Domestic

To target residents EMCS conducted CATI (computer aided telephone interviews) with a representative sample of this sector. In total 1,000 households were interviewed. This is provided a margin of error in the region of 3%, with results representative of local households in terms of district.

4.5 Agriculture

EMCS sought to conduct interviews with 20 individuals involved in the agriculture sector comprising a mix of livestock and crop farmers. EMCS also conducted a discussion that took the form of a focus group with one of the associations within the agriculture industry.

4.6 Tourism Sector

Interviews were carried out with the tourism sector (a total of 15 comprising primarily hoteliers).

Furthermore, a questionnaire was designed and subsequently sent out to circa 500 entities via email. Unfortunately, this medium did not prove successful and responses were minimal. This, notwithstanding that the questionnaire was uploaded online such that the target audience could complete the questionnaire when most opportune for them. EMCS also allocated a pool of interviewers such that the survey could be carried out utilising CATI (computer assisted telephone interviews). A printed version was also available should the target audience prefer this medium.

4.7 Commercial

EMCS sought to conduct 15 face-to-face interviews with commercial entities. Originally the focus was on entities deemed to be high consumers of water.

Furthermore, EMCS sought to complement the face-to-face interviews with the distribution of a questionnaire to a representative sample of commercial entities. This option was sought as it simplifies matters for responses with the questionnaire uploaded online, thereby enabling the target audience to complete when most opportune for them[2]. This endeavour however did not provide meaningful results. Responses were minimal and non-conclusive in that the variances between business clusters did not enable the identification of specific technologies that would benefit this sector. Likewise, following the initial interviews, it became evident that the distinct clusters comprising this sector would not have enabled us to draw up meaningful information and the identification of water saving technologies that could be applied across the board.

In liaison with the Contracting Authority we thus altered our approach as follows:

- With over 90% of businesses being micro/small enterprises, this audience was targeted and their water usage identified. Available technologies were subsequently identified for this segment;
- To identify specific cluster/s deemed to utilise considerable volumes of water and that comprised a number of players. In view of the goals and objectives of Activity 1, the identified cluster to focus on eventually fell on the commercial laundry service providers, with circa 20 entities operating across the island.

[2] Should the target audience have preferred, EMCS also provided a pool of interviewers such that the questionnaire could be carried out utilising CATI (computer assisted telephone interviews). A printed version will also made available should the target audience prefer this medium.

Another cluster identified as utilising considerable volumes of water related to the commercial car wash service providers. Since initial research evidenced that such entities tend to utilise similar technologies, this specific cluster will be further analysed as part of Activity 2.

4.8 Identification of technologies

When determining the water saving technologies to focus on, the experts focused on seven (7) criteria, these being – the technology's:

- Water saving potential,
- Suitability to the local context,
- User acceptance,
- Affordability in absolute terms and/or when compared to savings,
- Ease of installation/retrofitting,
- Ease of use,
- Ease of market penetration and eco-friendliness

This report illustrates 5 technologies that are being proposed for each industry under review (in line with the tender document). Nonetheless as clearly evidenced in the table overleaf, some technologies may be easily adopted by other sectors.

Ref.	Technology	Tourism	Commercial	Agriculture	Residential
1	Restrictor for shower				
2	Water saving shower head				
3	Flushing toilets with manual stop				
4	Dual flush toilets				
5	Technologies the displace water in the flushing system				
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5. Results

5.1 Residential

5.1.1 Overview

Maltese citizens use around 110 litres of water per person a day, which is relatively low compared with other EU countries[3]. Nonetheless, the influx of foreigners that are being seeking employment on the island is placing new pressures that cannot be ignored. It is estimated that circa 45,000 foreigners[4] came to work in Malta in connection with its recent economic growth, with this figure expected to continue to grow in the foreseeable future.

Needless to say, that more people on the islands means a higher demand for water. Furthermore, and linked to the above, if such foreigners are accustomed to consuming more volumes of water (with research indicating that this could be as much as 250 litres of water per day in a water-rich country), this places further strain on the provision of water.

In terms of modern technologies, the market is aiding residents consume less with modern washing machines and dish washers today tending to be more efficient in terms of both water and electricity consumption. Similarly, there exist various alternatives to large-volume toilet flush- cisterns, with modern cisterns tending to be low-volume.

Furthermore, the quantitative research[5] has evidenced that:

Overall households are not aware of their water consumption patterns, with under 20% being able to indicate the amount of water they consumed (at household level). Furthermore, 92% were unable to indicate the cost per meter cubed of water provided by WSC. Also, 64% indicated that they did not feel that it would be beneficial for them to invest in water saving technologies. In line with such response, 63% indicated not to be willing to accept free advice from trained staff on how their home could be more water efficient.

The washing machine (48%) followed by the shower (24%) were identified as the highest water consuming points within the household. Kitchen tap ranked 3rd with 16% of responses. A total of 20% indicated using tap water for drinking. A review of such perceptions with actual consumption patterns with data collated by the energy and water agency evidences that '*at home, around 30-45 % of water is used for showering and a similar share for flushing*[2]'.

With regard to the shower, this was the preferred means for washing oneself for the majority of households (90%), with 72% indicating to do so at least once daily.

[3] https://www.eea.europa.eu/signals/signals-2018-content-list/articles/interview-2014-malta-water-scarcity
[4] https://timesofmalta.com/articles/view/43000-foreign-workers-in-malta -and-more-are-expected.682918
[5] 1,000 households contacted and participated in CATI

Overall, households do not feel the need to invest in water saving technologies. In total only 11% of households indicated investing in such technologies with efficient washing machines being indicated as the primary investment made (59% responses within this cluster). A review of responses by location of residence evidenced that Gozitan households were slightly more inclined to invest in water saving technologies than other districts, while the Northern district and the Southern Harbour district were least inclined to invest in such technologies.

When residences were prompted on the various technologies installed in households it transpired that volume reducers (6%) and aerator or flow reducers (5%) were generally not installed.

Main reasons for not investing in water saving technologies were varied with the primary reasons being: the perceived expense of such investments (13%), lack of awareness (11%) and the old age of the residents (11%).

By and large households (84%) are not aware of water demand management/water saving technologies. Among those that are aware, energy saving washing machines (11%) were the technologies to attain highest responses[6].

As for rain water storage systems just over half all households (55%) indicated having such a system in place, though residents in apartments tended not to have such a system in place.

The above results highlight:

- Lack of awareness on water spend
- Lack of interest in managing water consumption at household level
- Lack of investment in water saving technologies along with limited awareness of such technologies

To instigate households any water saving technologies identified ought to

Be affordable in absolute terms,

Be easy to install/ retrofit,

Easy to use

[6] 18% also indicated the Reverse Osmosis though this is not deemed to be a water saving technology.

5.1.2 Current state of play

The above findings are based on a survey carried out (Computer-Aided Telephone Interview – CATI) with 1,000 households, with the sample being representative of Maltese households in terms of household size and location of residence.

Further details of such findings are being presented below.

a. Details about the household

With 56% responses, the majority of respondents indicated living in a terraced house. Apartments ranked 2nd with 24% responses.

Respondents tend to own their location of residence (82% responses). Furthermore, households indicated to have been residing in their current location for 20 or more years (69% of respondents), with 16% indicating to have been residing in their current premises for under 10 years.

b. Water consumption

Overall

66% of respondents indicated being the person generally responsible for paying water (and electricity) bills, with another 27% indicating to be 'partially' involved. Nonetheless, under 20% were able to indicate the amount of water consumed and, in most instances, indicated the cost rather than the volume. A further 3% were only able to indicate the aggregated cost of both water and electricity consumption.

Consumption patterns

Two-thirds of respondents (63%) indicated that their water consumption patterns have remained the same over the past 3 years.

A total of 14% indicated an increase in consumption, with the main reasons for such increase relating to:

- Increase in household members (22%);
- Children use more water (9%);
- Children have grown up (7%)

A total of 29% were unable to identify a particular factor that had instigated such increase.

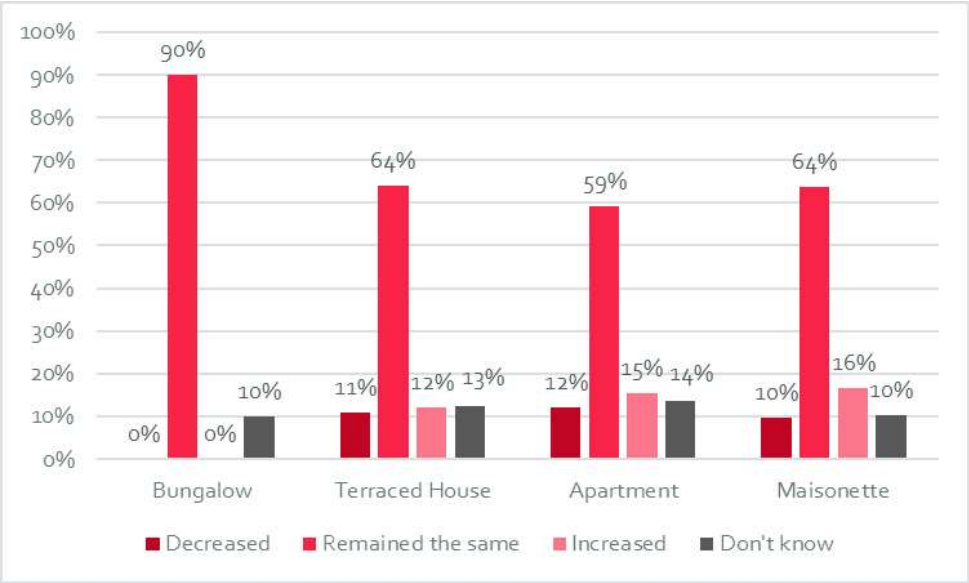
A total of 11% indicated a decrease in consumption, with the main factors effecting such decline relating to:

- Decrease in household members (39%);
- Decrease in consumption due to changes in habits (17%);

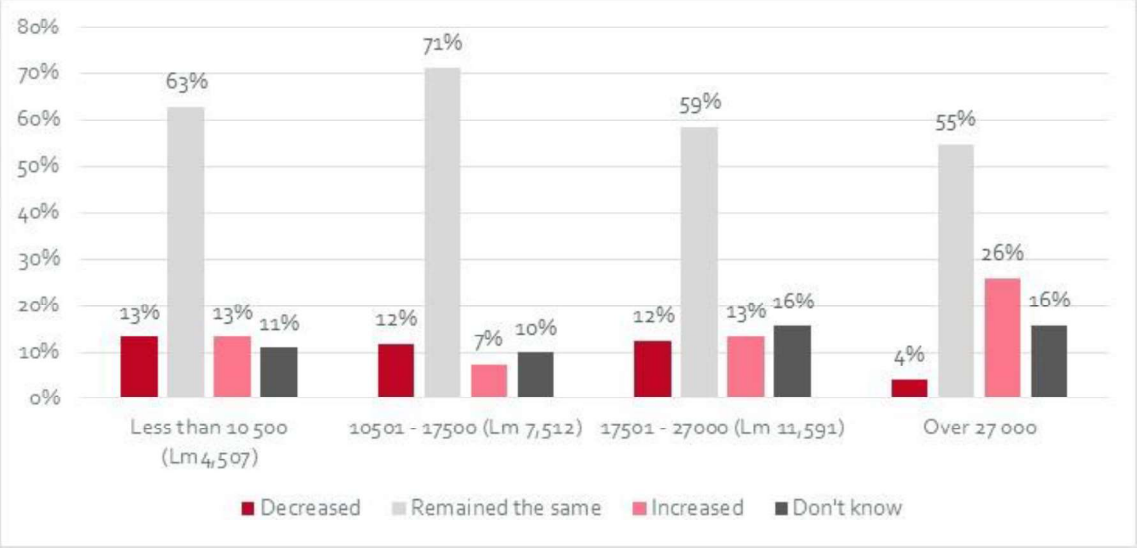
- Use water from well (12%).
- Decrease in bills (12%) – the respondents linked this question to their bill. In reality respondents may have not decreased consumption.

A total of 23% of respondents within this cluster were unable to indicate a specific factor that had contributed to such decline in water consumption.

A cross analysis of responses by type of dwelling (graph below), indicates that with the exception of bungalows[7], no significant variances were observed among the different dwelling types



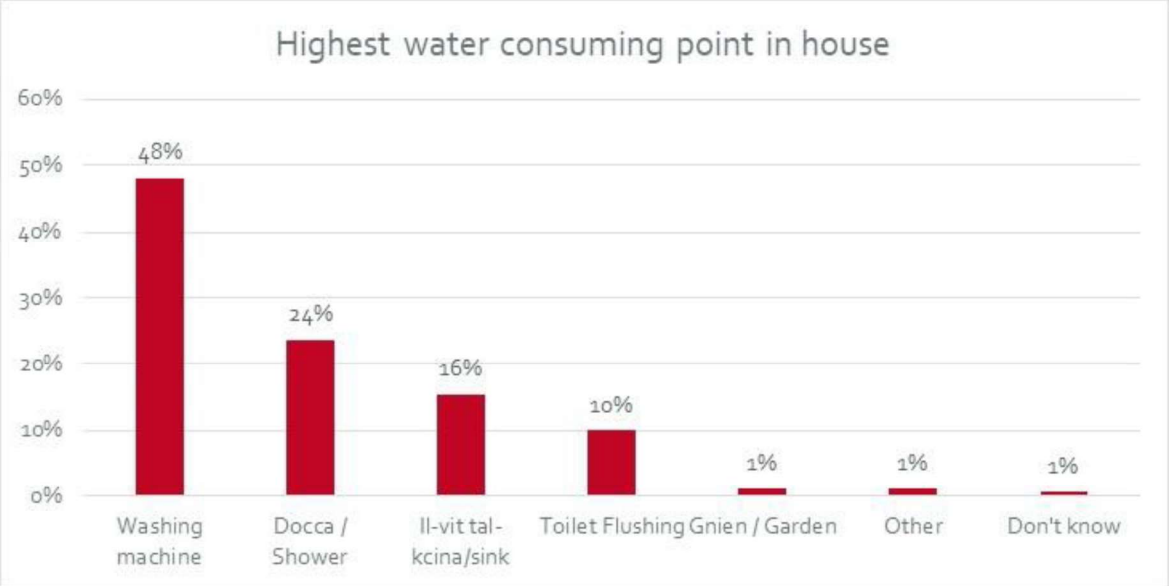
Furthermore, a review of responses by the average household income evidences that the percentage of households that indicated an increase in consumption increased within the higher household income brackets – figure below refers.



[7] The sample size of bungalows was low (1%)

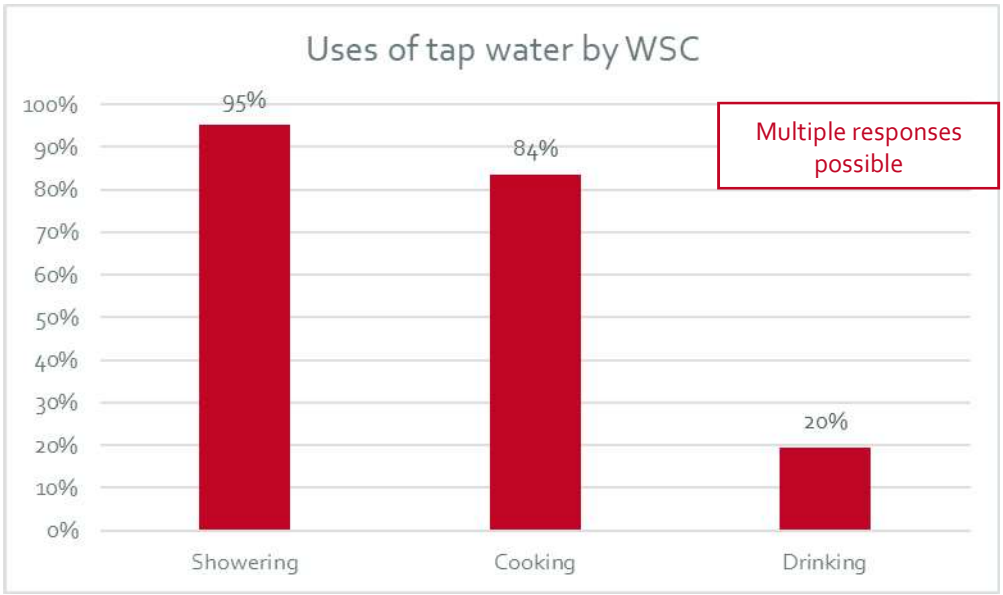
Highest consuming point

Households were asked to indicate, what in their opinion was the highest consuming point in their dwelling. 'Washing machine' rated highest with 48% of households indicating this technology to be the highest consuming point in their household.



c. Tap water usage

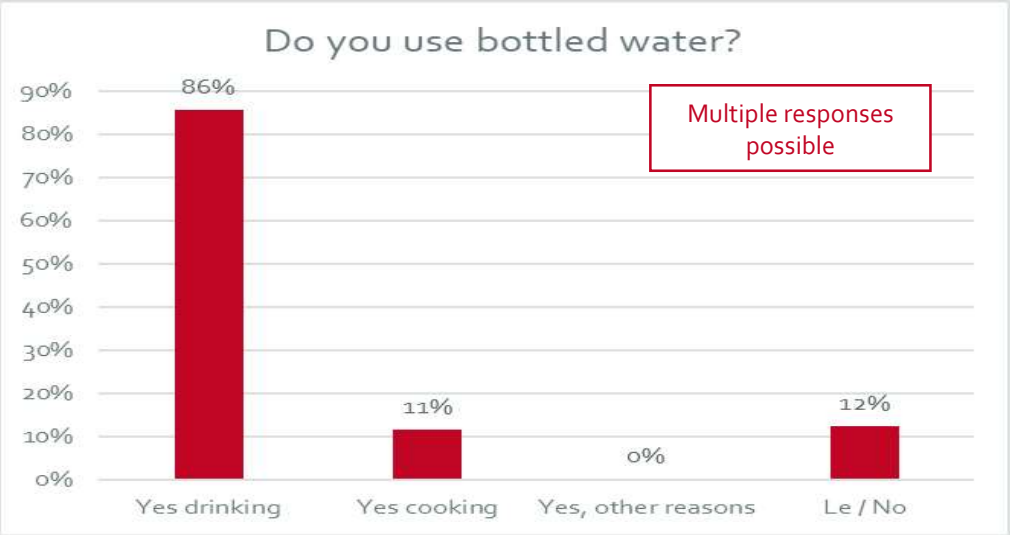
The survey sought to identify what were the primary reasons households used tap water by Water Services Corporation. Showering and cooking were identified as the primary usages of tap water with 95% and 84% responses respectively.



d. Bottled water

Individuals that did not indicate using tap water for drinking purposes were asked whether they used bottled water. Furthermore, this cluster was asked whether they used bottled water for other purposes.

With 86% responses, households that utilise bottled water, primarily do so for drinking purposes.

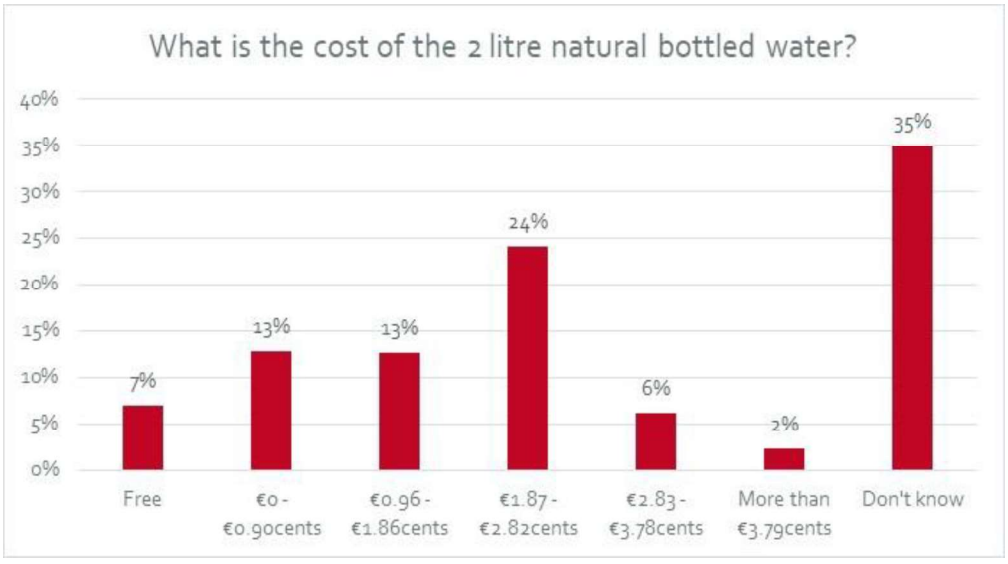


e. Pricing

Bottled water

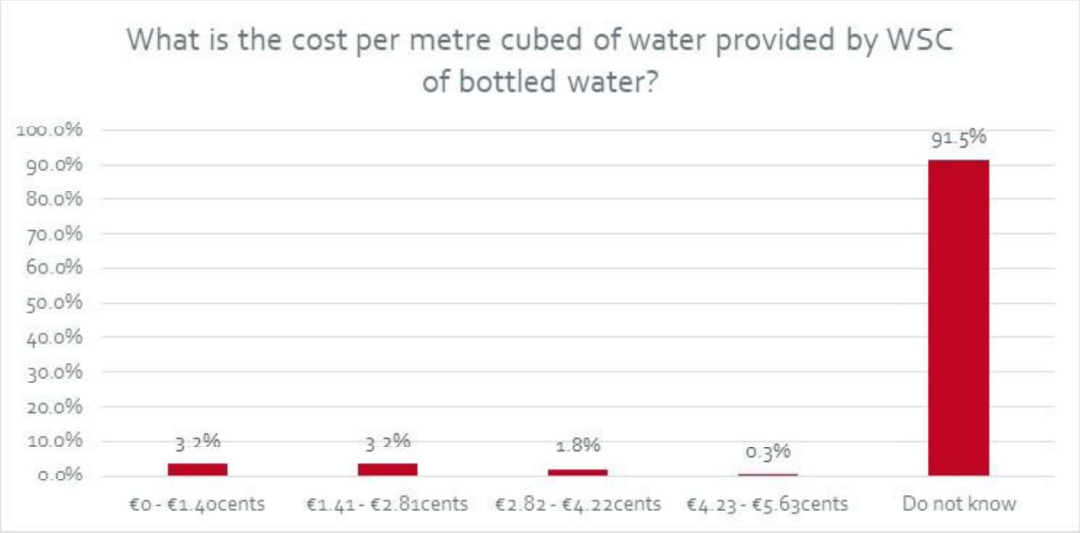
In order to determine awareness levels and costings, households that indicated using bottled water were asked to indicate the cost of a 2-litre bottle of natural water.

35% of respondents indicated not being aware of the cost. Furthermore, 7% indicated that there was no cost (bottled water was given for free with groceries spend).



Water provided by Water Services Corporation

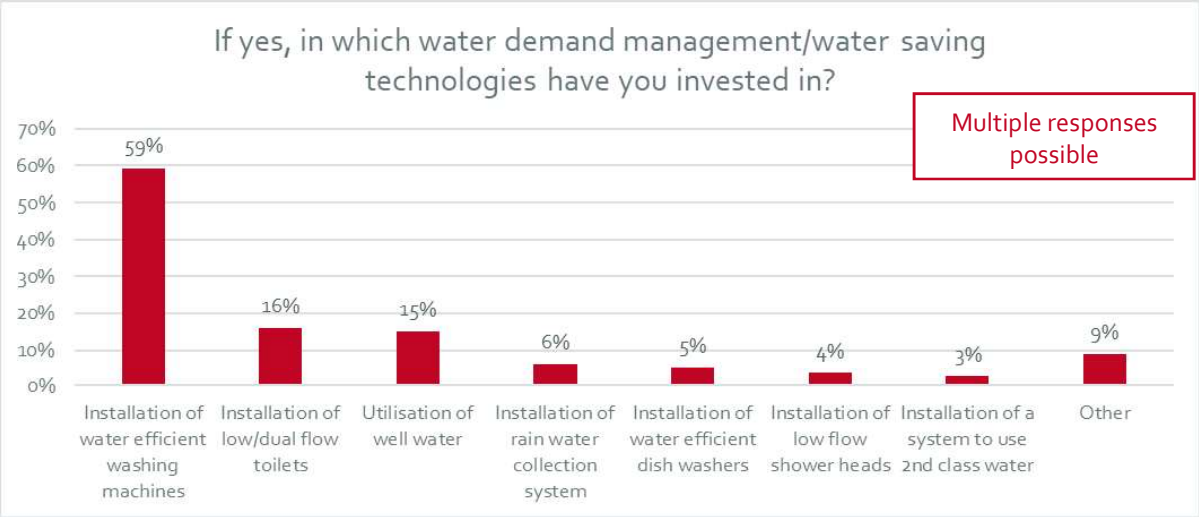
The survey sought to determine to what extent households were aware of the cost of 1m³ of water provided by Water Services Corporation (1m³ = 53 bottles of 18.9 litres). The results clearly illustrate that households are unaware of the costs as clearly evidenced from the below graph.



f. Investment in water technologies

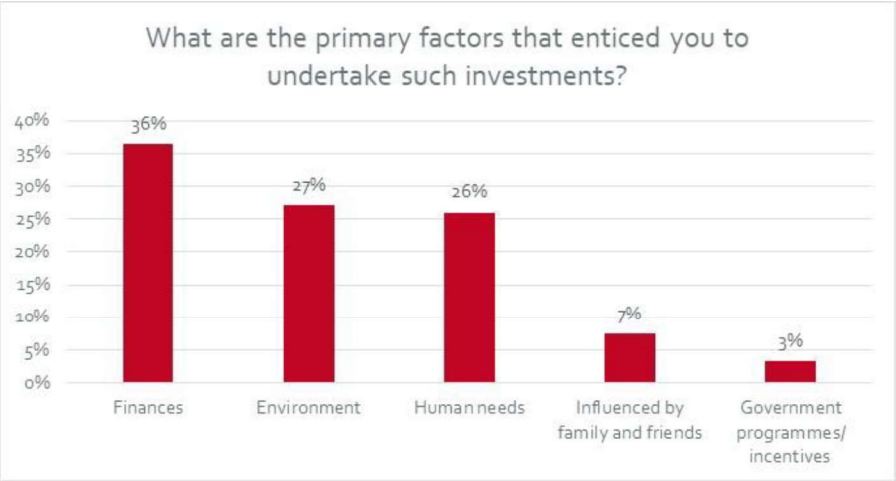
A total of 11% of households indicated investing in water demand management/ water saving technologies. Within this cluster:

- 59% indicated investing in water efficient washing machines;
- 16% invested in low/dual flow flushing;
- 15% indicated utilising a well.

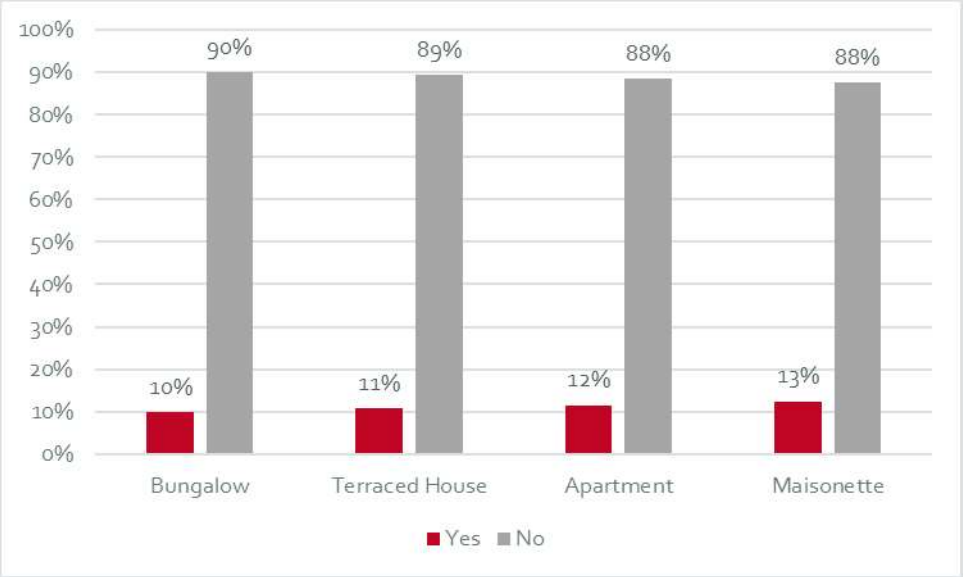


Among this cluster, the primary factors that instigated such households to invest in water demand management/ water saving technologies related to:

- Finances (36%);
- The environment (27%) and
- Human needs (26&)[8].

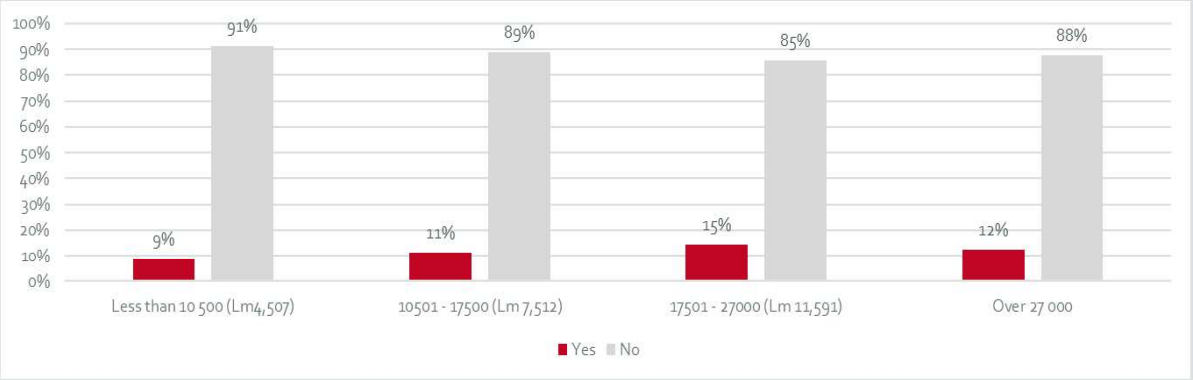


Responses in relation to investments in water saving technologies were also analysed by dwelling type. As per graph below, no significant variance in responses was however observed.

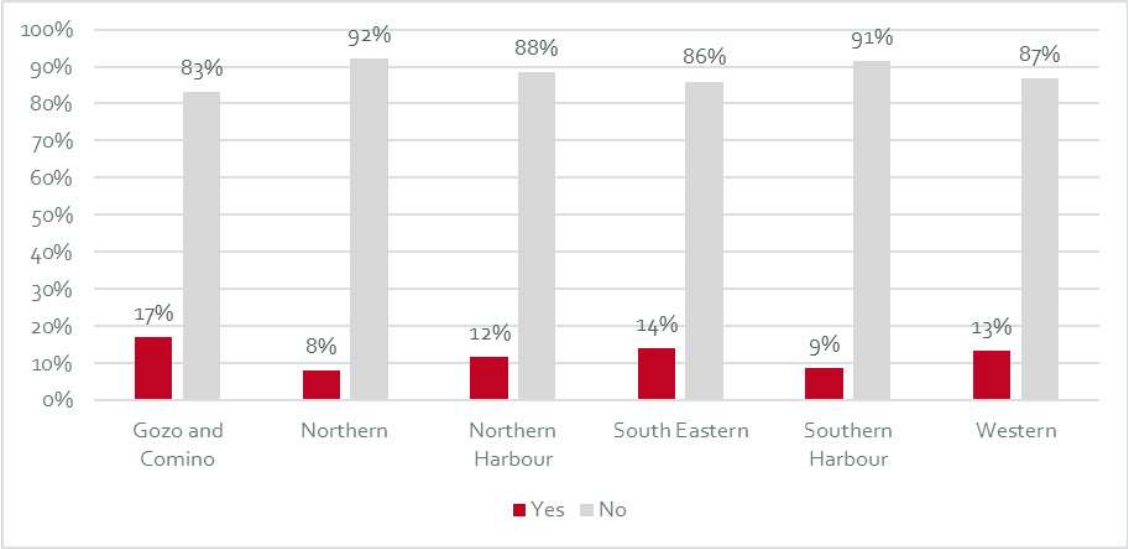


A cross analysis of responses by household income evidences that there is no significant variance or correlation between the income at household level and the likelihood of investment in water saving technologies.

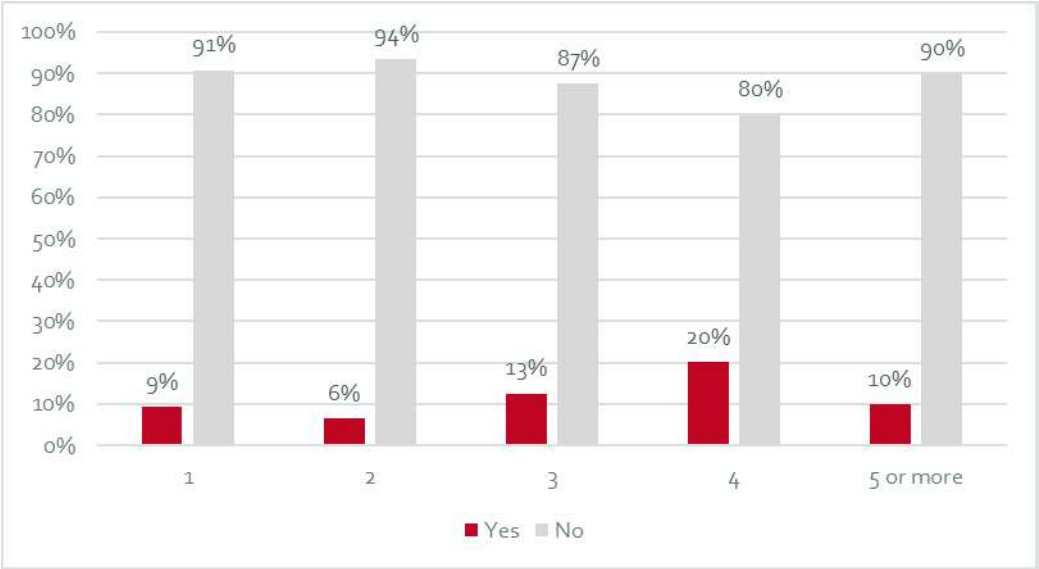
[8] Respondents were asked to rank the three primary factors. In this respect a score of 3 points was given to 1st ranked factors, a score of 2 for 2nd ranked factors and a score of 1 for 3rd ranked factors. A weighted average was then calculated with the results reflective in the corresponding graph.



Furthermore, a cross analyses was carried out of households' investments in water saving technologies by district, to determine whether or not certain districts were more inclined (or not) than others to invest in water saving technologies. As per table overleaf, households in Gozo were slightly more inclined to invest in water saving technologies than other districts. Conversely, the Northern District and Southern Harbour Districts were the least inclined to invest in water saving technologies.

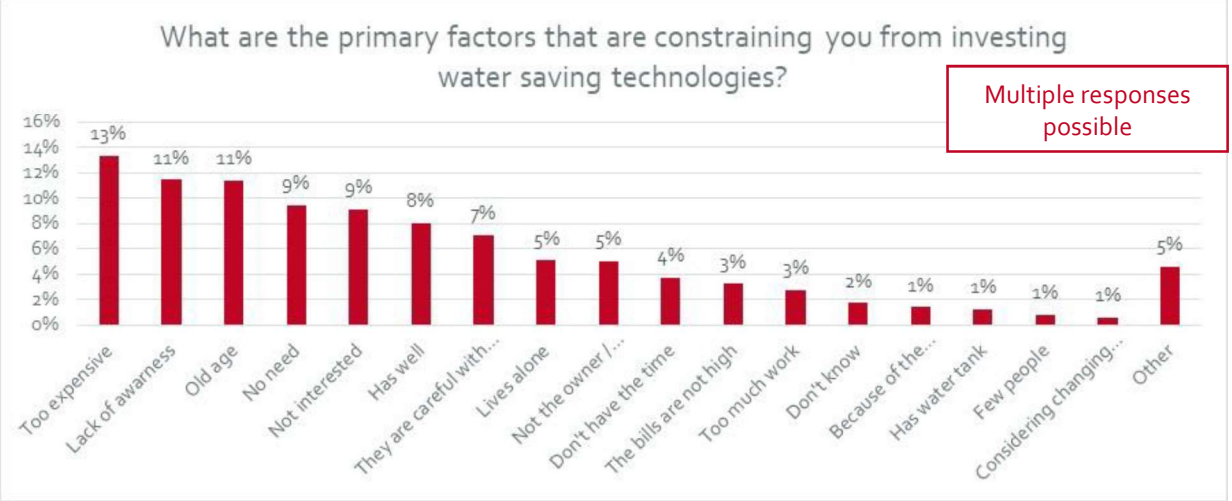


A review of responses by the number of individuals living in each household evidences that household with a total of 4 individuals were the most inclined to invest in water saving technologies. Conversely, only 6% of households comprising 2 residents invested in water saving technologies.



Households that indicated to have not invested in water demand management/ water saving technologies, were asked to mention the main factors that constrained them. As evidenced from the below graph, responses were varied, with the top mentions relating to:

- Such technologies being perceived as being too expensive (13%);
- Lack of awareness (11%);
- Old age (11%).

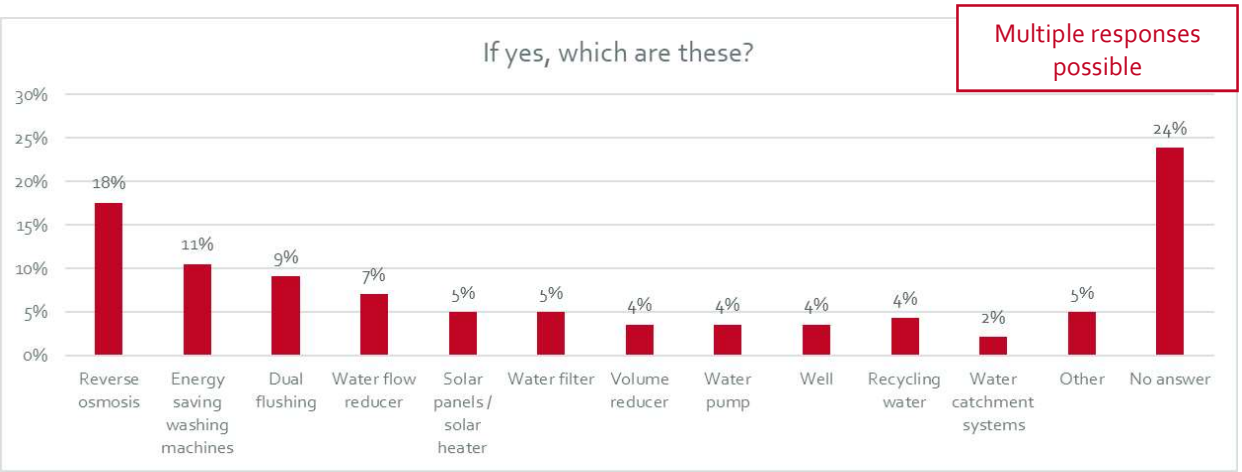


g. Awareness of water demand management/ water saving technologies

Top of Mind

The research also sought to determine to what extent households were aware of current, available water demand management/ water saving technologies.

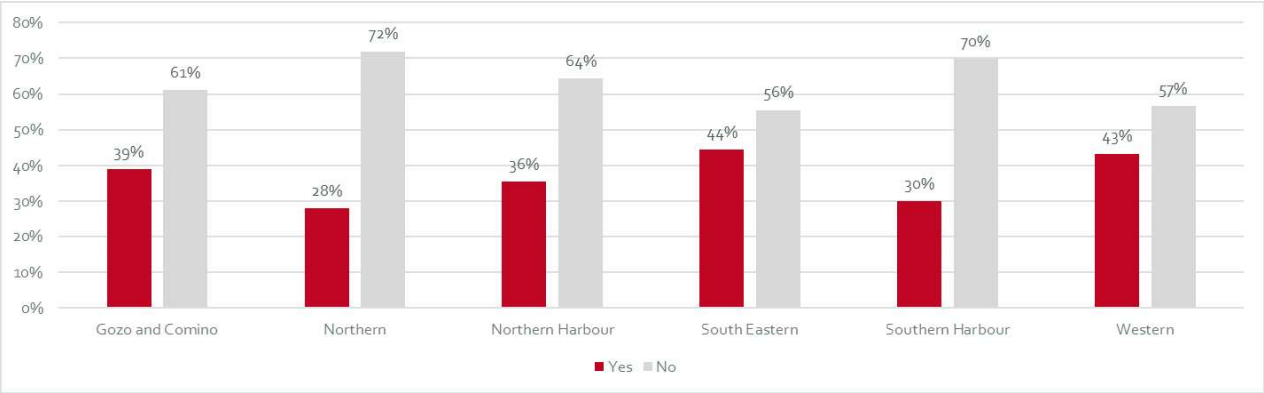
In this respect, 16% answered in the positive with reverse osmosis being the primary technology indicated (18%), this notwithstanding that such technology is not classified as a water saving technology.



The majority of households (64%) indicated that they do not feel it would be beneficial to them to invest in water saving technologies.

A review of responses by region (graph below) indicates that overall, all regions tended to perceive investing in water saving technologies not to be beneficial. The least inclined regions to invest (and indicated not to feel it beneficial for them to invest in water saving technologies) being:

- Northern region (72%) and
- Southern Harbour (70%).

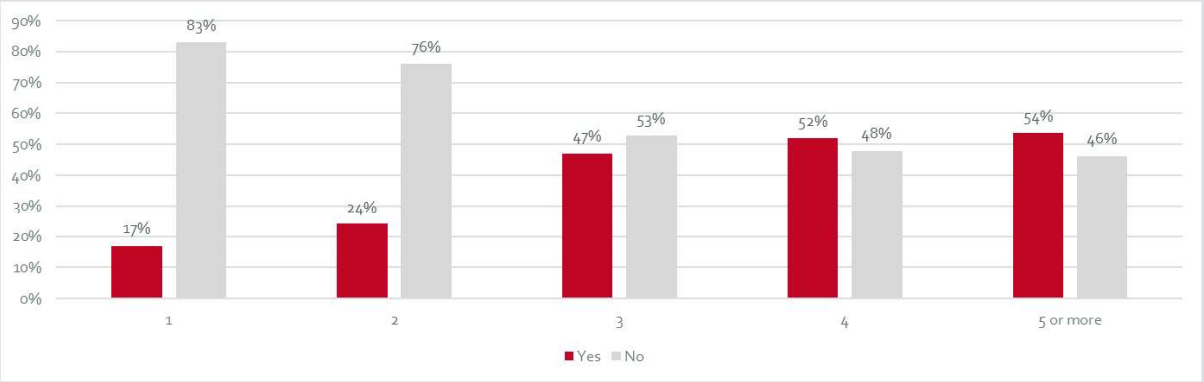


Among those households that thought it would be beneficial,

- To save money (38%) and
- Less consumption of water (26%)

were indicated as the primary beneficial factors for investing in water saving technologies.

A review of responses by the number of individuals residing in each household evidences that households' perception of the benefits to invest in water saving technologies increases with the number of individuals residing in each household.



Prompted

To better understand to what extent households understood/ were aware of water saving technologies, and whether or not such technologies were in fact installed within the households, part of the research comprised the researcher specifically asking households whether or not specific technologies were installed. In this respect a total of 5 technologies were analysed, these being:

I. Reverse Osmosis System

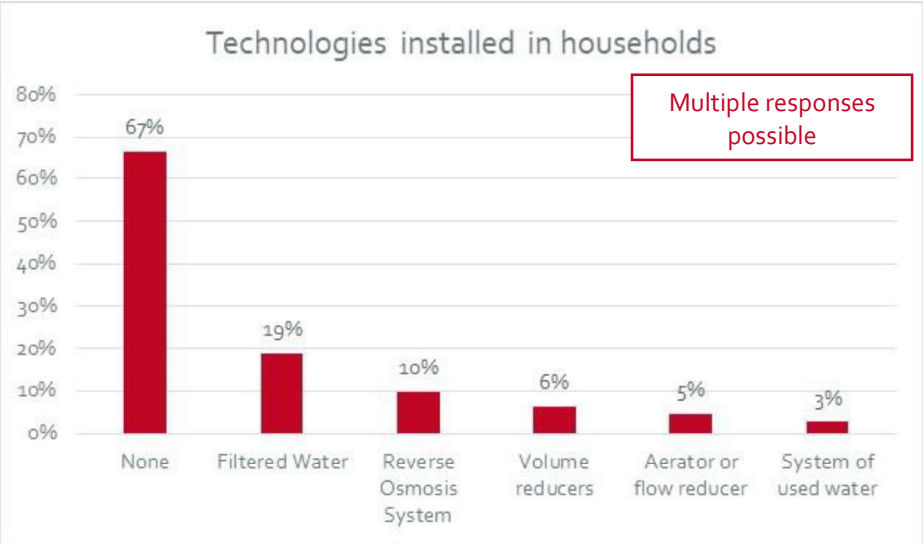
II. Filtered water

III. System of used water

IV. Volume reducers (used in flushing tanks) and

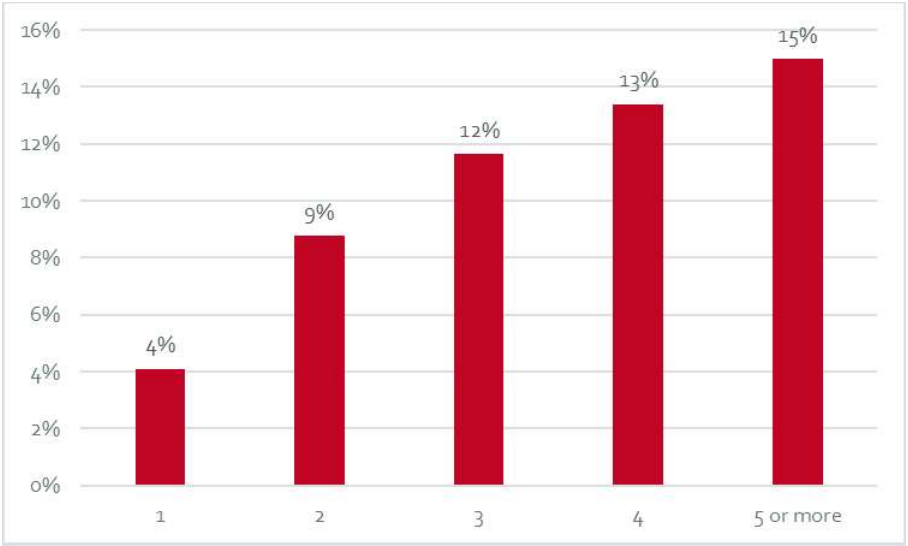
V. Aerator/s or flow reducer/s

With 67% responses, households reiterated that none of the systems under review were installed in their residences. 19% of households had a filtered water system installed while another 10% had a Reverse Osmosis System in place.



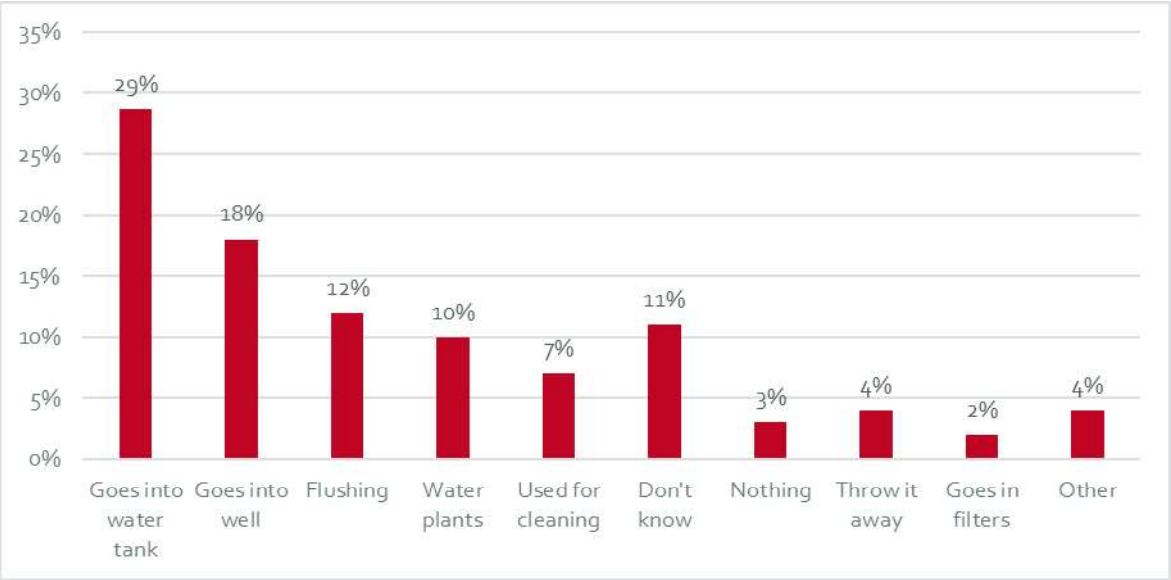
Reverse Osmosis System

A review of the households that indicated having a Reverse Osmosis system in place evidences that the households comprising one resident were the least inclined to invest in such a system, with the likelihood of investing in this system increasing as the number of individuals residing in a dwelling increased.



Individuals that indicated having a Reverse Osmosis System installed were asked to indicate whether they utilised the RO reject water. By and large households indicated utilising such water with 29% indicating that such water was diverted to the tank. Another 18% indicated diverting such water to the well, while 12% indicated that it was used to flush (toilet/s).

7% of households indicated throwing such reject water away (in the drains).



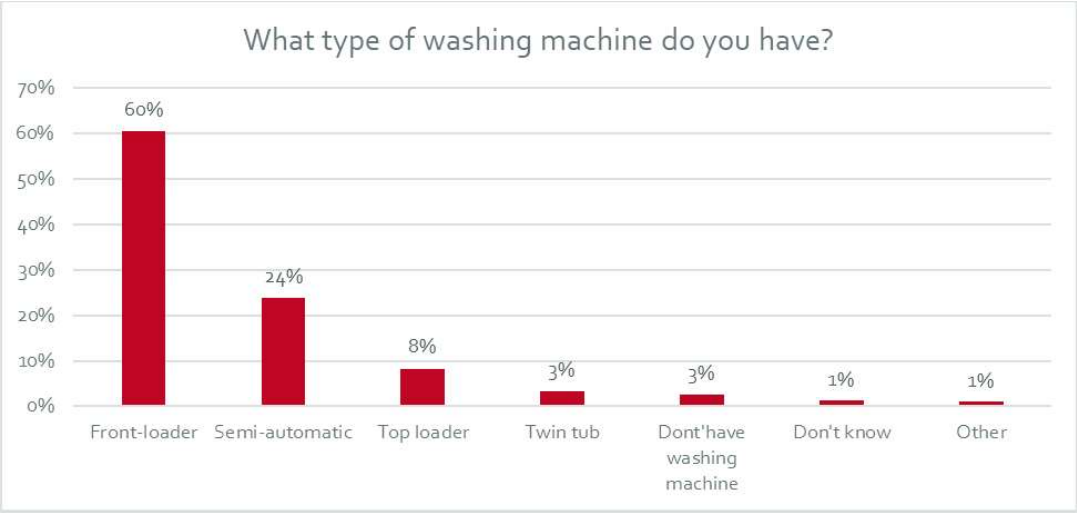
h. Clothes washing

Part of the survey sought to determine clothes washing habits. In this respect the following aspects were analysed:

- Type of washing machine used
- Number of loads per week
- To what extent is the washing machine filled
- Programmes/ washing cycles used

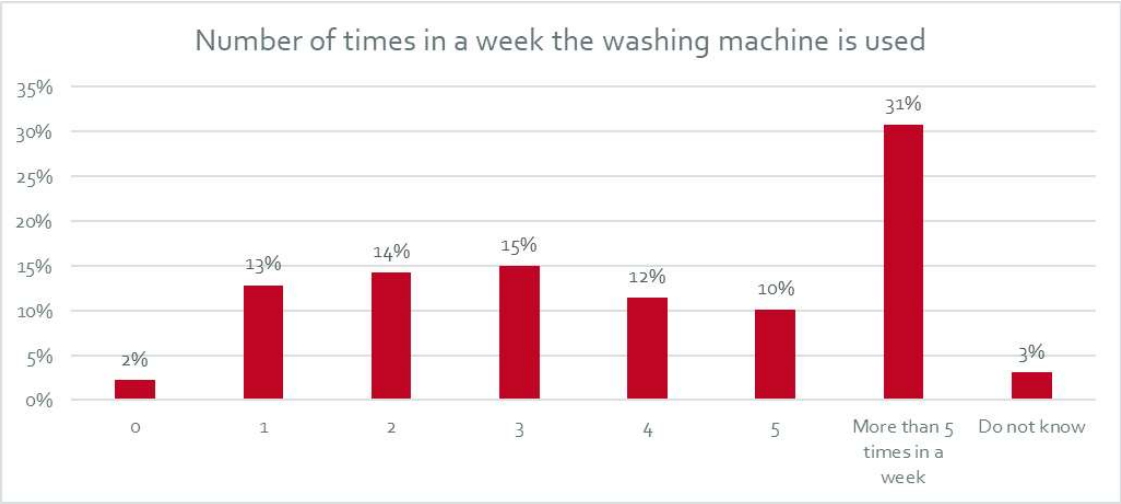
Type of washing machine

The top two types of washing machines used by households are front loaders (60% responses) and semi-automatic (24% responses).



Number of loads

31% of respondents indicated using their washing machine more than 5 times in a week. Conversely, 2% indicated not using a washing machine.

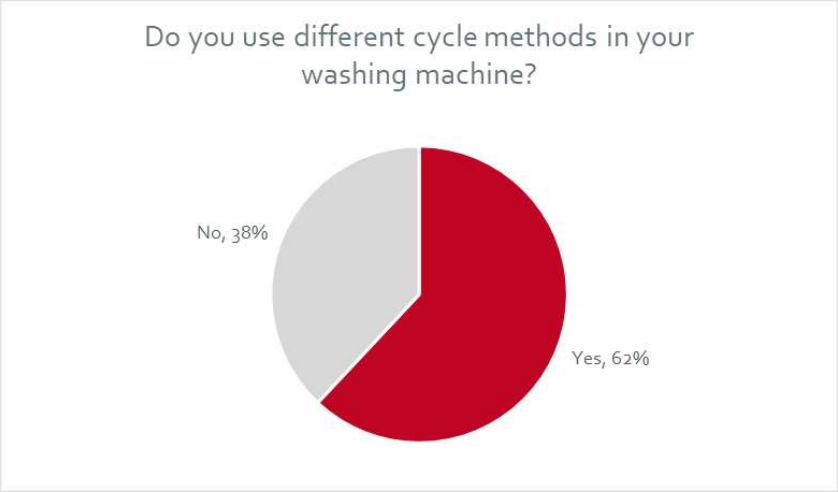


Washing machine load

Households were asked to indicate to what extent they fully loaded their washing machine when using it. With 65% responses, households indicated that they generally fully load their machine. Conversely, 7% indicated that they generally do not fully load their washing machine.

Cycles used

With 62% responses, households generally use different cycle methods (depending on the type of wash they intend to carry out.

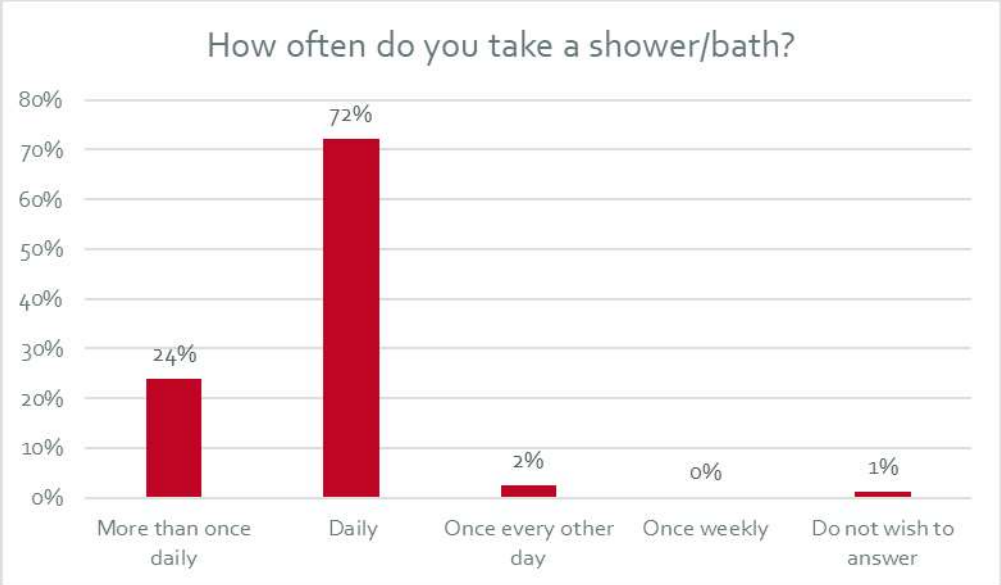


i. Washing oneself

The research also sought to determine individuals washing (shower/bath) habits.

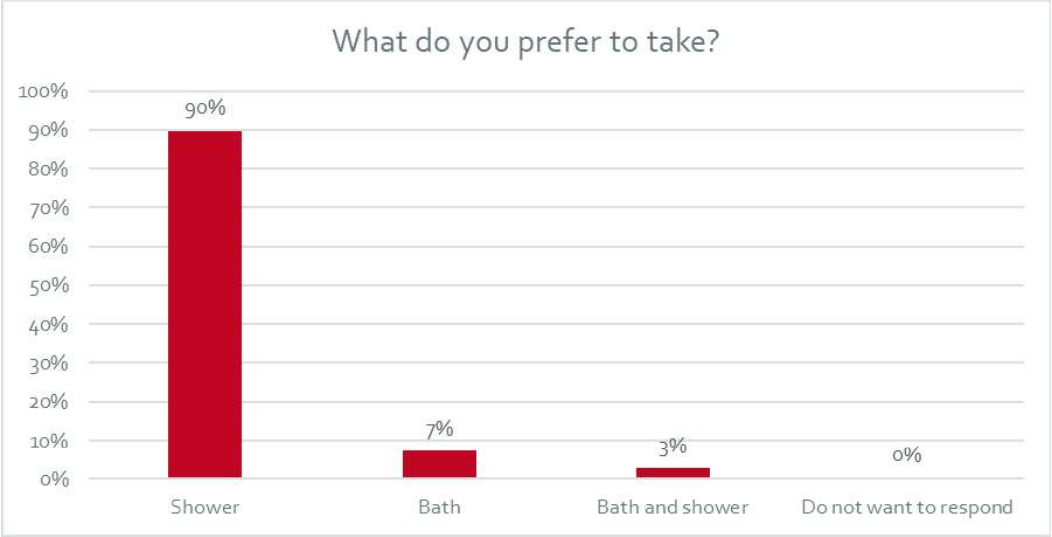
Frequency

Respondents were asked to indicate how often they took a shower / bath, with 'once daily' being the most common reply (72% responses).



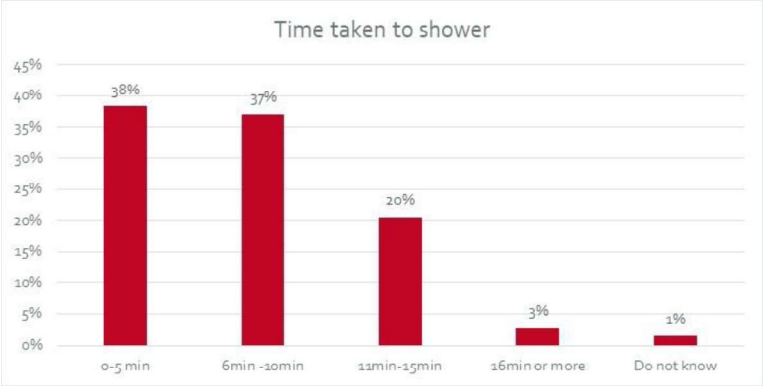
Preference & duration

Furthermore, respondents indicated to generally prefer taking a shower (as opposed to a bath).



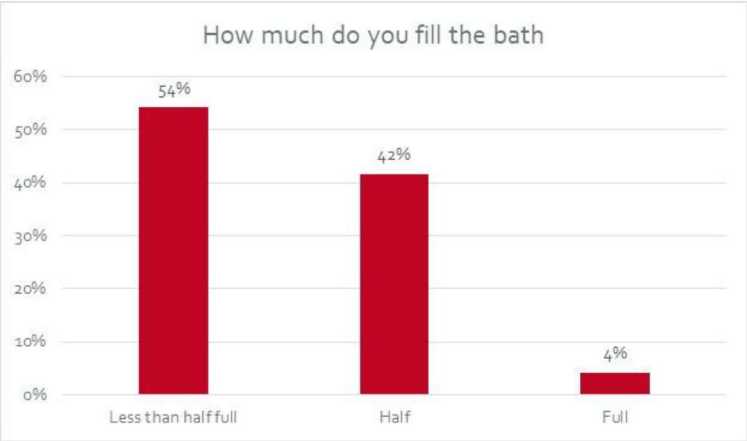
Shower users

A review of how long respondents generally lasted in the shower varied, with 38% indicating spending up to 5 minutes, while 37% indicated spending 6 minutes to 10 minutes. Close to one-fourth of respondents (23%) indicated spending over 10 minutes in the shower.



Bath users

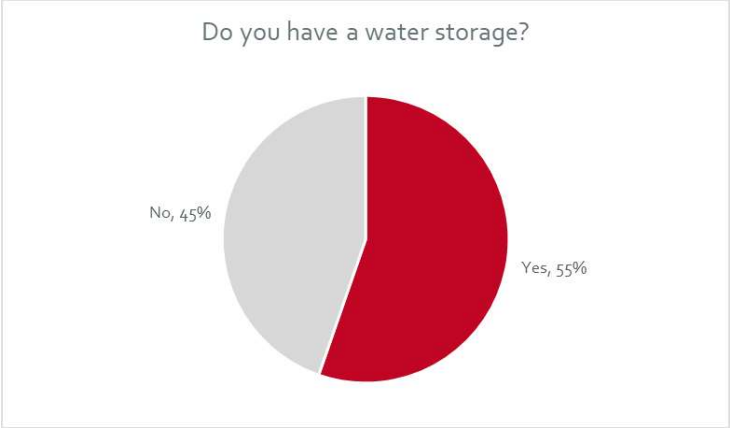
When bath users were asked how much they generally fill their bath, the vast majority (96%) indicated that they do not fill the bath completely.



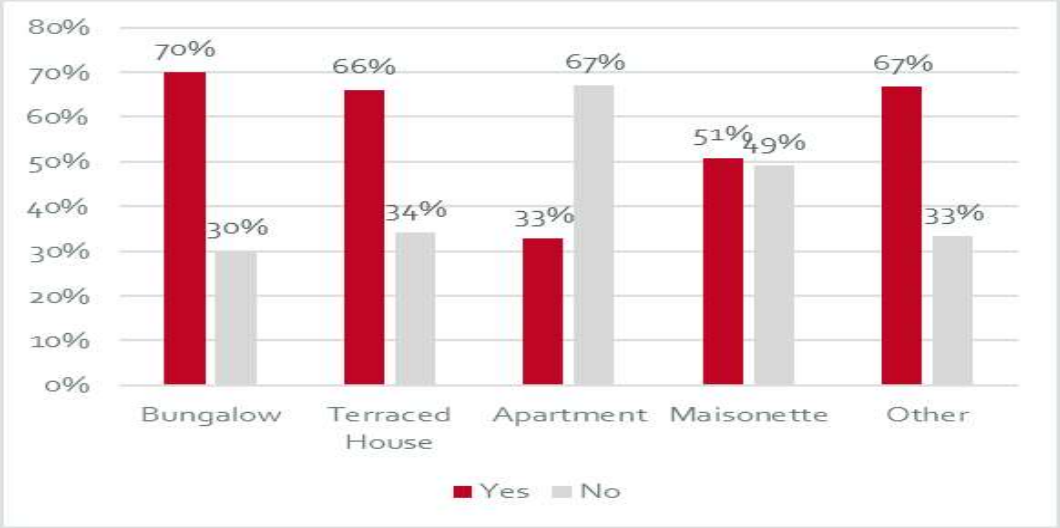
j. Water Storage

The questionnaire also sought to determine to what extent dwellings had rain water storage systems in place, and for what purpose/s id households utilise such water storage.

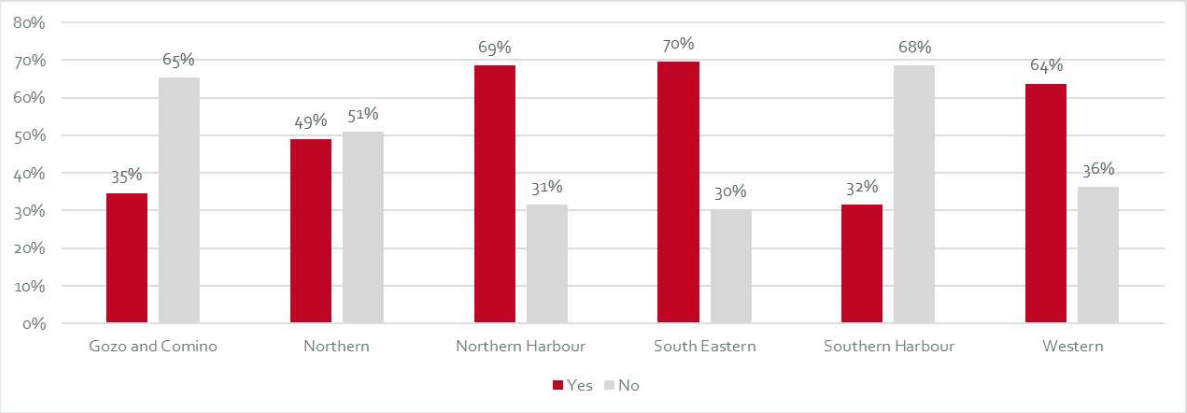
With 55% positive responses, just over half the sample indicated having a water storage.



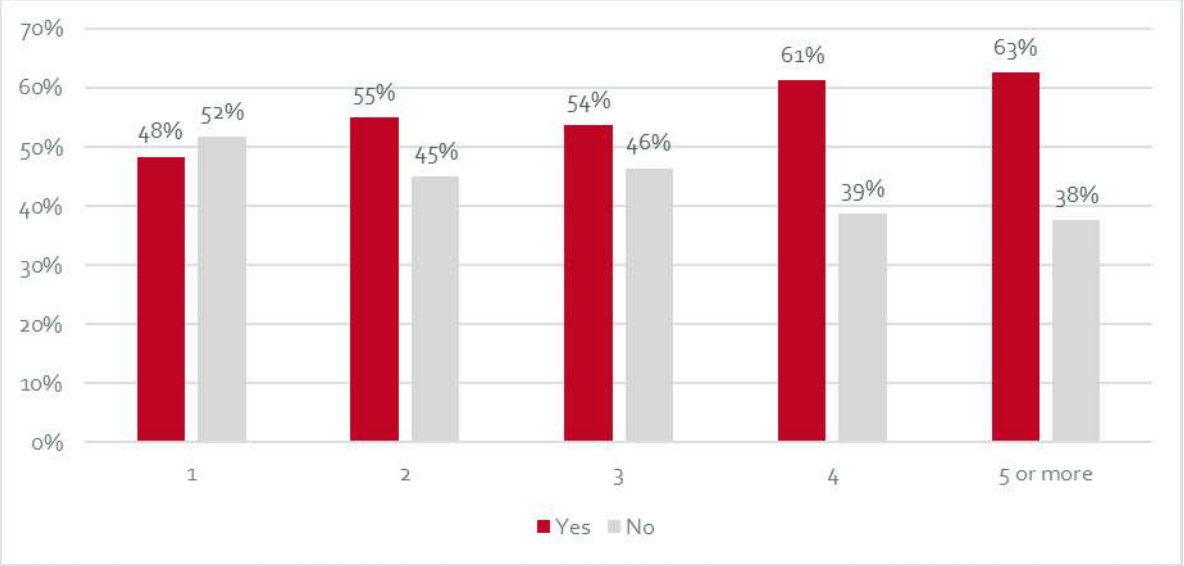
A review of responses by dwelling type indicates that individuals residing in apartments and maisonettes were the least likely to have rain water storage systems in place.



Analysing responses by district, illustrates that residences in Southern Harbour district, followed by residences in Gozo were the least likely to have water saving technologies in place (graph overleaf refers).

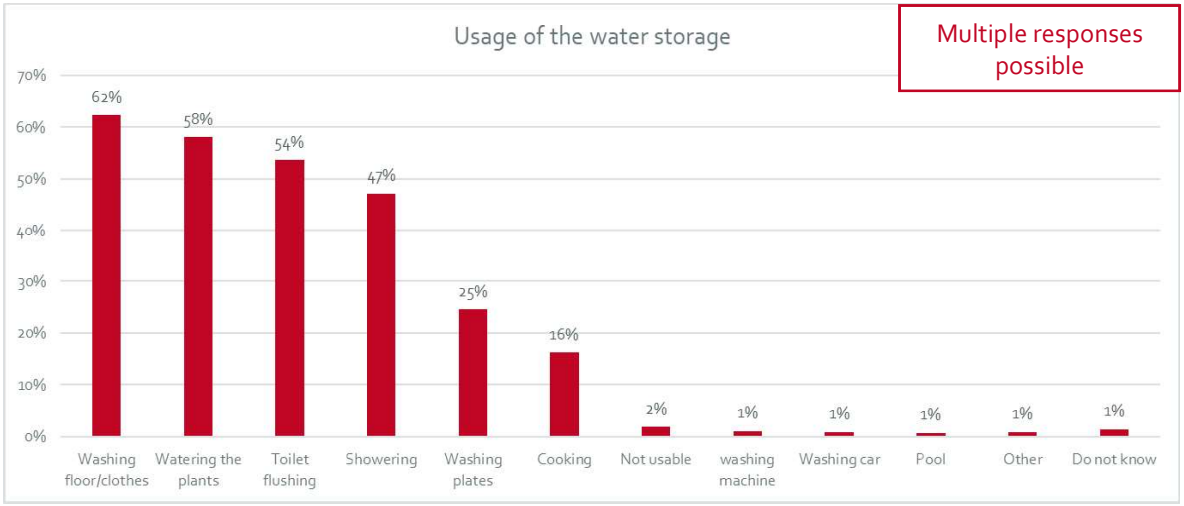


A review of responses by the number of individuals residing in each household evidences that the likelihood of having water storage systems increases as the number of individuals living in a household increases. Households with one member are least likely to have a water saving system in place, while households having five or more members are the most likely to have a water saving system in place.



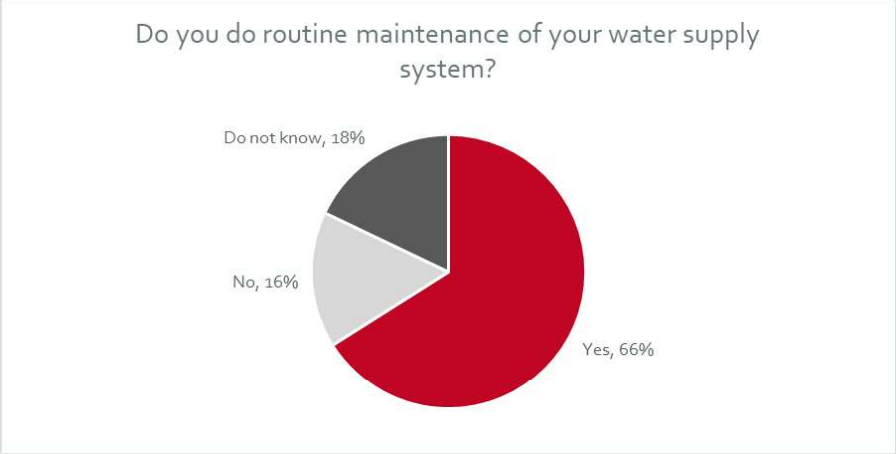
As evidenced from the below graph, the main usages of such rain water storage relate to:

- Washing (floor/clothes)
- Watering the plants
- Toilet flushing; and
- Showering.

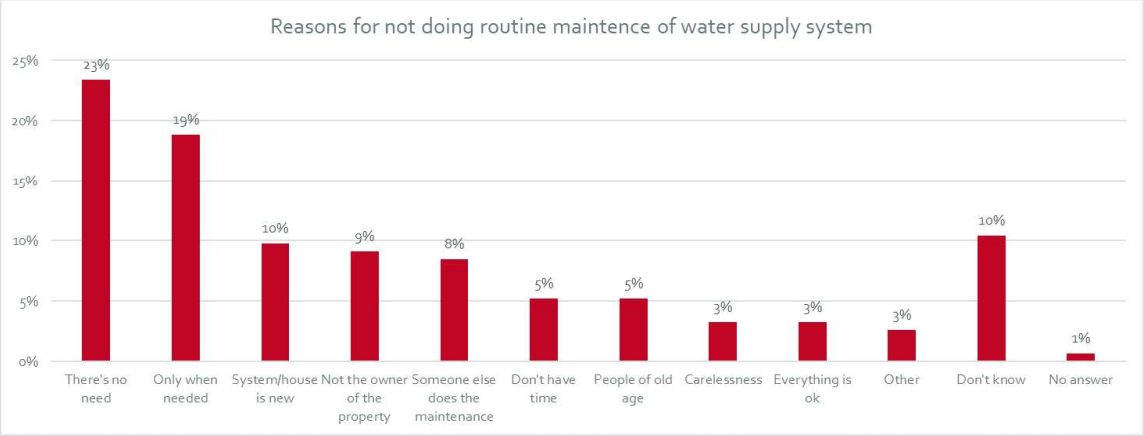


k. Maintenance of water supply

Households were asked whether they generally undertook maintenance of their water supply system, with responses evidencing that 66% of households indicating to generally do.



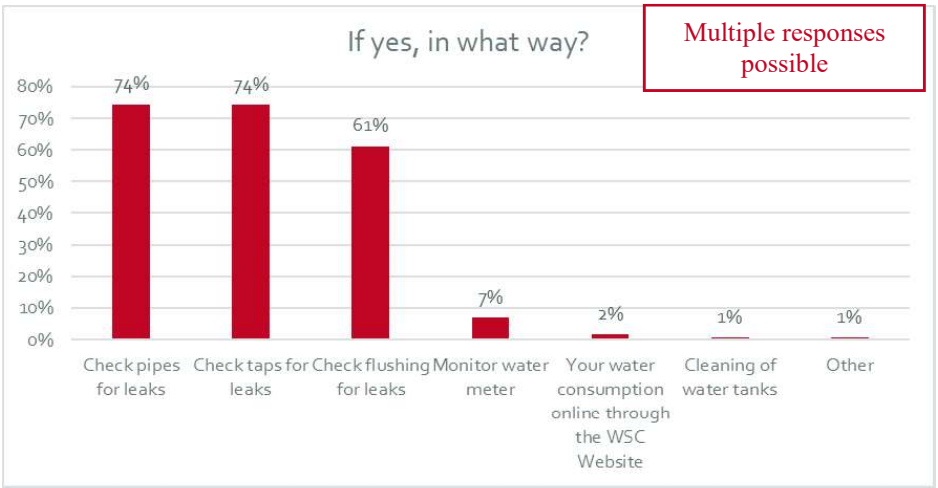
Those that answered in the negative were asked why they generally did not, with the main reason given being that they felt that there was no need to (23%). A further 19% indicated that they only carried out works when needed. An indication that such households undertook a reactive rather than a proactive approach.



Households that indicated carrying out maintenance were asked to indicate what sort of maintenance they generally undertook, with the top three (3) mentions relating to:

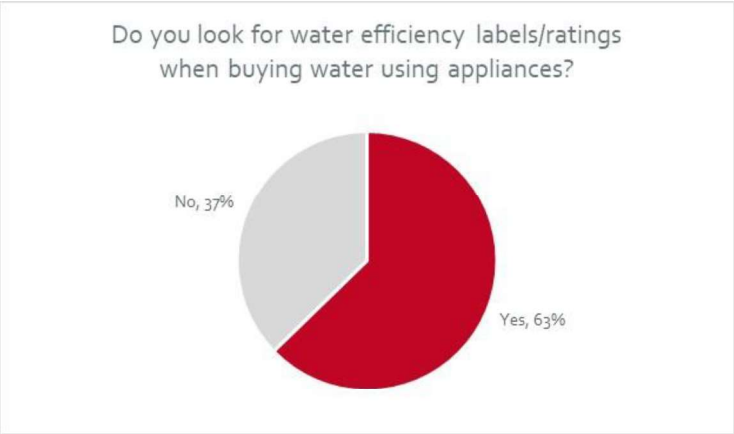
- Check if the pipes leak (74%)
- Check taps for leaks (74%)
- Check flushing for leaks (61%).

All other mentions attained a score below 10%.



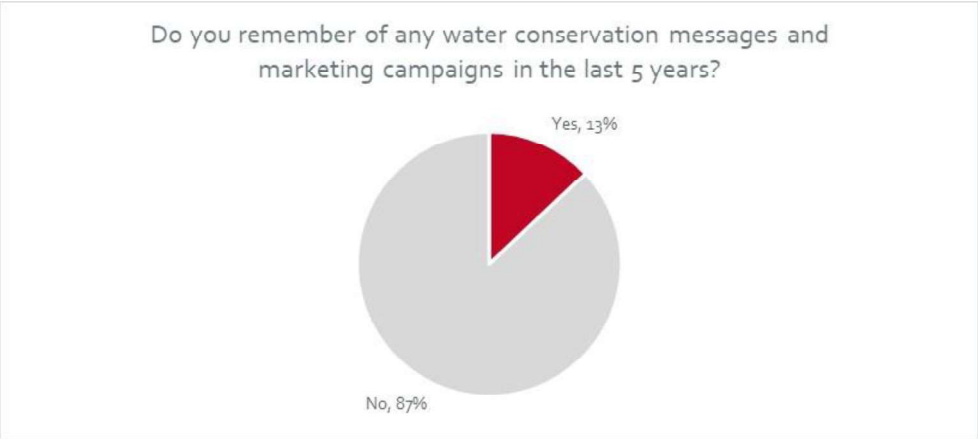
I. Attitudes when purchasing water using appliances

Households were asked whether they look for water efficiency labels/ratings when buying water using appliances, with 63% answering in the positive.

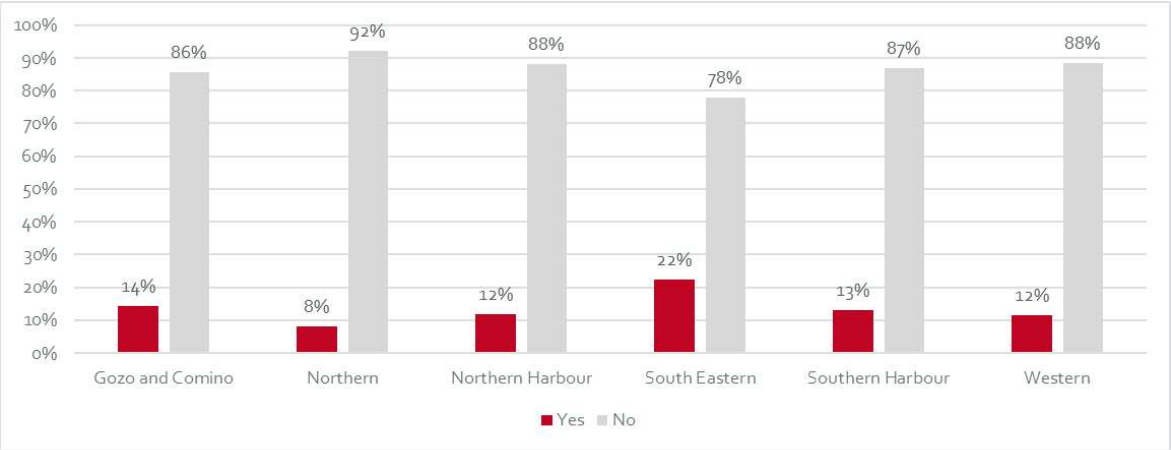


m. Marketing recall

By and large, households did not recall water conservation message/s and marketing campaign/s in the last 5 years. In total 13% recalled such message/s.



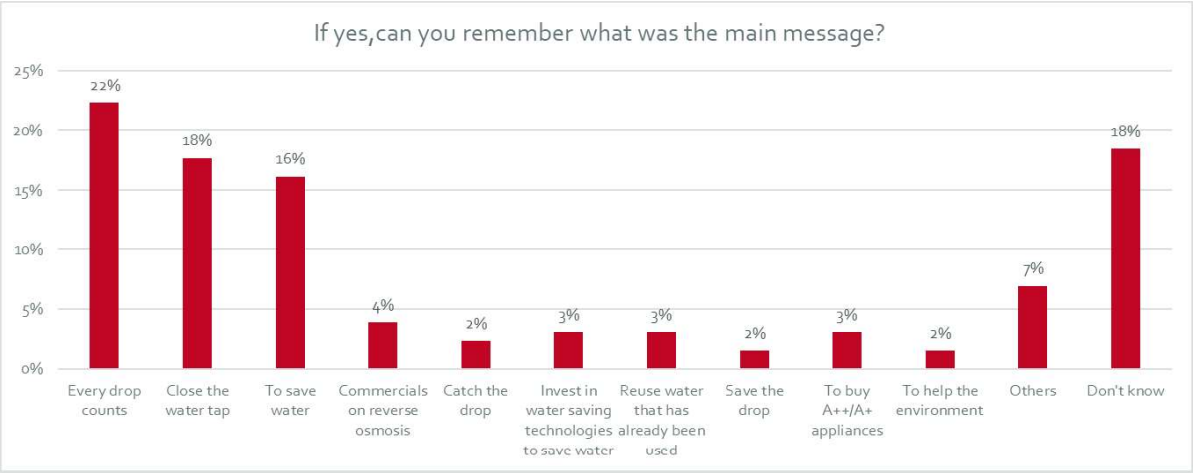
A review of responses by region evidences that just over one fifth (22%) of residents in the South Eastern region recalled water conservation message/s and marketing campaign/s, this being the highest score among the various regions. Conversely, only 8% of Northern district residents recalled a water conservation message/s and marketing campaign/s.



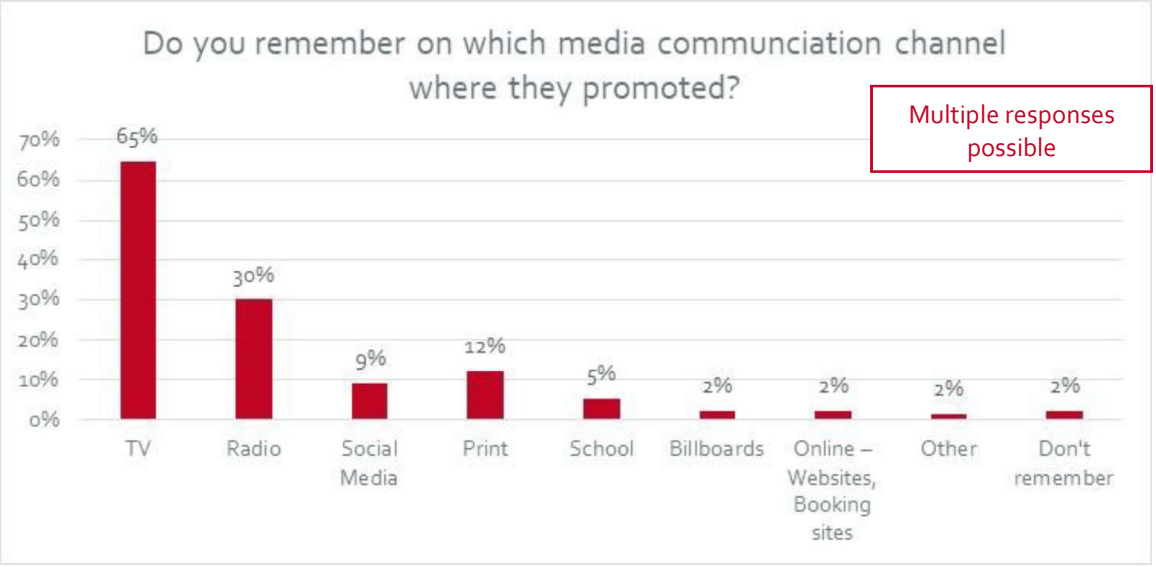
Among respondents that answered in the positive, feedback regarding the main message varied, with the most common responses relating to:

- Every drop counts (22%);
- Close the water tap (18%); and
- Save water (16%).

All other mentions attained a score below 5%. A total of 18% indicated to recall a campaign on the topic but were unable to indicate what the main message referred to.

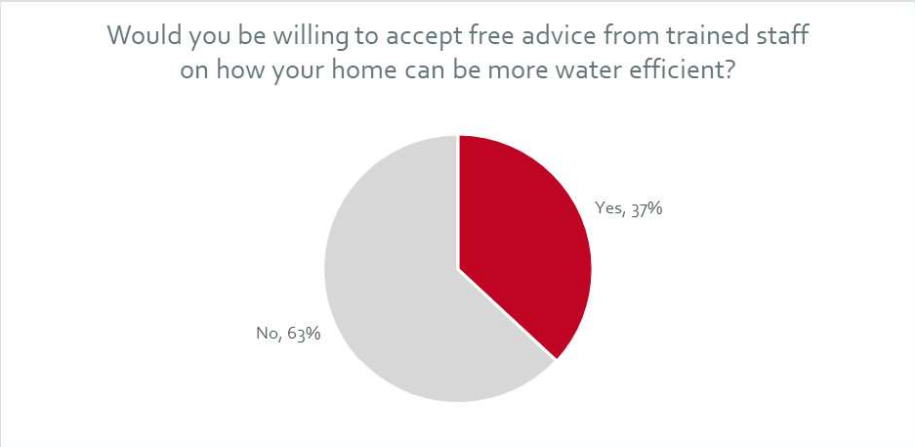


The research also sought to determine how this cluster got to know about the water conservation message/s and marketing campaign/s, with television being indicated as the primary medium through which they were reached (65% or responses).

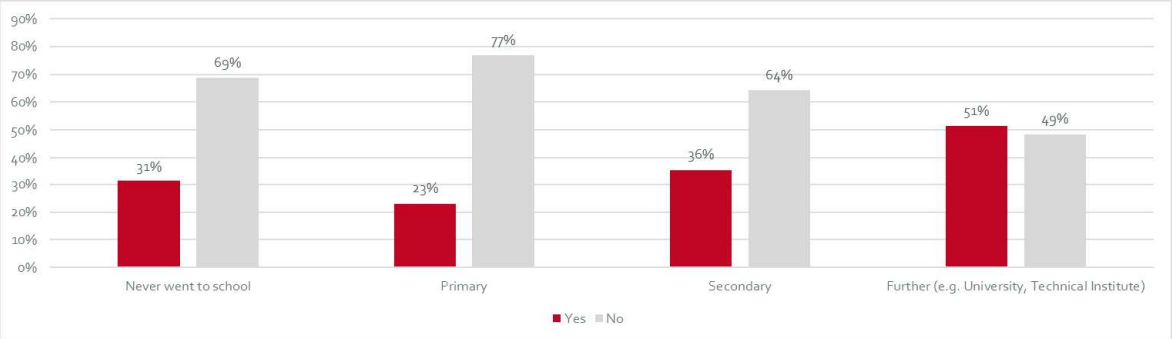


n. Free advice

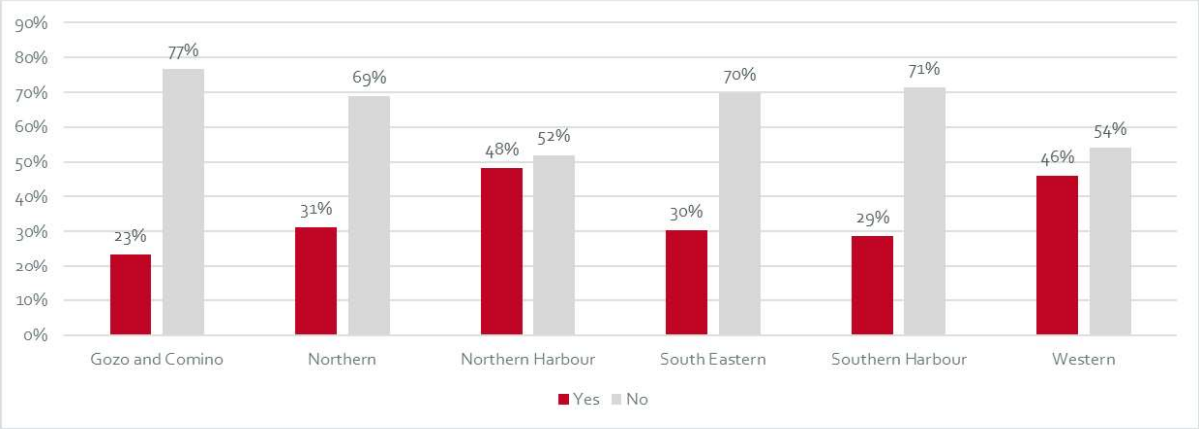
Overall, households do not perceive themselves to consume large amounts of water and have indicated a lack of interest in decreasing their current water consumption patterns. When asked whether they would be willing to accept free advice from trained staff on how their home could be more water efficient 37% indicated to be willing.



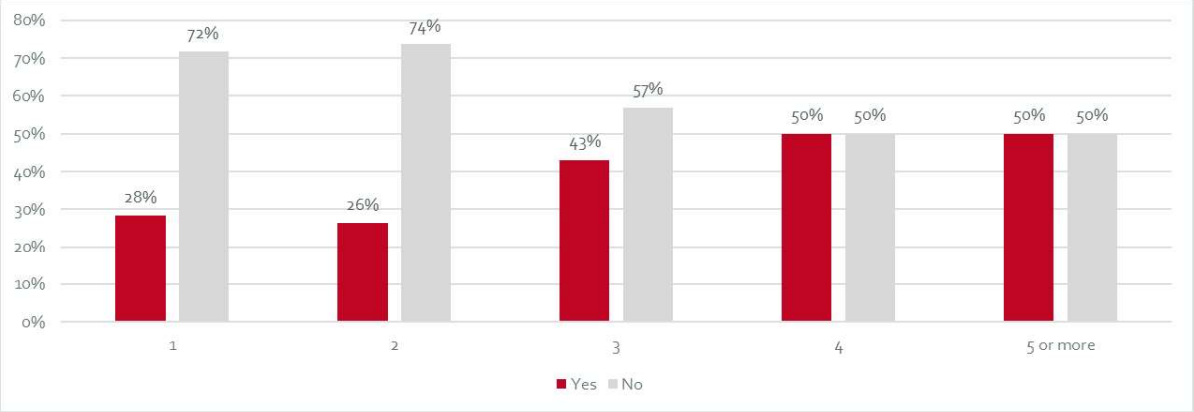
A review of responses by education level evidences that the inclination to accept free advice increases as the level of education increases.



Furthermore, a cross analysis of responses by region evidences that individuals residing on the Northern Harbour and Western Regions were more inclined to accept free advice (48% positive responses each). Conversely, with 23% positive responses, Gozo was identified as being the least inclined region.



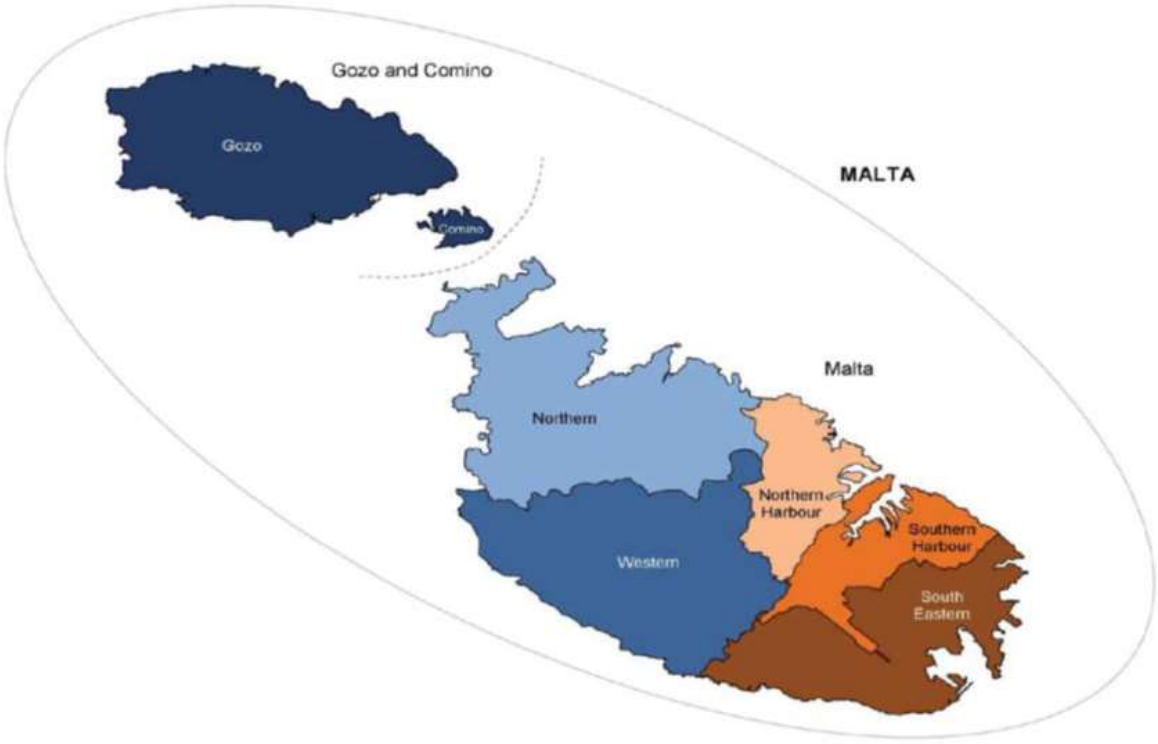
A review of responses by the number of individuals living in the household illustrates that the inclination to accept free advice increases with the increase in number of individuals living in the household.

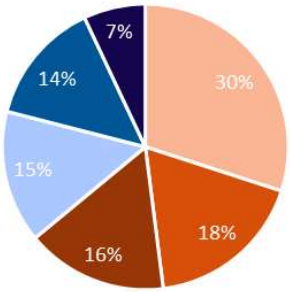
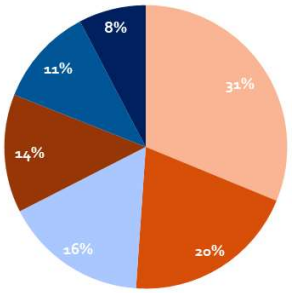


o. Sample Demographics

Research results illustrate that the sample collated was representative in terms of location of residence.

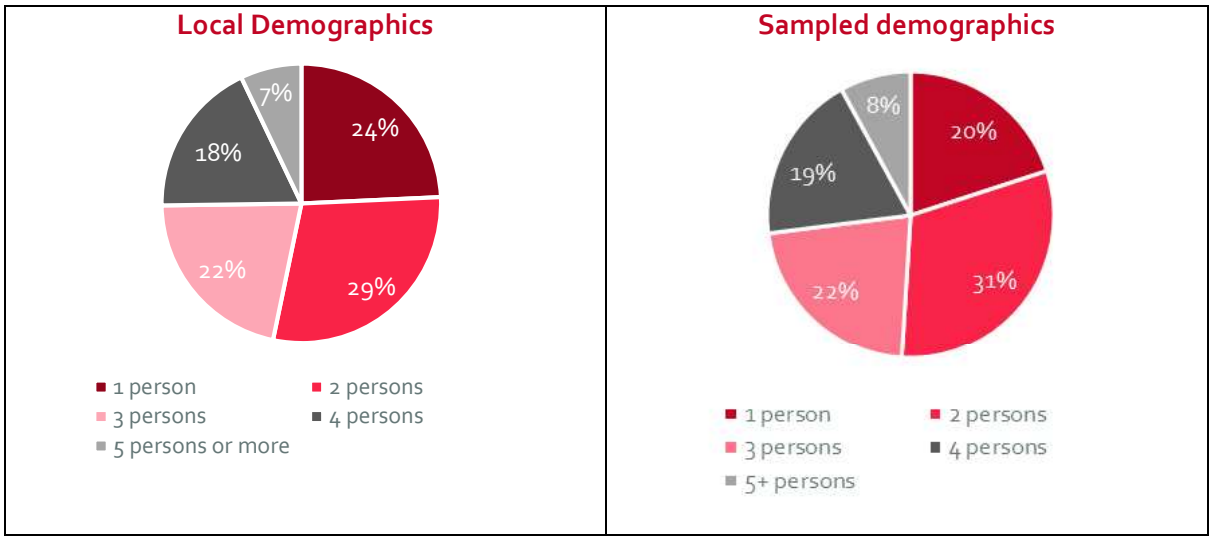
Location of residence



Local Demographics	Sampled demographics
	

Household size

The data collated was also representative of Maltese households in relation to number of members living in such household.



5.1.3 Tips

Close the tap

One should not leave the water running when brushing teeth or washing hands. Leaving a tap running for no reason can waste up to 6 litres of water per minute. It is also important to fix a dripping tap. A dripping tap can waste 15 litres of water a day.

Full loads

Be sure to have a full dishwasher and washing machine before running a load. Doing a half load will not use less water and therefore all that extra water will go to waste.

Cistern displacement device

This is as simple as placing a small 0.5 litre bottle of water in the flushing cistern to reduce the volume of water used in each flush. It is also important not to flush unnecessarily. Therefore, a loose tissue should be thrown into the bin and not the toilet.

If you hand wash dishes

Fill the sink up with water rather than using running water the whole time while scrubbing the plate clean. Using a fully loaded modern dishwasher is more water efficient than washing dishes under running water.

Watering outdoor plants

It would be beneficial to water outdoor plants in the morning as it is cooler at that time rather than in the afternoons. By watering plants in the morning, you will reduce the amount of water lost through evaporation.

Reuse the pasta cooking liquid

It would be good practice to reuse one's pasta cooking liquid to water plants. In this way the water is not going to waste, and plants are getting the water they need. It is important that the water cools down before watering the plants, as the heat may damage them.

Take a shorter shower

A shower can waste from 6 to 45 litres a minute. Having shorter showers and closing off the shower when soaping goes a long way to reducing waste.

5.1.4 Proposed technologies

a. Technology 1: Restrictors for showers

Overview

This is a commercially available low-cost device which can be fitted to most shower mixers and which reduces the flow of water through a shower while still giving a feel of 'pressure'. It is a known fact that showers are a main consumer of water in households. A 15-minute shower, issuing 10 litres per minute will result in the use of 150 litres, which is more than the average consumption of water per person in Malta. An advantage of this technology is that it is DIY and it does not affect the style of the sanitary ware in the bathroom.

This product is very easy to penetrate into the market as it is an easy installation that one can do, and it is an inexpensive product.

Availability

Easily purchased from bathroom stores and online.

Technical specs (specification sheets)

Shower Flow Regulator[9]

Diameter	1/2"
Installation	Screws in-between shower arm and showerhead to limit the water flow
Finish	Chrome plated brass
Flow rate	8 LPM
Compatibility	Suitable for all shower arms and hoses
Certificates	WaterSense Label and cUPC from EPA US
Warranty details	Standard 1 year manufacturer's warranty

Price

Circa €7.95 excl. VAT

Payback Period

Return on investment would be in under 2 months.

b. Technology 2: Water saving shower head

Overview

There are now numerous water-saving shower heads on the market – which can be used as retrofit solution or installed in new bathrooms. They are available in various styles and some have the facility to adjust the flow pattern (e.g. massage, rain etc.). A good water saving shower head can reduce the flow coming out of the shower by more than 50% (depends on original flow, water pressure etc.). Savings in showers also results in savings in hot water, and therefore in electricity bills.

[9] https://renergise.ie/shop/flow-regulators/shower-flow-regulator/

With several designs and features now available there are options for consumers to find a shower head that is appealing for them.

Availability

Easily purchased from bathroom stores and online.

Technical specs (specification sheets)

Water saving shower head[10]

Product name	Sava Fixed-Mount Showerhead
Part number	N2517CH
Item weight	3.2 ounces (90.7 grams)
Product dimensions	3.1 x 4.4 x 4.4 inches
Item model number	N2517CH
Colour	Chrome
Finish	Biscuit
Material	Plastic
Item Package Quantity	1
Water Consumption	1.7 GPM
Batteries Included?	No
Batteries Required?	No
Warranty Description	10year warranty

Price

Circa €10

[10] https://www.amazon.com/1-75-Sava-Fixed-Mount-Showerhead-Finish/dp/B008DVGKLQ/ref=sr_1_5?keywords=water+saving+shower+head+1.75+GPM&qid=1560785920&s=gateway&sr=8-5

Payback Period

The EU Life+ Investing in Water Project[11], administered by the Malta Business Bureau (MBB) had come to the conclusion that showers in hotels were issuing as much as 10% more water than required (over and above the 7 litres per minute guideline).

For a typical Maltese family of 2.67 persons per household[12], with each member of the household using the shower 3 times a week, for a duration of 5 minutes per use, and the shower issuing 7.7 litres per minute, the household water consumption would amount to

2.67 persons/household x 7.7 LPM x 5 minutes per use x 3 times a week x 52 weeks a year = 16,036 litres a year.

By reducing the shower flow to 6.6 LPM (i.e. 14% savings), savings amount to 2290 litres a year.

According to water tariffs structure[13], for a:

1) **Household using a Residential water tariff, low consumer:**

2290 litres amounts to a monetary saving of € 3.20 a year. At a purchase price of € 10, **payback is 3.13 years.**

2) **Household using a Residential water tariff, high consumer:**

2290 litres amounts to a monetary saving of € 11.78 a year. At a purchase price of € 10, **payback is 0.85 years.**

3) **Household using a Domestic water tariff, low consumer:**

2290 litres amounts to a monetary saving of € 5.00 a year. At a purchase price of € 10, **payback is 2.0 years.**

4) **Household using a Domestic water tariff, high consumer:**

2290 litres amounts to a monetary saving of € 11.78 a year. At a purchase price of € 10, **payback is 0.85 years.**

[11] http://www.investinginwater.org/Downloadables/Recommendations-National-Water-Management-Plan/2445

[12] https://nso.gov.mt/en/publicatons/Publications_by_Unit/Documents/02_Regional_Statistics_(Gozo_Office)/Regional%20Statistics%20MALTA%202017%20Edition.pdf

[13] https://www.rews.org.mt/#/en/fa/35

c. Technology 3: Kitchen tap aerators

Overview

Kitchen taps are used primarily for the washing of plates and the rinsing of food products. A standard kitchen tap can issue as much as 15 litres per minute, given that it is connected directly to the mains water supply. A low-cost low-maintenance kitchen tap aerator can result in water savings of more than 50%.

Availability

Easily purchased from a kitchen store and online.

Technical specs (specification sheets)[14]

Features:

- Dual threaded
- Fits most male and female threaded faucets.
    - Male 15/16-27
    - Female 55/64-27
- Housing constructed from ABS plastic with high-polish chrome finish and no un-plated brass parts.
- Warranty: 10 years
- Dimensions: Length 2.188", Width 1.375"

Certification and Performance requirements:

- ASME A112.18.1 / CSA B125.1; ANSI/NSF 61.
- Chrome plated parts meet ASTM B368 for corrosion testing.

[14] http://www.amconservationgroup.com/products/water-conservation-products/dual-spray-swivel-faucet-aerator-2/?variation_id=9235

Potential annual savings

Utility savings	Flow rate	Water	Electric heating	Gas heating
	1.5GPM	6132 gallons	347kWh	19 therms

Dual Spray Swivel Aerator - N3115P

Spray	Aerated Bubble / Needle
Finish	Chrome/White
Flow rate	1.5 GPM
Water sense	Yes
Case quantity	250

Dual Spray Swivel Aerator - N3115P-FC

Spray	Aerated Bubble / Needle
Finish	Chrome/White
Flow rate	1.5 GPM
Water sense	No
Case quantity	200

Dual Spray Swivel Aerator - N3115VP-FC

Spray	Aerated Bubble / Needle
Finish	Black/White
Flow rate	1.5 GPM
Water sense	Yes
Case quantity	200

Price

€3 – 15

Payback Period

Standard kitchen faucets could be issuing anywhere between 10 litres per minute to a massive 25 litres per minute[15].

The lower value will be used, for the calculation of water savings and payback. The cost for use will be an average cost of €8 for a water-saving kitchen aerator that delivers 6 litres per minute (1.5 GPM). The average daily use of the kitchen faucet is 8 minutes.

For a daily kitchen faucet use of 8 minutes at a delivery rate, the annual water consumption would amount to:

10 lpm x 8 minutes per use x 7 times a week (once a day for plates washing) x 52 weeks a year = 29,120 litres a year. By reducing the shower flow to 6 LPM (i.e. 40% savings), savings amount to 11,650 litres a year.

According to water tariffs structure[16], for a:

1) **Household using a Residential water tariff, low consumer:**

11,650 litres amounts to a monetary saving of € 16.27 a year. At a purchase price of € 8, **payback is 0.49 years (6 months)**

2) **Household using a Residential water tariff, high consumer:**

11,650 litres amounts to a monetary saving of € 59.88 a year. At a purchase price of € 10, **payback is 0.13 years (1.5 months)**

3) **Household using a Domestic water tariff, low consumer:**

11,650 litres amounts to a monetary saving of €25.46 a year. At a purchase price of € 8, **payback is 0.31 years (almost 4 months)**

4) **Household using a Domestic water tariff, high consumer:**

11,650 litres amounts to a monetary saving of € 59.88 a year. At a purchase price of € 10, **payback is 0.13 years (1.5 months)**

[15] https://www.portlandoregon.gov/water/article/305150
[16] https://www.rews.org.mt/#/en/fa/35

d. Technology 4: Reuse water that is discarded from the domestic RO system

Overview

A number of houses in Malta source their drinking water from a domestic Reverse Osmosis unit, which is usually fitted in the kitchen, with the drinking water being served through a faucet. A total of 10% of households indicated having such a system. However, it is not a widely known fact that the Reverse Osmosis unit wastes 5 times as much water as it produces (as drinking water) in the form of brine, which some run to drain. It is therefore being proposed that the brine will be run to either the roof tank (where it is diluted with tank water and reused) or to a rainwater cistern (where it is diluted with rainwater and reused). All this involves is an extension of the brine line to the roof tank or rainwater cistern (well). There is no need of a separate pump. It is believed that the household can save as much as 200 litres of water a week.

This is a retrofit and inexpensive option, that homeowners can easily install.

Availability

Can be bought locally[17].

Technical specs (specification sheets)

A specification sheet per se is not available for this product, as it is merely an extension of the PE (polyethylene) tubing normally provided with the domestic RO unit.

Price

Installation cost for recovering brine: € 5 (DIY) - € 25

Payback Period

It is estimated that the drinking and cooking water requirements average 6 litres per person per day18. For a typical Maltese family of 2.67 persons per household19, this works out to 16 litres a day per household.

[17] Stocked at AIM Enterprises

[18] http://ec.europa.eu/echo/files/evaluation/watsan2005/annex_files/WHO/WHO5%20-%20Minimum%20water%20quantity%20needed%20for%20domestic%20use.pdf

[19] https://nso.gov.mt/en/publicatons/Publications_by_Unit/Documents/02_Regional_Statistics_(Gozo_Office)/Regional%20Statistics%20MALTA%202017%20Edition.pdf

The nominal water recovery of a domestic RO unit is 15%. That is, to produce 16 litres a day, 106 litres a day are used, resulting in 90 litres of reject water a day. This volume of water can be recovered through this practice/technology.

So, annual savings: 90 litres a day x 365 days/year = 32,850 litres a year.

According to water tariffs structure[20], for a:

1) **Household using a Residential water tariff, low consumer:**

32, 850 litres amounts to a monetary saving of € 45.88 a year. At an installation cost of €25, **payback is 0.55 years (6 – 7 months).**

2) **Household using a Residential water tariff, high consumer:**

32, 850 litres amounts to a monetary saving of € 168.83 a year. At a purchase price of € 25, **payback is 0.15 years (almost 2 months).**

3) **Household using a Domestic water tariff, low consumer:**

32, 850 litres amounts to a monetary saving of € 71.78 a year. At a purchase price of € 25, **payback is 0.35 years (just over 4 months).**

4) **Household using a Domestic water tariff, high consumer:**

32, 850 litres amounts to a monetary saving of € 168.83 a year. At a purchase price of € 25, **payback is 0.15 years (almost 2 months).**

e. Technology 5: Rain water harvesting system

Overview

A rainwater harvesting system, which is a time-proven practice, can save a family as much as 50,000 litres a year, equating to 50% of the annual water consumption (based on a 100 m^2 roof area, 553mm annual precipitation and for a family of 3 persons). Rainwater collected from the roof is run into an underground cistern (well) where it is stored. It can then be pumped to a roof tank which then delivers water to toilets, washing machine, and taps for gardening, washing floors, cars and filling swimming pools, or directly to these utilities. The quality of clean rainwater is ideal for these applications as it is free from salt and hardness.

A rainwater harvesting system can be installed in both new and existing buildings.

[20] https://www.rews.org.mt/#/en/fa/35

Availability

One can purchase the components from a hardware store and ironmongeries.

Technical specs (specification sheets)

There are some factors one had to take into consideration when selecting a rainwater harvesting system[21]. These are:

- Type and size of catchment area
- Local rainfall data and weather patterns
- Family size
- Length of the drought period
- Cost of the rainwater harvesting system.

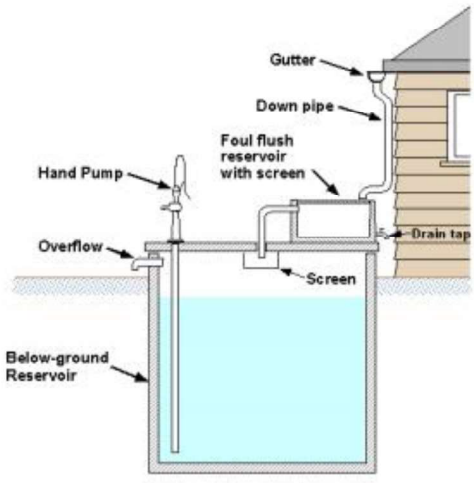
Rainwater harvesting systems generally consist of four (4) basic elements:

I. A collection area

II. A conveyance system, which would consist of the pipes and gutters

III. A storage facility (cistern, storage tank)

IV. Delivery system (tap or pump)



The above diagram shows one type of a domestic rainwater harvesting system.

[21] http://www.ercsa.eu/uploads/media/Rainwater_Harvesting_-_an_overview_.pdf

Price

Installation cost for rainwater harvesting system kit: €200 (DIY) - €2000

Payback Period

Maltese building legislation makes it mandatory for a new residential building to have a rainwater cistern. Technical Document F22 - Minimum Energy Performance Requirements for Buildings in Malta - administered by the Building Regulations Office within the Ministry of Transport and Infrastructure provides guidelines on the storage capacity of rainwater cisterns and the use of rainwater collected therein.

For a typical terraced house with a roof area of 100 m^2, for a family of 4, with a small garden the volume of rainwater that can be harnessed in a year is almost 50 m3 (using a runoff coefficient of 0.9 and annual precipitation of 553mm).

On the demand side, a family of 4 will probably use the washing machine twice every 3 days for an annual demand of 12 m3 (using 50 litres consumption per load) and use the average 8-litre toilet 10 times a day for a toilet water demand of 29 m^3 per year. It can also be assumed that the garden needs watering (100 litres per event) twice a week in summer, and once every 2 weeks in spring and autumn, for an annual consumption of 4 m^3. Car and yard washing will use another 3 m^3 a year, for a total demand of 48 m^3 a year. Rain water can meet this demand, thus saving an equivalent amount in town water. 48 m^3 represents 36% of the volume of water used by the household for all uses.

According to water tariffs structure[23], for a:

1) **Household using a Residential water tariff, low consumer:**

48 m^3 of town water saved amounts to a **monetary saving of € 67.03 a year**.

Payback[24] - 3 - 30 years, depending if DIY or professionally designed/installed (€ 200 or € 2,000)

2) **Household using a Residential water tariff, high consumer:**

48 m^3 of town water saved amounts to a **monetary saving of € 246.70 a year**. 0.8 - 8 years

Payback - 0.8 - 8 years

[22] https://www.rews.org.mt/#/en/fa/74
[23] https://www.rews.org.mt/#/en/fa/35
[24] While we have included the payback period, the focus should be on the savings per year (and not a payback period), given that there is a legal requirement to install this system.

3) **Household using a Domestic water tariff, low consumer:**

48 m^3 of town water saved amounts to a **monetary saving of € 104.88 a year**.

Payback - 1.9 - 19 years

4) **Household using a Domestic water tariff, high consumer:**

48 m^3 of town water saved amounts to a **monetary saving of € 246.70 a year**.

Payback - 0,8 - 8 years

Given that the construction of a cistern (and the ancillaries like pump and water distribution system) is a requirement by law, one should not include the cost of construction of the system in the calculation of payback. The operational cost of operating the rainwater system (electricity used for pumping the water, and the cost of replacing the pump every 10 years) does not exceed the monetary savings in water.

5.2 Agriculture

5.2.1 Current state of play

Agriculture in the Maltese Islands is characterised by small-scale holdings that invariably reduce the competitiveness of farms, with the' National Agricultural Policy for the Maltese Islands 2018 – 2028 highlighting lack of natural resources, in particular, water scarcity among the primary constraints effecting the industry[25].

Crop production may be broadly segmented into two distinct segments:

1. Dry (arable) farming that relies on rain to grow with the primary crops relating to:
    - Fodder,
    - Onions,
    - Garlic,
    - Broad beans,
    - Potatoes and
    - Permanent crops such as vines, olive trees and fruit trees, and
2. Irrigated farmland which is used to grow a wider range of fruit and vegetables utilising mostly drip irrigation and sprinklers.

With respect to the latter, the primary research highlighted that farmers generally tend to rely on their insight/ experience when determining the amount of water to provide their crops with, with investment costs and lack of adequate premises being highlighted as factors limiting their investment in computer-based technologies. From the discussions it transpired that farmers watering practices are very much dependent on weather conditions. There was accord among all that the recent winter proved beneficial in terms of rain water fall (both for growing crops and filling their reservoirs).

In terms of consumption, the agriculture sector is the main user of all the water resources in Malta, with figures indicating that from 2005 to 2013 the agricultural sector used 46.7% of all the water which was made available for use[26] (table overleaf refers).

> **It could be opportune is the industry does not rely that heavily on natural water resources and possibly emulate other sectors that are seeking alternative methods. In this respect, utilisation of new water too, is viewed as a positive shift.**

[25] National Agricultural Policy for the Maltese Islands 2018 – 2028. Final Report prepared for the Ministry for the Environment, Sustainable Development and Climate Change (2018)

[26] https://nso.gov.mt/en/News_Releases/View_by_Unit/Unit_B3/Environment_Energy_Transport_and_Agriculture_Statistics/Documents/2015/News2015_055.pdf

Water resources and exploitation by year

thousand m^3

Type of resources and exploitation	Computational notes	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Precipitation	1	159,795	170,628	196,058	158,204	214,992	162,133	186,767	164,083	151,540	159,371
Actual evapotranspiration	2	73,475	78,457	90,150	72,744	98,856	71,081	81,881	71,936	66,437	69,870
Total freshwater resources	3 = 1-2	86,319	92,171	105,908	85,460	116,136	91,052	104,886	92,147	85,103	89,501
LTAA total freshwater resources	4	93,010	91,689	94,077	93,062	94,701	94,407	95,197	95,860	96,312	95,460
Total groundwater abstraction	5 = 6+7+8+9+10	32,246	32,317	36,587	35,851	31,656	40,894	38,154	40,008	45,614	44,393
Public water supply	6	13,995	13,059	13,958	14,076	12,677	12,784	13,061	13,299	13,788	13,963
Agriculture (for irrigation)	7	15,908	16,953	20,298	19,250	16,545	25,653	22,551	24,055	29,020	27,526
Manufacturing industries	8	862	820	816	969	902	858	907	966	1,047	1,092
Services	9	468	470	495	529	497	561	591	635	695	746
Households	10	1,013	1,014	1,020	1,028	1,035	1,038	1,044	1,054	1,064	1,065
Water Exploitation Index (%)	11 = 5/4*100	34.7	35.2	38.9	38.5	33.4	43.3	40.1	41.7	47.4	46.5

Source: NSO, Water Services Corporation, Malta Airport Meteorological Office.

With the main source of freshwater used by agriculture in the Maltese Islands relating to groundwater extracted from aquifers it is worth noting that "*The state of the water resources is currently poor and notwithstanding that a significant portion of the domestic water demand is being catered for by reverse osmosis plants, statistics are indicating that the demand for groundwater is outstripping its supply*[6]". Such a stance evidences "*an urgent need to reverse these trends through sustainable demand management, supply augmentation and strategic protection of ground water resources (FAO, 2006 in Dwyer et al., 2014)*" [6].

The research has evidenced that the sector is rather fragmented with some farmers being well aware of the water constraints and seeking ways and means to better manage the usage of this scares resource, while others seem to adopt a laissez-faire attitude. Likewise, among livestock breeders the research has evidenced that some of those interviewed had done little (if anything) to maximise the utilisation of their water consumption and minimise wastage while others acknowledged that water consumption costs were a major hurdle for their business.

Furthermore, the situation being faced by farmers and livestock breeders is one in which they have to struggle to reduce input costs and utilise farm resources such as water in the most efficient way. Water requirements have increased both within the crop sector that is mostly based on a competition through quantity production as well as within certain livestock farms that have been restructured in such a manner that they require more water for cleaning purposes and the physiological water needs of livestock that are increasing.

Managing water sustainably is key to the future of food and agriculture

The interviews also discussed New Water - one of the initiatives undertaken by WSC to limit ground water usage and provide the agriculture industry with an estimated seven (7) million cubic metres per year. The topic is a sensitive one as not all the farmers currently have access to new water, with those that are currently not serviced complaining that this places them at a disadvantage when competing in an already difficult industry. One farmer indicated that this is resulting in him having to spend around €300 a week in order to get bowser water.

There were mixed reactions in terms of the quality of such New Water with some farmers indicating new water as beneficial to their business, while others commented "the quality is not the same as the groundwater, crops do not grow as quickly… we thus mix the two when watering our crops".

Among the initiative undertaken by farmers to better manage water consumption are investments in:

- Collection and storage of rainwater;
- Drip irrigation,
- Computerised systems (particularly in large green houses),
- Installation of water valves,
- Irrigation sensors, and

- Hydroponic systems among others.

From the face-to-face interviews it emerged that one farmer had installed a Reverse Osmosis System in order to desalt the water that he pumps from a (registered) borehole, while another has sought to implement measures aimed at recycling and reusing water throughout his farm through the installation of two small grey water systems, an aquaponic system and swales. With respect to swales, a number of farmers had indicated the use of swales to reduce runoff rainwater rates and volumes. An opportune method that does not require investment/s in specific technologies, with far reaching benefits, that comprise:

Benefits	Level
Reduce flood risks	High
Slow runoff	High
Groundwater/aquifer recharge	Medium
Flood risk reduction	Medium
Prevent surface water status deterioration	Medium
Better protection for ecosystems	Medium
Store runoff	Medium
Reduce erosion and/or sediment delivery	Medium

With the advent of New Water, the below indicated technologies still need to be encouraged so as to make the utmost from of the water supply that is used with utmost efficiency.

> **Agriculture production is highly dependent on water and increasingly subject to water risks. It is also the largest using sector and a major polluter of water. Improving agriculture's water management is therefore essential to a sustainable and productive agro-food sector.**

5.2.2 Tips

Irrigation Scheduling

Sustainable water management relates to the use of water:

I. At the right time,

II. In the right amount,

III. In the right place and

IV. In the right manner.

This may be done by carefully monitoring the weather forecast, soil and plant moisture, then adapt the irrigation schedule accordingly. The outcome is increased productivity and water efficiency.

Going Organic

Having a farm using organic methods helps in retaining soil moisture A study released by Cornell University Professor David Pimentel in 2005[27] reported that organic farming produces the same corn and soybean yields as conventional farming and uses 30% less energy and less water. Moreover, because organic farming systems do not use pesticides, they also yield healthier produce and do not contribute to groundwater pollution.

Drought-Tolerant Crops

Crops selected to grow should be ideal for the climate they are growing in. Selecting crops that survive during periods of drought decreases the amount of watering that needs to be done. It is also smart to grow crops that are native to the country as the weather conditions will be ideal for their survival.

Compost and mulch

Adding compost to soil helps improve the structure of the soil and therefore its water holding capacity. Adding mulch materials helps in the reduction of moisture evaporation. Another added advantage is that mulch materials then decompose and become organic matter which in turn helps in the water holding capacity of the soil.

[27] https://www.organicconsumers.org/news/reports-show-less-water-used-organic-farming

5.2.3 Proposed technologies

a. Technology 1: Hydroponics

Overview

"Hydroponic greenhouses use about 10 times less water than a field crop", said Pat Rorabaugh, who works at the University of Arizona's Controlled Environment Agriculture Centre. This result was confirmed by separate studies carried out by Dr. Daniel Leskovar, director of the Texas A&M AgriLife Research and Extension Centre in Uvalde on the hydroponic production of high-value lettuce cultivars using minimal water[28].

From information obtained from NSO News Release of the 21 March 2012[29], the measured volume of water used for the cultivation of fresh vegetables in Malta was around 9,000 m^3 per hectare per year. The irrigated area for fresh vegetables is 1200 hectares, giving a total volume of water used for the (open field) cultivation of vegetables at 10,800,000 m^3 a year.

Availability

Has to be specifically designed for the farm.

Technical specs (specification sheets)

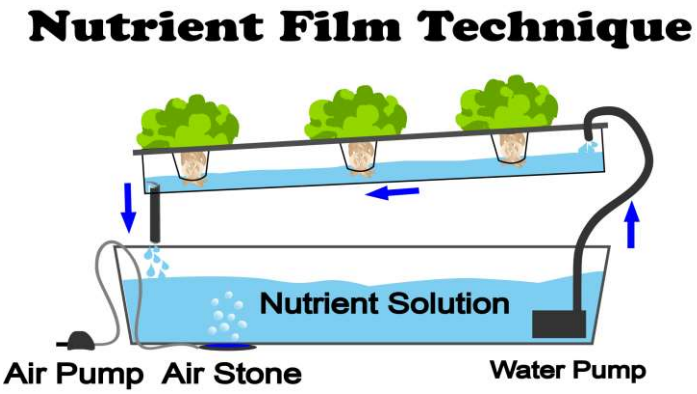
There are many types of hydroponics systems though the basic principle is common – growing plants in a water based, nutrient rich solution[30].

The system which has been taken up in Malta is the Nutrient Film Technique (or NFT), which is a type of hydroponic system where a continuous flow of nutrient solution runs over the plants roots. This type of solution is on a slight tilt so that the nutrient solution will flow with the force of gravity.

This type of system works very well because the roots of a plant absorb more oxygen from the air than from the nutrient solution itself. Since only the tips of the roots come in contact with the nutrient solution, the plant is able to get more oxygen which facilitates a faster rate of growth.

[28] https://phys.org/news/2015-08-high-value-lettuce-percent.html
[29] https://nso.gov.mt/en/News_Releases/Archived_News_Releases/Documents/2012/News2012_056.pdf
[30] https://www.fullbloomhydroponics.net/hydroponic-systems-101/

Schematic drawing of an NTF Hydroponics System



Price

Dependant on the size of the hydroponic system.

Payback Period

If there were a shift towards the cultivation of fresh vegetables to hydroponics, this may result in a water savings of 80 – 90%, which in absolute terms results in a decrease of 8.5 – 9.7 million cubic metres a year.

The use of groundwater in irrigation carries a cost of € 0.20 – 0.25 per cubic metre[31], which reflects the cost of electricity used by the pumps and the maintenance of the pumping systems. At these prices a national shift to hydroponics would save Maltese farmers anywhere between € 1.7 million to € 2.4 million a year.

The start-up costs of hydroponic systems are rather high. Both upfront and operational costs tend to be higher for hydroponics than they are for normal soil cultivation. However, larger-scale hydroponic systems tend to be more cost-effective than small-scale systems.

The profitability also depends on the type of crop grown because (1) some crops are more suited for hydroponic cultivation than others and (2) some crops fetch a high price on the market.

Payback period – The payback period is dependent on a number of factors that comprise:

- Capital costs – that vary depending on whether it is mainly a do-it-yourself (DIY) job or one opts to install a professional system

[31] https://www.maltatoday.com.mt/environment/environment/95269/get_caught_drinking_from_the_tap_why_better_taste_is_the_next_step_in_maltas_water_revolution#.XTBPgugzbcs

- Whether part of the infrastructure already exists (the land, the greenhouse, reservoir, tanks, pumps etc.)
- Crop yield and market prices (that vary considerably from place to place; as well as
- The choice/sales value of crop cultivated.

That said, there is scientific evidence[32] that hydroponic systems are economically viable with a discounted payback period of 5,24 years[33].

b. Technology 2: Soil Moisture Sensor

Overview

This technology allows for automatic and optimised irrigation and can be used for drip irrigation systems. It is an improvement on irrigation timers, as the determining factor for irrigation is shifted from time to soil moisture deficit (i.e. the actual need for irrigation). Given that rainfall is unpredictable, timers have the disadvantage of activating irrigation even when it's raining. The soil moisture controller offsets this disadvantage; a sensor is placed in a patch of land in the field which is representative of the whole field. It takes readings of soil moisture every few minutes. When the sensor detects dry conditions prior to the normal watering cycle, that cycle is allowed. When the soil moisture is above the set moisture threshold, the watering cycle is suspended to avoiding water. Water savings (over timer-only irrigation systems) are 40% or more.

Availability

Available locally.

Technical specs (specification sheets)

Soil Moisture Sensor

Components	In ground soil moisture sensor Sensor control user interface
Digital TDT™ sensor	Enables highly accurate readings that are independent of soil temperature and electrical conductivity

[32] https://www.sciencedirect.com/science/article/abs/pii/S0264837718304010

[33] Economic viability of the project was evaluated. An annual interest rate of 9.1060% was used as a Minimum Acceptable Rate of Return (MARR). Sensitivity analysis based on a Monte Carlo simulation was adopted for risk analysis. Initial investment for deploying the project was estimated at $89,653.66, with gross annual revenue of $103,903.63. Results of economic viability analysis showed the following financial values: Net Present Value (NPV ($ 177,845.74), Internal Rate of Return (IRR) (30,45%), Modified Internal Rate of Return (MIRR) (16,81%), Benefit-Cost Ratio (BCR) (2,13), Cash Generating Index (CGI) (2,29) and Discounted Payback Period (DPP (5,24 years).

Water saving features	Reading happens every 10 minutes. Only when dry condition is sense will it allow the cycle. Typical water savings of 40% or more.
Operating temperature range	-20˚C to 70˚C
Dimensions	Sensor control - Width: 76 mm - Height: 76 mm - Depth: 19 mm In ground soil moisture sensor - Width: 50 mm - Length: 200 mm - Depth: 12 mm

Price

€300 (for the sensor and controller)

Payback Period

Watersense estimates that soil moisture controllers can save as much as 20% of water currently used in irrigation.

For a Maltese farm with a cultivated area of 1 hectare (10,000 m^2 or 9 tumoli), growing fresh vegetables, the irrigation requirement is estimated at 9,000 m^3 per year[34].

Going on the information that a soil moisture and controller can reduce water demand by 20%, the savings total 1800 m^3 of water a year. This equates to a monetary saving of €720 - €900 a year (using a pumping cost of € 0.2 - €0.25 per cubic metre).

A complete soil moisture sensor coupled to an irrigation controller costs around €300. So the **payback is less than 1 year.**

c. Technology 3: Rain Sensor

Overview

Rain sensors are similar to the soil moisture sensor described previously (Technology 2) but is a simpler and more affordable device. These systems come in both wireless and hard-wired versions, most employing hygroscopic disks that swell in the presence of rain and shrink back down again as

[34] https://nso.gov.mt/en/News_Releases/Archived_News_Releases/Documents/2012/News2012_056.pdf

they dry out (mimicking soil) - an electrical switch is in turn depressed or released by the hygroscopic disk stack, and the rate of drying is typically adjusted by controlling the ventilation reaching the stack. Wireless and wired versions both use similar mechanisms to temporarily suspend watering by the irrigation controller — specifically they are connected to the irrigation controller's sensor terminals, or are installed in series with the solenoid valve common circuit such that they prevent the opening of any valves when rain has been sensed. Water savings of more than 25% are reported, though this depends on climatological conditions.

Availability

Available locally.

Technical specs (specification sheets)

Rain Sensor[35]

Sensor type	Industry-standard hygroscopic discs
Raining sensitivity	Adjustable nominal 3-25mm
Operating temperature	-29˚C to 49˚C
Housing material	UV-resistant engineered polymer
Transmission range*[36]	Up to 91,4m line of sight
Battery*	Two CR2032 V cells
Battery life	5 years (typically)

- Enhanced communication and signal link integrity features
- Fully adjustable shutoff points from 3-25mm of accumulated rainfall
- Compatible with nearly all controllers
- Easy, versatile one-piece mounting requires no special tools.
- Visual sensor status and alert indicators verify consistent operation
- Signal strength indicator ensures correct installation, communication link and signal integrity

[35] https://www.irritrol.it/eng/accessories/rain-sensor/
[36] *wireless only features

- Smart Bypass™ for easy system override—sensor switches back automatically on next activation.
- Slide/snap-on cover protects receiver from the elements

Price

€30.

Payback Period

A typical rain event may yield 5 mm of rainfall, which over 1 tumolo of land (1124 m2) equates to 5620 litres of water. This also roughly equates to the amount of water delivered during an irrigation cycle.

Assuming that the rain sensor is effective in interrupting a programmed irrigation cycle, in mid cycle, 20 times a year (there are approximately 90 days of rainfall a year) then the volume of water saved is:

5mm x 1124 m2 x 20 times x 0.5 (interrupted in mid cycle) = 56,200 litres a year.

At a cost of pumping of € 0.2 - €0.25 per cubic metre, this results in an annual savings of €11 – 14 a year, for a **payback period of 2 – 3 years**.

d. Technology 4: New Water

Overview

New Water is the name given to polished water derived from wastewater. It is a low salinity renewable source of water which is being produced by the Water Services Corporation and is being given for free to farmers for use in irrigation. Distribution networks are being constructed to make this water available in the north of Malta, in Gozo and in the south-east of Malta. It is a known fact that irrigating with saline (brackish) borehole water requires large volumes in order to obtain a decent crop. It is anticipated that the use of New Water will result in an overall requirement for water, simply through source substitution.

More hydrants in different areas of Malta would be ideal in order for the water to be accessible for all.

Availability

Available in the north of Malta through hydrants[37].

Technical specs (specification sheets)

The Water Services Corporation certifies that New Water meets the quality standards of recycled water of Class A as shown in the document on the use of recycled water for agriculture as issued by Joint Research Center (JRC) of the European Commission. Moreover, all the water produced and distributed as well as all processes involved are tested at each stage in the accredited laboratory of the Corporation. However, the following parameters are guaranteed limits as listed here:

- BOD5 <10 mg / L
- TSS <10 mg / L
- Turbidity <5 NTU
- E. coli <10 cfu / 100ml or less
- Legionella <1000 cfu / L

Moreover the WSC laboratory also checks other parameters including salts (chlorides), the conductivity and the amount of TDS (Total Dissolved Solids). Typical values are:

- Chloride <300 mg / L
- Conductivity < 1000 us / cm
- TDS < 800 mg / L

Price

No charge.

Payback Period

In terms of salinity, the quality of New Water is superior to most sources of groundwater in Malta, including groundwater sources used by farmers for irrigation. The WSC is installing a distribution

[37] http://www.wsc.com.mt/information/new-water/

network across parts of Malta and Gozo to make New Water more available and to reduce transportation costs.

In previous examples, it was calculated that a Maltese farmer cultivating fresh vegetables on 1 hectare of land may require 9,000 m^3 of irrigation water a year, at a groundwater pumping cost of €1800 - €2250 a year.

The fee for WSC's New Water is € 25 per year and farmers have a free quota, depending on how the extent of land they cultivate. (The actual price is € 0.20 per cubic meter, but the Government is subsidizing this price to farmers).

It is evident that there are tangible and immediate gains for farmers to switch to New Water.

Moreover, it is a known fact that irrigating with saline groundwater results in a deterioration of crop yield, an increase in the salinity of the soil, and the need to irrigate more frequently. Although, to our knowledge, there are no scientific studies that have been carried out in Malta to establish the need for additional irrigation to counteract the negative effects of using saline water, it is an established practice among farmers. This apart from the fact that certain crops (e.g. vines) cannot be cultivated using saline water.

New Water therefore opens new opportunities for farmers, and results in an overall reduction in the water used for irrigation (by virtue if it's low salinity), and safeguards groundwater.

e. Technology 5: Using water-efficient varieties of crops

Overview

While it is desirable for Maltese farmers to replace traditional water-hungry crops with drought-tolerant crops, farmers (and to a certain extent consumers) will be somewhat reluctant to do this. One solution is to cultivate the same crops, but switch to water-efficient varieties. It is understood that these varieties are already available in the market, but so far there has been little demand from Maltese farmers. A switch from water-hungry varieties of crops to water-efficient varieties will go a long way in saving significant volumes of water, while delivering the same product/service, and without necessitating a major overhaul in farmers' practices and infrastructure.

Availability

Available from local stocklists on demand.

Technical specs (specification sheets)

Seeds for drought-tolerant varieties of crops are available from seed/seedling importers on demand.

Black from Tula Tomato [38]

Quantity	20 seeds
Plant height	48 to 60" tall
Planting season	Spring
Sunlight requirement	Full sun
Planting method	Indoor sow

Celebration Tomato[39]

Quantity	20 seeds
Plant height	36 to 48" tall
Planting season	Spring
Sunlight requirement	Full sun
Planting method	Indoor sow

Crovarese Tomato[40]

Quantity	20 seeds
Plant height	48 to 60" tall
Planting season	Spring
Sunlight requirement	Full sun
Planting method	Indoor sow

[38] http://www.reimerseeds.com//black-from-tula-tomato.aspx
[39] http://www.reimerseeds.com//celebration-tomato.aspx
[40] http://www.reimerseeds.com//crovarese-tomato.aspx

Peron Tomato[41]

Quantity	20 seeds
Plant height	60 to 84" tall
Planting season	Spring
Sunlight requirement	Full sun
Planting method	Indoor sow

Price

€3.50 for 1 packet of 20 seeds (tomatoes).

Payback Period

A packet of tomato seeds may cost €2.50 for a packet of 20 seeds. The cost of a drought-tolerant variety may go up to € 3.50 (also for 20 seeds).

The water requirement for an average field-grown tomato cultivar is 100 to 150 L/plant (a 400 to 600 mm irrigation rate) for a 90 to 120 day growth period (FAO, 2015).

A tomato plant may yield as much as 10kg of tomatoes. This equates to a water requirement of 10 – 15 litres per kg.

This European research project states that drought-tolerant varieties of tomatoes may need 40% less water than standard varieties[42].

Water savings per plant are therefore:

- 40% x 12.5 litres per kilo = 5 litres per kilogramme of tomato (tomato fetches a price of €2.50/kg in a supermarket)

The payback period is calculated as follows:

- Additional cost of seed per plant : € 0.05

[41] http://www.reimerseeds.com//peron-tomato.aspx

[42] http://www.tomatonews.com/en/tomres-more-food-per-drop-of-water-_2_214.html

- Produce per plant : 10 kg
- Water saved : 100 – 150 litres per plant
- Cost of water : €0.20 – 0.25 / 1000 litres
- Monetary value of water saved : €0.02 - €0.025

This means that there is no payback as the cost of the seed is more than the monetary value of the water saved. This is attributed to the relatively low cost of groundwater. However over-irrigation will worsen the quality of the crop[43]. The size of the tomato is also a determining factor. Which is why cherry tomatoes (which fetch a good price) are grown in Israel.

[43] http://sonomamg.ucanr.edu/The_Kitchen_Garden/All_About_Tomatoes/Growing_Tomatoes_with_Less_Water/

5.3 Tourism

5.3.1 Current state of play

Over recent years the tourism industry has grown from strength to strength, with figures indicating a constant gradual increase.

In 2018 the number of inbound tourists reached a record 2.6 million, reflecting an increase of 14.3% over the previous year and reflects the major contribution this sector is to the Maltese economy. According to the World Travel and Tourism Council, tourism accounts for 27.1% of Malta's Gross Domestic Product (GDP) when the wider effects from investment in tourism and its supply chain are taken into account. This represents a contribution that is much higher than that in Europe and the World, where tourism contributed 10.3% and 10.4% to GDP, respectively.

Noteworthy, particularly in relation to this study is that the increase in tourism has positively affected the demand for non-hotel accommodation. For several years, the vast majority of tourists preferred to spend their stays abroad in collective accommodation establishments[44]. However, since the turn of the century there has been a pronounced shift in preferences from collective accommodation towards stays in private accommodation establishments[45] [46] with NSO statistics indicating that "*other accommodation types, comprising of guesthouses, hostels and tourist villages, increased by 37% in 2018 when compared to the corresponding period of 2017*".

That said, such increases in tourism are taking a toll on infrastructure and the environment with water consumption being one of utilities being strained by tourism (though relatively low compared to other sectors such as agriculture) [47] – caused by specific problems pertaining to this sector as highlighted in a study conducted by Eurostat - MEDSTAT II: 'Water and Tourism' pilot study (2009) that relate to three primary factors (of particular relevance to Malta):

- Though improving, the tourism industry still comprises seasonal concentration, with the peaks coinciding with the period in which water resources are scarce (summer);
- A spatial concentration on the coast, on sites characterised by the scarcity of local water resources (islands), and often on sensitive natural sites.
- A tourist offer that is often based on facilities that consume an excessive amount of water, such as golf courses, swimming pools and aquatic centres;

[44] As per NSO definition, these include hotels, guesthouses, hostels, tourist villages, holiday complexes, bed & breakfast, and campsites

[45] The changing trend in tourists' preference to stay in private accommodation is a global phenomenon and not exclusive to Malta.

[46] Private accommodation includes rented accommodation, own private residence, staying with friends and other private accommodations.

[47] MEDSTAT II: 'Water and Tourism' pilot study. Eurostat (2009)

The fieldwork (face-to-face) interviews evidenced that the tourism sector lacked awareness of the various water saving technologies available. Coupled with this was the general lack of interest in promoting such technologies by designers, architects and the like. In line with this observation, most newly refurbished places did not have any water saving technologies or features in the building related to water management.

There seems to be a lack of awareness of the simple alternatives that exist (such as an aerator for the hand mixers, or smaller flushing cisterns) that would limit water usage without adversely affecting the customer experience. That said, a survey carried out by Mangion (2012), involving fifteen hotels in Malta, evidenced that some hotels, primarily three-star hotels had implemented measures/ relating to water management aimed at reducing the water consumption. Some measures adopted in Maltese hotels were:

- Reduction of the flushing cistern size;
- Reduction of water flow passing through shower heads;
- Use of the dual flushing; and
- Recycling of waste-water.

From the data collated (both qualitative and quantitative), this segment can be broadly segmented as follows:

I. Hotels belonging to international chains that have standards that are imposed on them from their international mother companies. The interviews evidenced that such entities did not have much say when it came to determining water saving technologies (along with any investments relating to the establishment) and followed the standards given by the mother Company. In many instances such establishments had the specifications and on occasion also the supplier/s from where to purchase.

II. Other large-scale accommodation establishments - Discussions with such accommodation establishments evidenced that many a time they were reluctant to alter technologies. Difficulties associated with having different technologies were highlighted emanating from: issues with stock/ stock control, maintenance and having an establishment with potential alterations in design that impacted standardisation. In this respect (standardisation) the elevated cost for installing a water saving technology throughout the accommodation establishment was also mentioned as a limiting factor.

III. Large and medium-sized hotels that are close to the sea and rely on one or more inhouse seawater Reverse Osmosis (RO) plants, to generate potable water at a cost that is lower than town water.

IV. Hotels with swimming pools. The fieldwork has evidenced that such establishments use a considerable volume of water in the backwashing of swimming pool filters with the common practice being for hotels to dispose of the backwash water that is used when cleaning such pools in the sewer. While such discard is too dirty to reuse and currently drained and wasted, there exist alternatives (such as installing a greywater system to clean and filter the water for

it to then be used for flushing and irrigation systems) and technologies that could aid minimise water wastage from swimming pools.

V. Hotels that have shied away from installing water saving devices because they feared repercussions (complaints) from customers who were paying good money for a service. The discussions evidenced lack of awareness and knowledge on the effects of an efficient water saving technology, with the general view being that water saving meant lowering the pressure of water provided to the client, or a slow flow. Furthermore, the discussions evidenced that generally, such establishments perceived water consumption not to be a major issue/cost.

VI. Non-hotel accommodation and entities such as restaurants where water consumption was not viewed to be a major cost (in relation to electricity). Water consumption technologies in these cases are similar to those found in residential dwellings.

VII. Establishments that have gardens/landscaping. In most instances such gardens were deemed (or perceived) to be small. Consequently, the establishments in question felt that it was more opportune to irrigate through the usage of a manual pipe. Such segment felt that the cost to invest in a water saving technology for irrigation purposes would not justify the potential water savings to be made.

VIII. Linked to the above – investment costs – there were some establishments (though these seem to be minimal) that were renting the building/ premises. In such instances the interviews evidenced a general reluctance to invest in water saving technologies with the payback period being identified as the limiting factor hindering such entities from undertaking investments related to water saving.

Apart from efforts at organisation level, there is the opportunity to also instigate behavioural change on the part of the guest and offer alternatives to minimise water usage. A number of entities already have signs instigating guests to limit their water consumption, with some accommodation entities also enticing guests not to request a towel change on a daily basis. With respect to the latter, apart from the environmental aspect, an accommodation establishment benefits from such efforts that relate to: a decrease in costs on water consumption due to reduced water wastage, energy consumption savings, as well as a decrease in the consumption of chemical detergents and labour costs (Bohner & Schlüter, 2014; Dimara, Manganari, & Skuras, 2017; Gold-stein, 2009).

That said, some guests feel that limiting water consumption is primarily a gain for the establishment, as the price paid per night would have already incorporated the cost for maximum usage of water. To mitigate such perception, and illustrate the enterprise's commitment towards the environment, some international firms are today coming up with innovative solutions that are deemed to be a win-win situation for both the establishment and the guest.

> **In one instance a hotel offered guests a free drink (that quantified the total value) if guests opted to reused their towel/s for an extra day.**

Based on research by prominent social psychologist Robert Cialdini and his colleagues, there are a number of behavioural insights entities can leverage on to instigate commitment towards water saving practices. These include:

Specialized social norms

One approach is to utilise the persuasive power of specialized social norms. By way of example an entity may provide that the following information to the guest when they get their room card:

"*80% of previous guests who stayed in your room participated in our pro-environment initiative to reduce energy consumption and cleaning detergents by reusing the towels, would you like to do the same?*"

The Power of Reciprocity

Another strategy that could be used, is to inform the guests that the accommodation establishment already do some good on behalf of the guests before they check in. By way of example, the receptionist can inform the guests that

"*We have donated 10% of our income on behalf of you to the World Wildlife Foundation in helping to conserve the planet, would you like to help us reduce energy consumption by reusing the towels during your stay?*"

Pre-commitment by identity

Entities can also harness the power of pre-commitment induced by categorising the guest into "Pro-environment Guests". By way of example, the receptionist can design a card to each guest saying that

"*We are proud to have you as a pro-environmental guest, could you help us reduce energy consumption by reusing the towels during your stay?*"

By calling a guest as "pro-environment", they (guests) are more likely to display identity congruent behaviour – reuse the towels to show that they are pro-environment guests.

Default

Another behavioural insight an entity can leverage on is the power of default. By way of example, in the online booking system, an entity can provide multiple options to the guests that also includes the option "*I promise to reuse the towels to support the hotel's pro-environment initiative*" as the default. Another strategy to make it more effective is to provide some incentive for the guest who stick with the default choice (e.g., by offering a free drink, a free newspaper, reward points, and similar).

The demand for water varies between tourists and local residents, with such variance normally associated to the 'pleasure' approach of tourists who tend to have a bath or shower more frequently than residents and generally use more water than they would normally use when they are at home. Other frequent usage of water relate to the use of toilets, spas and swimming pools, water parks, fresh water usage to maintain hotel gardens, and laundry among others (Chapagain and Hoekstra, 2008: 23).[48]

It was estimated that a tourist in Europe consumes an average of 300 litres per day (direct water use), when compared with consumption at home (160 litres per day). This indicates that tourism increases global water use (Eurostat, 2009: 23). At a local level, tourist spending is estimated (Blue Plan[49]) at most at 4.5 % of water demand in Malta.

Various studies, as shown in the below table, produce estimates of water usage relating to tourism evidencing that there are various factors that affect such demand such as geographical location of accommodation establishments (climate zone, urban/rural) as well as the hotel structure (high-rise, resort style) and the comfort standard (e.g. Campsite, 1-5 star hotel).

Water Use According to the Accommodation Type

Country/Region	Accommodation Type	Water use per Tourist per Day (litres)	Reference
Mediterranean	Two to three star hotels	250	Grenon and Batisse (1991)
Mediterranean	Campsites	145	WWF(2004)
Mediterranean	All Accommodation	440-880	WWF(2004)
Spain	Four Star Hotel	361	Rico-Amoros (2009)
Morocco	Four Star Hotel	400	Rico- Amoros (2009)
Zanzibar, Tanzania	Hotels	931	Gossling (2001)
Las Vegas, USA	Hotels	382	Cooley *et al.*, (2007)

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[49] Dossier on tourism and sustainable development in the Mediterranean, MAP Technical Report Series #159, PNUE/PAM Athens 2005

At a local level, the EU Life + Investing in Water Project[50] identified consumption patterns within the accommodation industry and the potential water savings arising from the implementation of water saving technologies (in m^3/year) at a national level. The table below refers.

Hotels	Wash-hand basins	Showers	Grey water recycling potential (minimum)	Totals
5 star	21,000	75,400	153,000	249,400
4 star	49,800	171,700	257,000	478,500
3 star	14,200	17,300	82,000	113,500
Totals	85,000	264,400	492,000	841,400

In another study conducted earlier (locally), Eman Mangion in 2013 - Tourism Impact on Water Consumption in Malta sought to determine to what extent tourists consume more water than residents[51]. Among his findings, the author noted that:

- Tourists, on average, consume almost twice as much water for personal use as local residents, taking into account the summer and winter season.
- Tourists (like residents) tend to prefer to have a shower rather than a bath.
- During the winter months, most tourists opted for having two or three showers a day (95 per cent). Likewise, in the summer months tourists took more showers than the local residents. In summer, the majority of local residents pointed out that they had one or two showers each day (99 per cent), while the majority of the tourists pointed out that they had three or four showers a day (83 per cent).
- In relation to toilet flushing, the majority of the tourists indicated using the flushing more than four times a day (69% of tourists in the winter and 77% during the summer months)).
- Similar patterns were observed with the washing of hands with 70% of the tourists washing their hands more than four times a day in the winter with a similar pattern observed during the summer months, but tourists washed their hands more often.

The table overleaf illustrates the water consumption patterns based on the above usage patterns (in litres).

[50] EU Life+ Investing in Water. Recommendations. National Water management Plan. Malta Business Bureau (2014)

Criteria Used for the Amount of Water Consumed by Several Activities*

Water Consuming Activities	Standard Flow Rate	Standardized Time/Flow Rate for Surveyed Activities
Flushing cistern volume	6 litres	6 litres
Shower flow rate	7 litres/minute	49 litres
Wash hand basin	5 litres/minute	0.833 litres
Bath	Standard	80 litres

[51] * Current consumption patterns obtained from audits in Malta as reported in Cremona and Saliba (2012)

Total Mean Daily Consumption of Water for Personal Use per Person per Day

	Winter Months		Summer Months		Weighted Average	
	Resident	Tourist	Resident	Tourist	Resident	Tourist
Showers	42	70	70	60	60	62
Baths	18	55	16	122	17	99
Flushing	21	26	22	28	21	27
Washing hands	2	3	2	4	2	4
Total	83	154	110	214	100	192

* The weights are 33 per cent for the winter months and 66 per cent for the summer months reflecting the inflow of tourists during these two periods.

Swimming pools (and spas) were also identified as activities that are quite common with the tourists and which consume a considerable amount of water both for the initial filling of water and subsequently to be topped up to maintain the water level, with loss being attributed to:

- Evaporation,
- Leakages
- Splashing of water by people and
- Backwashing of filters

Overall, the study concluded that the average amount of water consumed by the tourists that were surveyed amounted to 296 litres per person per day, with such figure being congruent to the one proposed by WRR[52] (2006) which stated that a tourist in Malta consumes 311 litres per person per day.

Total Amount of Water Consumed by Tourists in Malta (Litres per person per day)

Tourist Water Consumption	Winter	Summer	Weighted Average
Average total amount of water consumed per person (62%)	154	214	184
Average consumption relating to pools, spas, and other (38%)	94	131	112
Total amount of water consumed (100%)	248	345	296

Total Daily Water Consumption by Tourists and Local Residents in Islands under Study (Litres per Person, per Day)

Daily Water Consumption	Local Residents	Tourists
Malta (Survey by the present author)	143	296
Malta (WRR, 2006: 60)	136	312
Mallorca (Coccossis and Mexa, 2004: 253)	195	440
Cyprus (Techneau , 2009: 12)	198	465
Crete (Manios, 2005: 248)	220	440

52

> ***"The Pacific Institute and Western Resource Advocates (2007), estimate that if hotels install water efficient fixtures, they will reduce their consumption by 30%".***
>
> Tourism Impact on Water Consumption in Malta. Islands & small states Institute. Occasional Papers on Islands and Small States Eman Mangion - (2013)

The same report highlights a number of tips that can aid limit water consumption and indicates that hotels with gardens could minimise water consumption by 30% to 50% (dependent on the size of the garden).

5.3.2 Tips

Tips for establishments with gardens

- The selection of special plants (drought resistant plants), along with appropriate garden designs to reduce the need for irrigation.
- Installation of water meters to monitor water use,
- Mulching of garden beds to reduce evaporation,
- Installation of drip irrigation systems with electronic controllers and moisture sensors, and
- The use of rain or grey water for irrigation.

Tips for hotels with pools

- Reduce the pool size so that a large pool landscape should be avoided.
- Install drainage barriers to collect overflows and direct them back to the pool.
- Optimise filter backwashing frequency and duration
- Use non-chlorine based disinfectants, so that the backwash water can be used for irrigation

Tips for all tourist facilities and accommodation guest rooms

- Installation of efficient water fixtures.
- The use of dual flush/ reduce flush and dry compositing toilets
- Efficient and low showerheads – these can use less than seven litres per minute, compared to the thirteen litres used by older models.

Overall tips

- Awareness programmes, ranging from educational campaigns for staff to the installation of informative signs on how to save water.
- Use of recycled water for non-potable uses.

> **Adopting a standard 7 litres/minute flow rate for showers, 5 litres/minute flow rate for wash-hand basins would save an estimated 349,500,000 litres per annum amongst hotels[53]. Exporting these standards to other sectors, such as the domestic sector, would increase this figure considerably.**
>
> Recommendations – National Water Management Plan. By the Malta Business Bureau's EU LIFE+ Investing in Water Project (2014)

The benchmarks and standards are published in a paper titled 'Water Consumption Benchmarks – a step towards reduced consumption'. The paper reveals that 3 star hotels use 199 litres, 4 star hotels use 292 litres, and 5 star hotels use 462 litres per guest night.

5.3.3 Proposed technologies

a. Technology 1: Industrial Water Saving Dishwashers and Pre-Rinse Spray Valve

Overview

Commercial dishwashers are considered to be one of the largest water (and energy) consumers in kitchens of restaurants and hotels, often accounting for more than two-thirds of the overall water use. Water usage across commercial dishwashers does not appear to be directly related to the size of the machine. A typical commercial dishwasher consumes approximately 15 litres per rack (rack usually having 18 plates), but water efficient dishwashers can bring this figure down to 1.5 litres per rack. Moreover, a lot of water is used in the manual pre-rinse – the water used in the pre-rinsing operation is often twice the volume of water used by the dishwashing equipment.

Introducing water saving dishwashers and a pre-rinse spray valve will be possible as it will lead to big savings for the hoteliers and restaurant owners.

[53] Paper; Greening the economy – Greywater treatment and flow rate regulation as a job generator, water, energy and CO_2 saver 20th Dec 2013. www.investinginwater.org

Availability

Available on order.

Technical specs (specification sheets)

Commercial dishwashers come in various types – under counter, stationary single tank, single tank conveyor, multiple tank conveyor, among others. They are then divided between high temperature systems and low temperature systems.

Rather than providing a specification sheet for a particular water-efficient make and model, it was considered more appropriate to research water consumption standards against which a commercial dishwasher can be benchmarked.

Our research has shown that the Energy Star program (run by the U.S. Environmental Protection Agency and U.S, Department of Energy) provides comprehensive information on the energy and water consumption of products and devices, including commercial dishwashers, using standardised methods.

The ENERGY STAR® Qualification Criteria[54] can be found below:

Machine Type	High Temperature Efficiency Requirements		Low Temperature Efficiency Requirements	
	Idle Energy Rate	Water Consumption*	Idle Energy Rate	Water Consumption*
Under counter	≤ 0.50 kW	≤ 0.86 GPR	≤ 0.50 kW	≤ 1.19 GPR
Stationary single tank door	≤ 0.70 kW	≤ 0.89 GPR	≤ 0.60 kW	≤ 1.18 GPR
Pot, pan, and utensil	≤ 1.20 kW	≤ 0.58 GPR	≤ 1.00 kW	≤ 0.58 GPR
Single tank conveyor	≤ 1.50 kW	≤ 0.70 GPR	≤ 1.50 kW	≤ 0.79 GPR
Multiple tank conveyor	≤ 2.25 kW	≤ 0.54 GPR	≤ 2.00 kW	≤ 0.54 GPR
Single tank flight type	Reported	GPH < 2.97x + 55.00	Reported	GPH < 2.975x + 55.00
Multiple tank flight type	Reported	GPH < 4.96x + 17.00	Reported	GPH < 4.96x + 17.00

* GPR = gallons per rack; GPSF = gallons per square foot of rack; GPH = gallons per hour; x = sf of conveyor belt (i.e., W*L) /min (max conveyor speed).

[54] https://www.energystar.gov/ia/partners/product_specs/program_reqs/Commercial_Dishwasher_Program_Requirements.pdf

Price

€ 20,000

Payback Period

A heavy-duty multi-tank conveyor type commercial dishwasher, operating at high temperature may have a throughput of as much as 1440 dishes per hour (or 80 baskets, with 18 plates per basket).

A conventional commercial dishwasher of this type may cost € 20,000. With a typical water consumption of 15 litres per rack, 150 racks a day, annual water consumption works out at 820,000 litres a year. At a non-residential water tariff of € 2.375 for 1000 litres[55], this works out at a water cost of approximately € 1,950 a year.

An Energy Star rated dishwasher of the same type will bring the water consumption per rack down to 2.5 litres per rack, or 137,000 litres a year for an annual water cost of € 325. An Energy Star rated dishwasher with this throughput costs € 24,000.

With annual savings of 683,000 litres, or € 1625 a year, the payback period (calculated on water only, but one should also include savings in energy) works out at less than 2.5 years.

The U.S. Department of Energy has set the water conservation limit for every Pre- Rinse Spray Valve (PRSV) sold in the United States to flow at 1.28 gallons per minute (4.85 litres per minute) or less. Replacing an old PRSV consuming a standard 1.6 gallons per minute (6 litres per minute) in a commercial kitchen with a DOE-compliant model will save 26,000 litres of water a year. When including the savings in energy as well was water, the payback is estimated at between 5 to 8 months.

b. Technology 2: Water Saving Industrial Washing Machines in Hotels

Overview

A large hotel may need to wash 2,500 items (bedsheets, towels) a day, and this inevitably results in a huge consumption of water in the laundry – whether the laundry is part of the hotel, or the laundry services are subcontracted out. On-site facilities dedicated to washing fabrics used at the location are referred to as On Premises Laundry (OPL). Small to medium sized laundries mostly rely on equipment referred to as washer-extractors. These look and operate somewhat similar to residential front-loading clothes washers, except washer-extractors are 3 to 30 times larger. There are water-efficient models of washer-extractors. While a regular washer-extractor requires 25 – 35 litres of water per kilogramme of fabric cleaned, a good water-efficient washer-extractor needs only 15 litres per kilogramme.

[55] https://www.rews.org.mt/#/en/fa/35

Introducing water saving industrial washing machines would be possible as it will lead to big savings for the hoteliers and restaurant owners.

Availability

Available on order.

Technical specs (specification sheets)

One manufacturer of water-efficient washer-extractors is Girbau [56], a multinational company specialising in laundry equipment.

Girbau's HS-6008 washer uses a maximum of just 7.8 litres per kg while the larger HS-6057 machines use only 7.0 litres, making them some of the most water-efficient washers available today.

Girbau HS-6008[57]

Capacity	9kg (1/9) 8kg (1/10)
Diameter of drum	536mm
Volume of drum	79.2dm^3
Dimensions	1080 x 685 x 700 mm

- Logi pro control
- Logi pro versions
- Electric, hot water and steam heating

Girbau HS-6057[58]

Capacity	63kg (1/9) 57kg (1/10)
Diameter of drum	1080mm
Volume of drum	569dm^3
Dimensions	1925 x 1570 x 1493 mm

- Intelli control

[56] https://www.girbau.com/laundry-equipment/profile
[57] https://www.girbau.com/laundry-product/washer-extractors-hs6008/HS-6008
[58] https://www.girbau.com/laundry-product/washer-extractors-hs6057/HS-6057

- TILT option system
- Electric, hot water and steam heating

Price

Quote given on request.

Payback Period

The water savings potential of a commercial laundry can be calculated as follows:

- Site data: hotel, 500 rooms, 70% average occupancy
- Daily average of bed linens = 350 sets x 1.36 kg = 476 kg
- Daily average towel sets = 350 sets x 0.79 kg = 277 kg
- Pre-existing efficiency: 26 litres per kg
- Efficiency of water saving model: 8 litres per kg
- Efficiency differential: 18 litres per kg

Annual Savings: (476 + 277) x 18 x 365 = 4,947,200 litres a year

Using the mains water tariff for commercial consumers at €2.375/1000 litres, the monetary savings work out at € 11,750 a year.

A low-cost non-water efficient 6okg industrial washing machine costs around €8000. A modern water-efficient 60 kg washing machine (Girbau HS-6057 or equivalent) costs approximately €20,000. Therefore, the payback period for opting for a water-efficient model over a non-efficient one works out at almost 1 year.

(Note: Payback above has been calculated on the basis of water savings only – not electricity, which is also very substantial).

c. Technology 3: Pressure Regulating Valves

Overview

The research has evidenced that water used in hotels by guests is generally consumed in showers and wash hand basins, with such volume being dependent on the delivery pressure of the water supply system.

With numerous high-rise building hotels, there is a considerable variance in the water pressure for guest rooms at the ground level and the water pressure being delivered at the uppermost level. Given that building services engineers normally design the water pumping station to deliver adequate pressure at the upper levels, there is often over-pressure and therefore high-water flow rates at the lower levels. A technology that can be used to equalize the pressure in all guest rooms at all levels is the pressure regulating valve. By installing a pressure regulating valve on the water system at each level, the hotel engineer can regulate the water delivery pressure for each level individually and optimise the flow rates in the showers and wash hand basins in the guest rooms. This will result in a constant, adequate pressure flow for all guest rooms.

Availability

Available locally[59].

Technical specs (specification sheets)

A detailed specification sheet for 2 types of Pressure Regulating Valves[60] can be found below.

PRECISIO pressure reducing valve

Specially adapted to water installations in flats and houses, PRECISIO is more convenient, reduces water circulation noises and guarantees compliance with sound level requirements.

Body and head in DZR brass, corrosion resistant.

Regulation is achieved by harnessing the diaphragm to a disc-yoke assembly.

Seat Stainless Steel.

The screw and nut system allows easy setting adjustment.

Two 1/4" (8x13) side connections for pressure gauge.

[59] Brownrig, Marsa

[60] http://www.wattsindustries.com/images1/7/PDF/PRV_Applications_Guide.pdf

- Reduced the pressure without reducing the flow. Thanks to its low-pressure loss, it is possible to obtain a normal flow when there are multiple demands on the system.
- Respect the standards of comfort and acoustics. The water hunting is less noisy, and the taps do not splash any more.
- Maintenance free robust device.
- Dimensions allowing the interchangeability with the principal reducers of the market.
- Assembly any position.

Max. inlet pressure	25 bar
Adjustable	1,5 to 5 bar
Delivered pre-set	3 bar
Max. temperature	80°C
Approval	NF EN 1567

REGLEAU G.C. pressure reducing valve

Pressure reducing valve with disc-yoke and diaphragm.

- Yoke and diaphragm assembly: cast solid moving part highly sensitive spring and large diaphragm permits accurate adjustment and excellent performances.
- Stainless spring with large coils and high sensitivity: it guarantees a precise adjustment.
- Diaphragm and valve high temperature: resisting high temperatures (up to 70°C).
- Stainless steel seat: an exclusive design which protects the valve from the aggressive wear of water. A guarantee of longevity

Max. temperature	70°C
Max. inlet pressure	Until 20 bar
Adjustable	1,5 to 5.5 bar
Delivered pre-set	3 bar
Flow	Until 40 m^3/h
Assembly	Any position
Hot or cold water	Both
Seat	Stainless steel
Body	Bronze

Price

The price may vary from €50-400. This would depend on the pipe size.

Payback Period

In many high-rise and commercial settings, water booster pumps are necessary to overcome the loss of pressure due to increases in elevation and to maintain water supply in water towers and supply tanks. With these higher pressures, water flows through the system with resulting greater flow through terminal fixtures beyond rated flow capacities, and this additional water is wasted as it serves no additional benefit to the rated performance.

Consider a hotel with 250 rooms built over 5 levels, with 50 rooms at each level. The water pumping system is designed to deliver 3.5 bar water pressure at the highest level. This implies that the 4th level is receiving water at 3.8 bar, the 3rd level at 4.1 bar, the 2nd level at 4.4 bar, and the 1st level at 4.7 bar. This results in an average delivery pressure of 4.1 bar, up from the ideal pressure of 3.5 bar. This represents a 12% increase in consumption.

The diagram below illustrates the amount of water wasted when delivering water at an unnecessarily high pressure.

For a hotel occupancy level of 70%, and assuming that each guest uses 250 litres per day in the guest room, then the annual savings arising from installing pressure regulating valves at each level are:

12% savings x 70% occupancy x 250 litres/day x 250 rooms x 2 persons per room x 365 days = **3,832,500 litres a year**.

Using the mains water tariff for commercial consumers at €2.375/1000 litres[61], the monetary savings work out at € 9,100 a year.

Installing 3 pressure regulating valves, one for each level from the 1st to the 3rd level, at a unit cost of €400 each, will result in a purchase cost of € 1200, or €1500 installed.

Payback is therefore only 2 months.

d. Technology 4: Swimming pool evaporation rates

Overview

Large commercial pools lose a lot of water through evaporation, especially in the hot summer months. While pool covers exist and are effective in reducing evaporation, they usually are only suitable for rectangular pools and are rather cumbersome to open and close. However, there are liquid products on the market which are applied to the swimming pool and work as a blanket on the surface of the pool, reducing the evaporation rate by as much as 40%. The products are safe, non-toxic, biodegradable and compatible with other sanitizing products like chlorine. In use at the Hilton Malta.

Availability

Available locally.

Technical specs (specification sheets)

Aqua Blanket is a specially formulated solution that provides a non-toxic invisible barrier on the water, dramatically reducing evaporation from water surfaces. This product is especially formulated for swimming pools (indoor or outdoor).

Features:

- Energy-saving invisible barrier
- Saves money
- Extends swim season
- Greatly reduces heat loss
- Dramatically reduces water evaporation

[61] https://www.rews.org.mt/#/en/fa/35

- Safe, non-toxic, biodegradable
- Compatible with all sanitizing methods
- Safe for all pool surfaces, including vinyl

The dosage rate is 90 ml for 48 m^2 of pool area per week. This equates to a pool volume of approximately 57,600 litres.

It is interesting to note that the Florida Building Code, Energy Conservation (2014), stated below, requires some type of pool cover be used in order to pass building inspection. Some Florida locales accept Aqua Blanket as a suitable liquid cover to meet this code.

2014 Florida Energy Code
C404.7.3 Covers.

Heated swimming pools and inground permanently installed spas shall be equipped with a vapor-retardant cover on or at the water surface or a liquid cover or other means proven to reduce heat and water loss.

Price

€22.50

Payback Period

Calculating water loss from a pool:

There are various formulae for the calculation of evaporation rates from swimming pools including :

1. the US EPA Evaporation Equation, which was developed to estimate evaporation from the surface of a pool of liquid that is at or near ambient temperature.

2. Stiver and Mackay Evaporation Equation

3. John W. Lund Evaporation Equation developed specifically for swimming pools

For an easy and quick estimate many people suggest using a linear loss rate of 6.5mm of water per day during the summer.

For a swimming pool having a surface area of 150 m2 :

Evaporation rate in litres per day = 975 litres per day.

It is claimed that by using this product, evaporation is reduced by as much as 40%. This represents a water saving of 390 litres a day.

In monetary terms, using the applicable water tariff of € 2.375/m3, this equates to € 0.926 a day.

A 1 litre bottle costs € 22.50. A weekly dose of 270 ml is required for this size of pool, at a cost of €6.075/ week or € 0.868 a day.

This means that there are monetary savings in using this product.

e. Technology 5: Grey Water Recycling

Overview

This technology revolves around shower usage in guest rooms and toilet flushes.

Usually, a single water supply system provides potable water to all the water using utilities in a guest room, these being primarily showers/baths, wash hand basins and toilets. However, it is possible, and very ecological to use a non-potable source of water to flush toilets, that could be derived from the waste water from the showers and wash hand basins. Grey water systems work on the principle of collecting the used water from showers and wash hand basins separately from the used water from toilets; the former is filtered and treated to produce a 2nd class quality of water which can be used for the flushing of toilets, and for landscaping. It is estimated that as much as 30 – 40% of the water used in a hotel can be saved when using this technology. Installations have been done at the George Hotel, Paradise Bay Hotel[62] and Milano Due Hotel.

Having a grey water system will require planning and therefore it is not always easy to have it as a retro fit option. If a refurbishment is being done having one installed will be beneficial to the hotel and the environment.

Availability

Systems are usually designed according to the particular circumstances of the hotel.

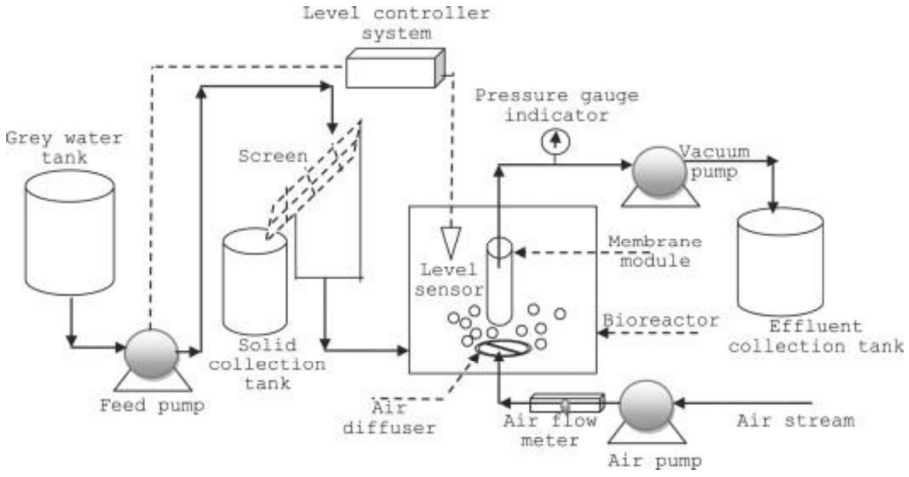
Technical specs (specification sheets)

We are aware of the existence of (at least) 3 grey water systems in hotels in Malta, using different technologies.

[62] http://www.investinginwater.org/News/MBB-encourages-2nd-class-water-policy/1584

One technology is a Membrane BioReactor (MBR) – which receives greywater from the showers and wash hand basins from guest rooms, and which uses aerobic treatment and membrane filtration to produce a filtrate which is used for the flushing of toilets in the same hotel.

A schematic diagram for a typical MBR system is shown below.



The other two systems in operation in Malta involve high-rate sand filtration and chlorination, with the filtration capability of the sand filter assisted by the addition of a coagulant.

Price

"Recycled greywater is a very cheap source of water, estimated at €0.40 per m^3. Costs for equipment start at around €60,000 with a repayment period of around 3 year." – MBB Investing in Water

Payback Period

Studies carried out by the Malta Business Bureau (MBB) LIFE+ Investing in Water Project in Malta assessed the availability and performance of existing greywater treatment plants in hotels in Malta in 2012 and concluded that grey water systems are financially and economically viable for hotels having a minimum water consumption of 25 m^3 per day.

In the report entitled "Recommendations - Grey-water treatment as a Green Economy Initiative" dated 20 December 2013[63], the Project concluded that "For an estimated cost of € 3,816,500 the hotel industry could adopt grey-water treatment, resulting in annual savings of € 979,000 on water bills, leading to a repayment on investment period of just under 4 years. This measure would also result in the industry saving 492,000 m^3 of water per annum".

[63] http://www.investinginwater.org/Downloadables/Recommendations-Greening-the-Economy/2195

5.4 Businesses

5.4.1 Current state of play

While business tend to be conscious of their energy spend, and seek ways to minimise such costs, the same could not be said with respect to water consumption. In this respect a Eurobarometer report[64] has evidenced that 74% of small and medium-sized businesses are seeking to cut down on energy consumption and become more resource efficient, only 34% of them indicated that they were trying to cut down on water usage, such figure being one of the lowest rates in the EU. Furthermore, such figure represents a 17 point drop when compared to 2015 when 51% of Maltese businesses took steps to save water[65].

A paper titled 'Water Consumption Benchmarks – a step towards reduced consumption' by the Malta Business Bureau (MBB) indicated that:

- Offices consume 25 litres of water per employee per day,
- Manufacturing enterprises consume 24 litres of water per employee per day, and
- Manufacturing enterprises where a number of employees also shower use 46 litres per employee per day.

The same paper evidenced that service water – that used in toilets, showers and wash hand basins, accounted for between 5% and 98% of a business' consumption. The lack of standards meant that, by way of example flushing cisterns varied in size from 6 to 15 litres.

[64] https://timesofmalta.com/articles/view/most-smes-trying-to-cut-down-on-energy-consumption.668576
[65] https://theshiftnews.com/2018/01/18/despite-water-scarcity-maltese-companies-less-keen-on-saving-water/

> **Rainwater harvesting is particularly attractive for industry. Industry requires good quality, cheap, 2nd class water for use in various processes. Rainwater, with no or minimal treatment and collected from factory roofs, meets these needs perfectly. Furthermore, with factories often having very large collection areas it is possible to harvest a significant percentage, at times even all, of an enterprise's demand.**
>
> Recommendations – National Water Management Plan. By the Malta Business Bureau's EU LIFE+ Investing in Water Project (2014)

Our primary research too has evidenced that the industry is highly fragmented and is made up of very distinct segments/requirements.

A review of the business community evidenced:

- 97% micro/small enterprises where water utilisation was that in line with residential in terms of volumes (< 500 litres a day).
- Large enterprises that utilised a sizeable amount of water that had very distinct and unique requirements that could not be generalised.
- Commercial entities that do not use a lot of water in their business do not find reason to implement water saving technologies, they would rather put that money towards energy saving ones.

> **The EU LIFE+ Investing in Water Project's paper publishes recommended standards flow rates of 7 litres per minute for shower flows, 5 litres per minute for wash hand basin flows, and a toilet flushing cistern volume of 6 litres.**

In view of the above, our focus has been to identify a specific segment were the impact of this Project could result in bigger savings in terms of absolute volumes, with our focus eventually shifting towards entities that provide industrialised laundry services.

When interviewing different entities of the industrialised laundry services it was evident that the water being used during the washes was being discarded and drained, with the exception of one laundry service provider which had tunnel washers and the water used in the last rinse was reused in the first wash of the next load. This allowed for the reusing of some water. This same company informed the interviewer that there are laundries abroad that are recycling all the water that is being

used during the wash, though this is a big investment and a lot of area is needed to hold this water recycling plant.

5.4.2 Tips

Low flow options

Having low flow options like aerators for hand mixers in the bathrooms and kitchens, and low flow shower heads will already be a start to reducing the amount of water used in a business. Having lower flow toilets would also be beneficial. A retro fit option for this is adding a water displacement system.

Water audit

It would be beneficial for big companies, or a company that utilises a lot of water to have a water audit done. This will benefit the company in terms of water conservation and consequently also in terms of financial savings. A water audit would evaluate a company's water usage and would then provide detailed options on how to reduce the amount of water used.

Water efficient equipment

When purchasing equipment ones should take into consideration its water saving features in order to go for the most viable option. While upfront costs could be higher, one ought to give due consideration to the payback period as such investment/s could prove beneficial.

Make employees aware

Educating employees is key. It is important to make each of them aware on the amount of water that is used as a business. The company can provide ways as to how they can reduce the water usage as a company and have them feel empowered to carry out these changes.

5.4.3 Proposed technologies

a. Technology 1: Flushing toilets with manual stop

Overview

The main water consumer in office premises is the toilet. A standard toilet may use as much as 10 litres of water per flush. In restrooms where there are no urinals, toilets are used for the flushing or urine and faeces; so, in a building with 20 employees the water used in toilets may exceed 600 litres per day. In a standard toilet, the flushing volume is constant and is usually on the high side, designed to flush faeces and toilet paper. An improvement on this basic design are toilets which have a flushing mechanism which allows the user to stop the flushing once the bowl is clear from its contents. This results in optimum flushing volumes.

Availability

Available on order locally[66].

Technical specs (specification sheets)

The P-80 Aquastop is one such flushing device with manual stop. By Faismilani Srl, Italy is available in Malta via their local supplier.

Detailed specifications for the P-80 Aquastop[67] can be found overleaf.

P-80 Aquastop

Dimensions	Length 410mm Height 595mm Thickness 78mm
Flush	Maximum 9-10 litres. Can be interrupted at any time during the flushing.
Connecting tube	50 x 40 mm
Pressure	Pressure enters stronger from the left hand side at 1/2" G.
Colour	White Chrome Stainless steel Gold Champagne

Individually tested.

Price

€90

Payback Period

The particular recessed flushing system is not marketed for its water saving potential.

[66] Available on order from Banju Boutique
[67] https://irp-cdn.multiscreensite.com/8102509g/docs/1.1758943..pdf

That said, there are a number of studies that show that dual flush devices do save water (with savings of 27% being recorded)., even though there is a possibility (exception rather than the rule) of people flushing a second time - leading to an overall increase in water consumption[68]. This report shows that some pilot studies have revealed that the use of dual flush systems led to a (marginal) increase in water consumption, in a particular case though the result is generally positive

This particular flushing system - which allows the user to stop the flush - does not suffer from 'double flush' and is therefore an improvement on standard dual-flush systems. Therefore, it can be safe to assume that the minimum flush volumes of 4 litres (half-flush) and 6 litres (full flush) will be attained with this product.

Considering an office building with 500 workers, with 40 toilets, with the employees working 260 days a year.

Pre-Retrofit Toilet Flush Quantities:

260 work days x 500 workers x 3 toilet flushes /day = 390,000 toilet flushes/year. At 13 litres per flush, toilet water consumption = 5,070,000 litres.

Retrofit Toilet Flush Quantities:

Replacing older 13-litre toilets with these manual stop flushes: with 2 flushes/day/worker at half flush (4 litres) and 1 flush/day/worker at full flush (6 litres) gives:

Full flushes: 260 work days x 500 workers x 1 full toilet flushes /day x 6 litres/flush = 780,000 litres a year

Half flushes: 260 work days x 500 workers x 2 full toilet flushes /day x 4 litres/flush = 1,040,000

Total consumption: 1,820,000 litres a year, for a water saving of 3,250,000 litres a year (or 64% reduction)

Replacing the 40 toilets with this device at a unit cost of EUR 90 (purchase price) + EUR 70 (installation costs) for a total capital cost of EUR 6400. At a water cost of EUR 2.375/m^3, monetary savings amount to EUR 7,720. Payback period is therefore less than 1 year.

[68] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/290337/sw6-011-ts-e-e.pdf

b. Technology 2: Dual flush toilets

Overview

A dual-flush toilet is a variation of the flush toilet that uses two buttons or a handle mechanism to flush different amounts of water. Modern dual-flush toilets use 3 litres and 6 litres per flush respectively. Dual-flush toilets are now commonly available in different styles; however, they cost more than standard (single flush) toilets. For maximum effectiveness, the installation of dual-flush toilets in offices should be accompanied with an educational campaign on its proper use and the ecological benefits.

Some flushing systems can be changed without damaging the tiling or having to change the plumbing system. Therefore, one can easily have this as a retro fit option. Though if a refurbishment of the bathrooms is being done it would be ideal to install a dual flush toilet system.

Availability

Available on order.

Technical specs (specification sheets)

The following is an example of a good quality water-saving dual flush toilet, which uses 4 litres for half flush and 6 litres for a full flush.

Technical Details[69]	
Part number	K-3987-0
Item weight	86.3 pounds
Package dimensions	39 x 34.5 x 24.5 inches
Item model number	K-3987-0
Size	2-1/8"
Colour	White
Finish	White
Material	China
Shape	Round
Item package quantity	1
Water consumption	1.6 GPF (6.1 LPF)
Flush type	Gravity flush toilets
Handle/lever placement	Left
Number of handles	1

[69] https://www.us.kohler.com/us/wellworth-two-piece-round-front-dual-flush-toilet-w-class-five-flush-technology-and-left-hand-trip-lever/productDetail/toilets/428047.htm

Certification	Yes
Batteries included?	No
Batteries required?	No
Warranty description	One-year limited warranty

Price

€220

Payback Period

The frequency of toilet flushes per toilet is often greater in offices than in homes, although the frequency is highly variable from facility to facility. According to Alliance for Water Efficiency[70] it is reasonable to assume an average of 2 to 4 flushes per person per 8-hour shift. Depending on the type of business conducted, transients (visitors and customers) might also incur additional flushing activity. The use of toilets is also greater for women than men, if urinals are installed.

Considering an office building with 300 male workers and 200 female workers, with 10 male toilets and 15 urinals, 25 female toilets, with the employees working 260 days a year.

Male Toilet Flush Quantities:

- 260 work days x 300 males x 0.5 toilet flushes /day = 39,000 toilet flushes/year
- 39,000 flushes/ 10 toilets = 3,900 flushes/year/male toilet

Male Urinal Flush Quantities:

- 260 work days x 300 males x 2.5 urinal flushes /day = 195,000 urinal flushes/year
- 195,000 flushes/15 urinals = 13,000 urinal flushes/year/urinal

Female Toilet Flush Quantities:

- 260 work days x 200 females x 3 toilet flushes /day = 156,000 toilet flushes/year
- 156,000 flushes/25 toilets = 6,240 flushes/year/female toilet

Replacing older model toilets using 13 litre flushing cisterns with modern dual flush toilets with an average flushing volume of 5 litres:

Savings from Male Toilets:

- 39,000 flushes/year x (13 -5) litres per flush = 312,000 litres of water saved per year

[70] http://www.allianceforwaterefficiency.org

Savings from Female Toilets:

- 156,000 flushes/year x (13 -5) litres per flush = 1,248,000 litres of water saved per year

Total Water Saved: 1,560,000 litres a year

At a non-residential water tariff of €2.375/ m^3, the monetary savings amount to €3705 a year.

A new dual-flushing toilet costs around €300. So, replacing 35 toilets would set the business off by €10,500, with a payback period of 2.8 years.

c. Technology 3: Technologies that displace water in the flushing cistern

Overview

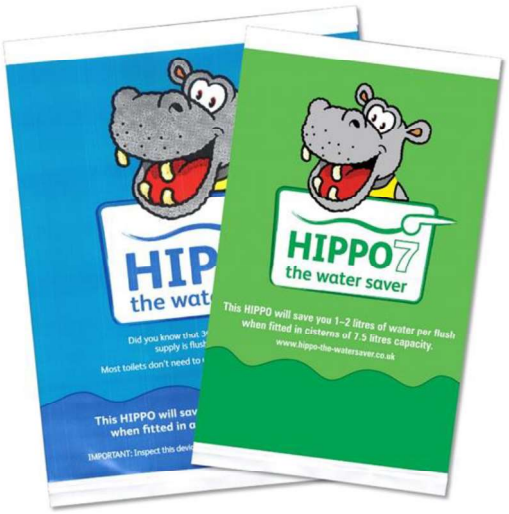
A typical flushing cistern installed in buildings that are more than 10 years old may have a volume of 10 litres or more, and flushes this volume of water with every flush. It has been shown that one can get a good flush with as much as 6 litres. However, one would be reluctant to replace an old but fully functional toilet in a tiled bathroom with a new water-efficient toilet. A solution is the installation of water-displacing devices (usually specialised plastic bags) that displace a volume of water in the cistern (usually between 1 – 2.5 litres) so that the flushing volume is reduced from the original volume. These displacement devices are very cheap, do not require any maintenance, and have been shown to last for years.

Availability

Purchased online.

Technical specs (specification sheets)

The Hippo range of water saving products was introduced to Malta a few years ago, and has been sold to hotels, offices and even residential units. More than 11 million Hippo bags have been sold worldwide since they were introduced in 1997.



In terms of specification, the Hippo is simply a Polyethylene bag that opens to look like a box, which sits neatly in the cistern of a toilet, and has a displacement volume of approximately 2 litres. It is made from durable heavy gauge polyethylene and printed using human grade food dyes.

The Hippo 9 is designed to save up to 3 litres in 1 9 or 13 litre cisterns; the Hippo 7 will save up to 2 litres in smaller cisterns down to 6 litres.

The link below (footnote 7) shows the water savings to be incurred when using a Hippo [7].

Hippo carried out testing on the amount of water saved when installing a Hippo [7]. The results were as follows:

- There was an average of 7.40 litre flush without the Hippo 7 device installed[71]. With the Hippo 7 installed the average flush was 5.55 litres. Concluding that 1.85 litres of water is saved during every flush.

Installation is very simple and does not require any technical expertise[72].

Price

€60 for 35 Hippo bags[73].

[71] http://www.hippo-the-watersaver.co.uk/about_hippo/flush_rig_testing.pdf
[72] http://www.hippo-the-watersaver.co.uk/installation.html
[73] http://www.hippo-the-watersaver.co.uk/buyhippo_uk.html

Payback Period

Considering an office building with 300 male workers and 200 female workers, with 10 male toilets and 15 urinals, 25 female toilets, with the employees working 260 days a year.

Male Toilet Flush Quantities:

- 260 work days x 300 males x 0.5 toilet flushes /day = 39,000 toilet flushes/year
- 39,000 flushes/ 10 toilets = 3,900 flushes/year/male toilet

Male Urinal Flush Quantities:

- 260 work days x 300 males x 2.5 urinal flushes /day = 195,000 urinal flushes/year
- 195,000 flushes/15 urinals = 13,000 urinal flushes/year/urinal

Female Toilet Flush Quantities:

- 260 work days x 200 females x 3 toilet flushes /day = 156,000 toilet flushes/year
- 156,000 flushes/25 toilets = 6,240 flushes/year/female toilet

Installing a Hippo 9 in the older 13 litre flushing cisterns, and assuming that the Hippo will displace 3 litres of water.

Savings from Male Toilets:

- 39,000 flushes/year x 3 litres per flush = 117,000 litres of water saved per year

Savings from Female Toilets:

- 156,000 flushes/year x 3 litres per flush = 468,000 litres of water saved per year

Total Water Saved: 585,000 litres a year

At a non-residential water tariff of €2.375/ m^3, the monetary savings amount to € 1390 a year.

35 Hippo bags cost around € 60 + VAT. So, retrofitting 35 toilets would deliver a payback period of only 2 weeks.

d. Technology 4: Eco-timer for faucets on wash hand basins

Overview

This technology is a device which is installed on wash hand basin faucets (instead of the standard strainer) and saves water in two ways

1. It acts as a restrictor, which reduces water delivery (flow) while increasing the velocity of the water for good hands washing and

2. It has a mechanical timer with a pre-set setting, which stops the flow of water automatically. Additional flow will require re-activation.

Availability

Available on order.

Technical specs (specification sheets)

Grohe Eurosmart Cosmopolitan T[74]	
Diameter	1/2"
Faucet	Self-closing Wall mount
Marking	Blue/red
Recommended pressure	3-90 psi
Flow time	Adjustable (7, 15 and 30 seconds) - Adjusted by the factory at 7 seconds
Flow restrictor	2.5 GPM
Recommended pressure	15 psi

- Escutcheon
- DVGW-approval applied for
    - GROHE EcoJoy® technology for less water and perfect flow
    - GROHE StarLight® finish
- For cold or premixed water

[74] https://pro.grohe.com/la-en/29427/special-faucets/self-closing-faucets/euroeco-cosmopolitan-t/produktdetails/?product=36266-G309&color=000&material=36266000

Price

€85

Payback Period

Prices of wash hand basin faucets vary considerably, depending on style, make and quality. However, assuming that a standard single lever wall mounted faucet, delivering 8 litres per minute, will cost €60, an equivalent self-closing Grohe Eurosmart Cosmopolitan faucet will cost €85.

Considering an office building with 300 male workers and 200 female workers, with 20 wash hand basins, with the employees working 260 days a year.

Faucet Water Quantities:

260 work days x 500 employees x 2.5 faucet uses/day = 325,000 faucet uses/year

Assuming that each faucet use would normally result in a duration of 20 seconds at a flow rate of 9 litres per minute, the resultant water use amounts to 975,000 litres a year.

Installing a self-closing water-restricting faucet on each of the 20 wash hand basins would limit each use to 7 seconds, at a delivery rate of 5.7 litres per minute. We will also assume that half the users will press the activation button twice.

Resultant water use is then calculated at 325,000 faucet uses a year x 7/60 minutes x 5.7 litres per minute x 1.5 activations per user = 324,200 litres a year. Water savings therefore work out at 650,800 litres a year.

At a non-residential water tariff of €2.375/ m^3, the monetary savings amount to € 1,545 a year.

The additional cost of 20 faucets is 20 x €25 = €500, for a payback period of 0.32 years, or almost 4 months.

The replacement cost for 20 faucets is 20 x €85 = €1700, for a payback period of 1.1 years.

e. Technology 5: Collection of air-conditioner condensate for landscaping/toilet flushing

Overview

Air conditioners operated in cooling mode cools the indoor air but also reduces humidity by absorbing moisture from the room. The air conditioner's cooling coil (or evaporator) cools water vapour which

collects on cold surfaces in the air conditioning unit in a way that is similar to the condensation that collects on an iced drink. An office premises may have tens of split-type air conditioners or a smaller number of large air conditioners. On a summer day in a hot, humid climate, a small air conditioner may collect and drain up to 8 litres of water a day; a larger central air conditioning system as much as 75 litres a day. The quality of the water is essentially the same as distilled. The water's low mineral quality makes it excellent for the purposes of irrigation. However, in a commercial setting there is ample use of this water for the flushing of toilets. An improvement on this system would be to also run roof drains into the same tank, so as to have a hybrid condensate and rainwater harvesting system.

Availability

Available locally.

Technical specs (specification sheets)

It is sensible to run the air-conditioning drain pipes into a tank to conserve and reuse this condensate water – which can be used for landscaping or for the flushing of toilets. The system requires a pump which would deliver the water on demand.

There is no specification for this system. In a household setting, it makes sense to place a bucket under the drain pipe to collect the condensate from the domestic air-conditioning unit. In a commercial setting, where there could be tens of small air-conditioning units or a few large ones, the water is best channelled into a storage tank (capacity depending on the number of air-conditioning units), and a pumping system that would deliver this water to the toilets in the building. Town water will automatically fill the tank if the supply of condensate water does not meet the operational demand.

Price

Approximately €250.

Payback Period

For a medium sized office building, with 50 employees in 15 offices, with 15 split-type air conditioners, and two restrooms, a condensate collection system would consist of a tank having 250 litres capacity, a small pump and a piping network that would feed the toilets in the two restrooms. An approximate installed cost for this system is €250.

Assuming that the air-conditioners are run in cooling mode for 8 months of the year, excluding weekends, the air-conditioners will generate 8 litres x 5 days a week x 35 weeks x 15 air conditioners = 21,000 litres a year.

At a non-residential tariff of €2.375/ m^3, the monetary savings amount to € 50 a year, for a payback period of 5 years.

The payback period decreases with the number of air-conditioners, as most of the costs are related to the plumbing

EWA/CFT/6/2018 – Market Research on Water Demand Management Technologies

Activity 2 – Final Draft

Date: 17/10/2019
Author: Ramon Muscat
Version: 2

Contents

1. Glossary of Acronyms

WRAS	Water Regulation Advisory Scheme
kWh	Kilo Watts Hour
lpm	Litres per minutes
LEED	Leadership in Energy and Environmental Design

2. Executive Summary

2.1 Identified Technologies

Ref no.	Technology	Residential	Commercial	Tourism	Agriculture
1.	Flood check	■	▫	▫	
2.	Grey water recycling home system	■			
3.	Water Recycling Shower	■	▫	▫	
4.	Water-saving (front loading) washing machines	■			
5.	Water pebble	■			
6.	Toilet with integrated wash hand basin	▫	■		
7.	Shower start device for public showers	▫	■		
8.	Recyclable plastic beads for Commercial Laundries	▫	■		
9.	Car wash water recycling systems		■		
10.	Waterless Urinals		■		
11.	Device providing real-time information			■	
12.	Hot water control system			■	
13.	Smart Wi-Fi Water Sensor	▫		■	
14.	Nozzle Dual Flow Pro technology			■	
15.	Activates Filter Media			■	
16.	Aquaponics				■
17.	Smart irrigation				■
18.	Buried irrigation diffusers				■
19.	Plant cocoon				■
20.	Facilitating irrigation with saline water				■

■	Indicates that in our report the technology in question has been placed under that respective sector
▫	Indicates that such technology may be adopted by the sector

Technology 1
Flood Check
A flood prevention device designed to protect property from internal flooding by monitoring the water supply. The *device* automatically switches off the main water supply if it detects a water leak, preventing water wastage, water damage, excessive insurance premium renewals and giving the homeowners peace of mind.


Technology 2
Grey water recycling home system
A greywater recycling technology designed to collect bathroom and washing machine water, cleans and disinfects it, saving water by recycling 85% of total in-house domestic water used. The system's water is clean, clear and safe and meets international standards. It can be utilised for several purposes including lavatory flushing and the washing machine. Some systems can also recycle grey water from the washing machine.


Technology 3
Water Recycling Shower
This technology is a digitally controlled recirculating shower system, a first of its kind. It uses a small amount of water, which is continuously purified, recirculated and comfort-corrected to the ideal temperature and pressure. It presents an innovative, new way to save water and energy for an immediate impact, without compromising the shower experience.

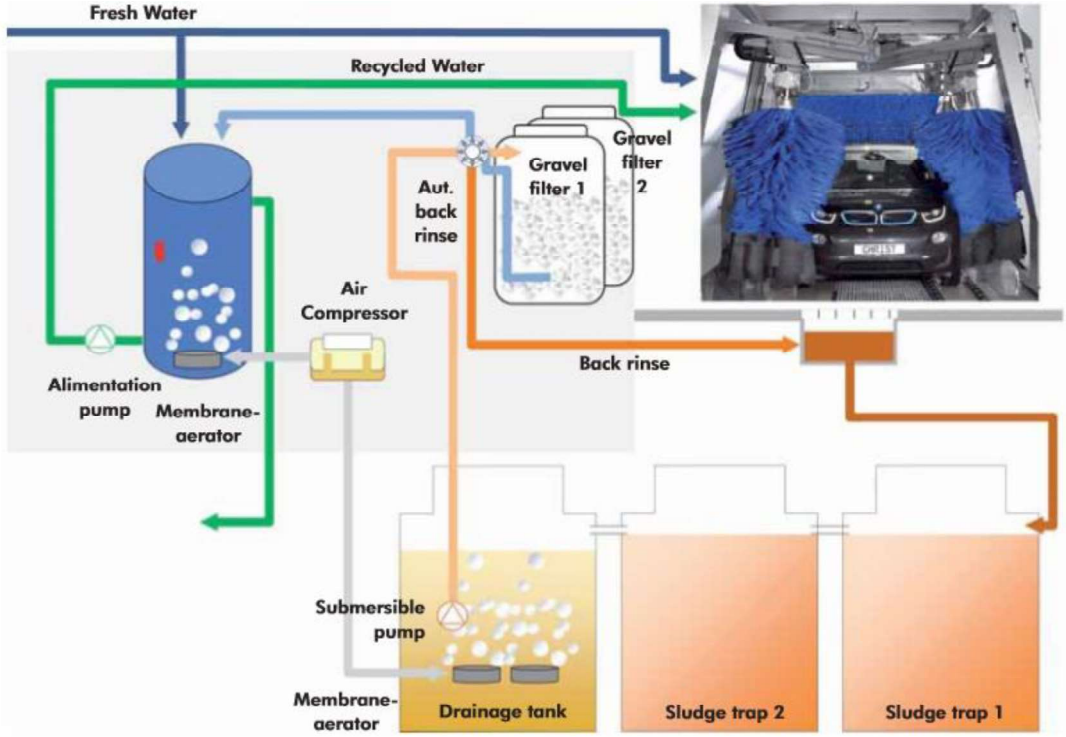

Technology 4
Very efficient water-saving (front loading) washing machines
Washing machines are among the biggest water consumers in Maltese households. Old washing machines may be using 100 – 170 litres per wash; the average washing machine may use 87 litres per wash. However, modern advanced technology can bring this figure down to 46 litres (for a 10 kg load). One such washing machine that employs the most advanced water (and energy) saving technology. We have opted to select a water-efficient front loader washing machine instead of a top loader, because the former is more popular, and will make a greater impact on the Maltese population.


Technology 5
Water pebble
The water pebble is a clever device that monitors the water going down the plug hole when you shower. Memorising your first shower and using it as a benchmark, Water pebble then indicated, via a series of 'traffic lights, flushing gently from green through to red, when you finish showering. Each time you shower your Water pebble automatically fractionally reduces your shower time helping you to save water without needing to think about it. it is considered to be very effective with children as they consider it fun, and compete with the water pebble by getting out of the shower before it triggers red.


Technology 6
Toilet with Integrated Wash Hand Basin
The Toilet with integrated wash hand basin saves water by allowing the same water to be used for two purposes. Fresh water is first used for hand washing and then flows into the cistern to ultimately flush the toilet. Therefore the water used for flushing the toilet is reused water.

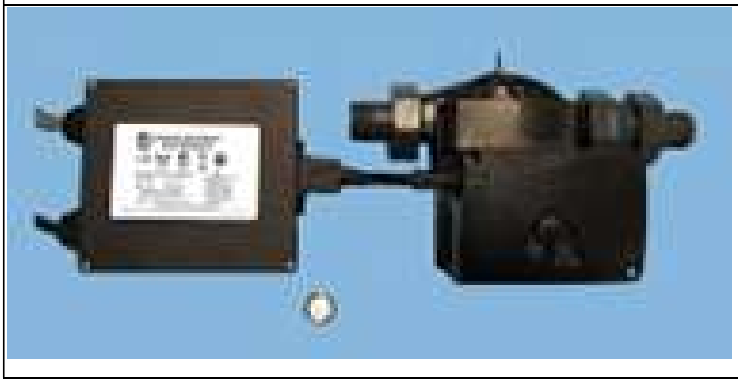

Technology 7
Shower Start device for public showers
The Shower Start is a device that is fitted to shower head and which stops the water flow once the required (hot) temperature is attained. The user then reactivates the water flow by manual intervention. The water savings arise from the fact that while waiting for the hot water shower users tend to move away from the shower and do something else (get shampoo, soap etc.) and only return to the shower once they are convinced that the shower is dissipating hot water. This results in an unnecessary waste of water and energy.


Technology 8
Recyclable plastic beads for Commercial Laundries
An innovative technology that uses recyclable plastic beads to cut down on water use by 80%. As they tumble through the cycle, the beads "*lift the stains away from the laundry in the wash, like a million tiny hands performing flexing motions on the fabric of each item in the wash*." A special extraction cycle separates the beads from the load, cleans them and adds them back while the cycle runs. Their weight causes them to drop to the bottom of the washer when the cycle finishes. A special washing machine has been developed to use these beads (i.e. the beads cannot work with any standard washing machine).


Technology 9
Car wash water recycling systems
There are various types of water recycling systems for car washes. A pit captures the water that runs off the cars and it is temporarily stored until it is treated and normally recycled in the early rinses and to mix with the detergents. It may also be used in the high-pressure washer.


Technology 10
Waterless Urinals
Waterless urinals are, as the name implies, urinals that do not flush with water. Waterless urinals have been commercially available in some international markets since the 1990s, but, to date, have failed to make a presence in Malta. Waterless urinals can save between 57,000 and 170,000 litres of water per urinal per year, depending on the amount of water used in the water-flushed urinal for comparison purposes, and the number of uses per day. For example, these numbers assume that the urinal would be used between 40 and 120 times per business day. The biggest single issue with waterless urinals is of course odour control and scale build up. However, there are various technologies available today that mitigate this problem. What is being proposed here is a retrofit kit i.e. converting an existing flushing urinal into a waterless urinal. Almost all standard urinals can be converted to waterless, whether the urinals are newly purchased or were installed many years ago.


Technology 11
Device providing real-time information on showering practices
This technology is designed for hotels; it saves water by providing real-time information on showering practices to the hotel operator but also to the guest. This information assists hotel managers to adjust the hotel's water supply and water heating systems (pumps and boilers) to optimise the water delivery service, while making the guest aware of the resources being used in showering. From experience it has been established that hotels equipped with this technology have cut their water use by 20%.
 

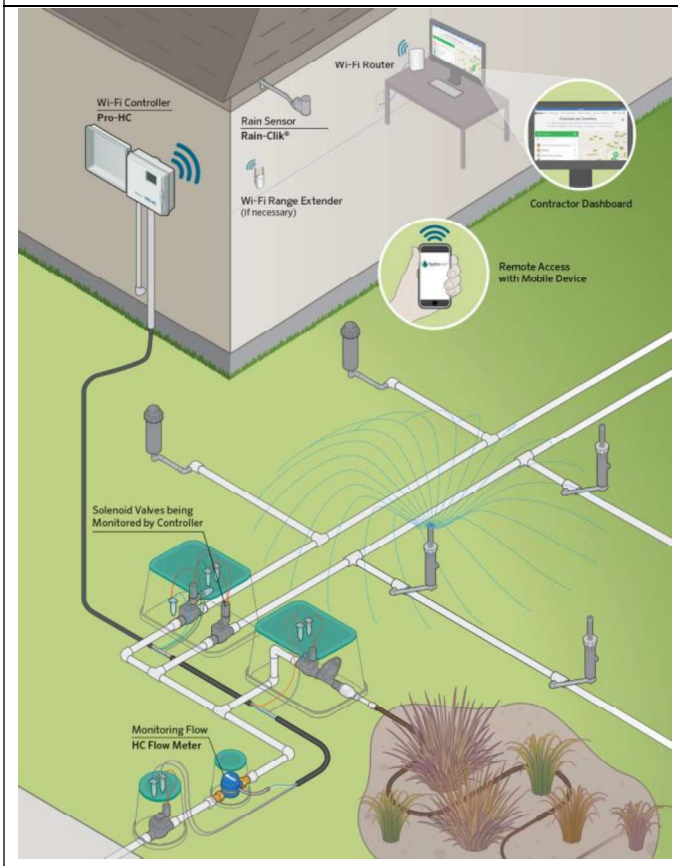
Technology 12
Hot water control system
This control system is designed for hotels saves water by circulating the ambient temperature water in the hot water lines back to the water heater. This is water that is normally run to drain. Apart from the water benefits, the system also delivers hot water at a lesser time than just letting the water run down the drain—the usual scenario.


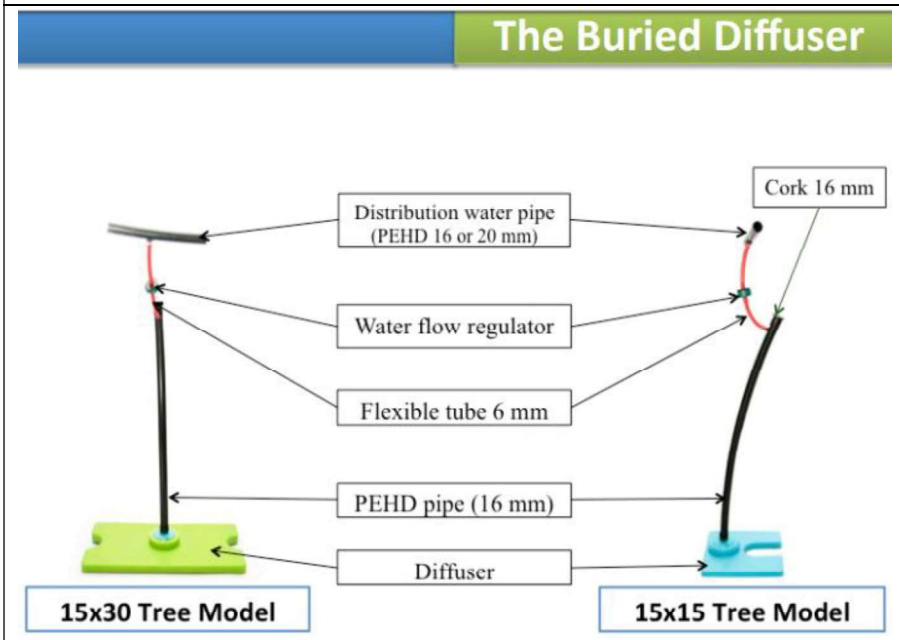
Technology 13
Smart Wi-Fi Water Sensor
Increasingly, hotels are building water storage systems underground (instead of the traditional roof tanks). Although this provides benefits in terms of water quality, it makes leaks from water tanks more difficult to detect. This technology consists of a Smart Wi-Fi Water Sensor, which acts as a flood and leak detector, giving an alarm and App notification alerts. Having a sensor installed around an underground tank/reservoir, with a channel excavated to drain any water to the sensor will catch out a leak which may go undetected for months or years. One such flood sensor is produced by Wasserstein.
   

Technology 14
Nozzle Dual Flow Pro Technology
Nozzle Dual Flow Pro technology from Altered takes water flow reduction from faucets to the extreme. The patent pending atomization technology converts water into millions of droplets (effectively a mist) instantly drenching the users' hands, with only 2% of the water used during a normal hand wash (i.e. 98% savings). Specifically designed for public areas, it comes with an anti-theft feature.

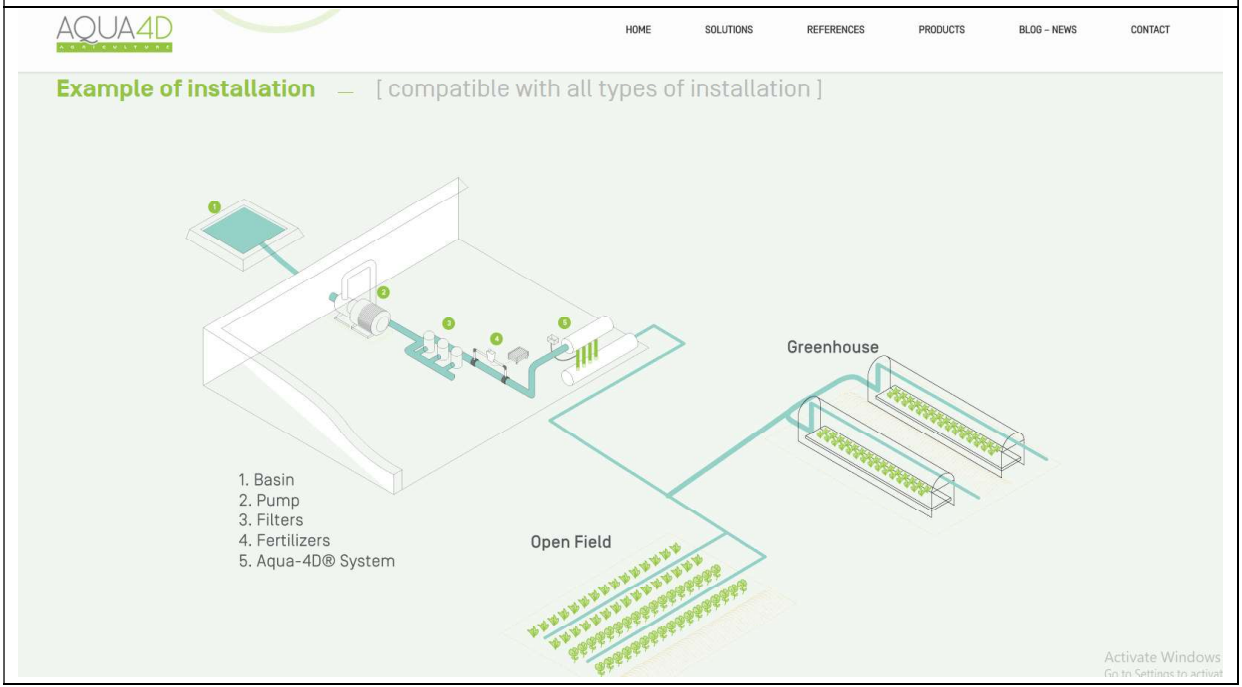

Technology 15
Activates Filter Media
Activated Filter Media is an activated filter media specially developed for swimming pool filters, made from recycled green and brown glass. The water-saving advantages arise from the fact that AFM (unlike standard filtration sand) is bio-resistant and prevents bacterial growth. This allows for less frequent and shorter backwashes, which is the major consumer of water in a swimming pool.


Technology 16
Aquaponics
Aquaponics is the term that is applied to a system of aquaculture in which the waste produced by farmed fish or other aquatic creatures supplies the nutrients for plants grown hydroponically, which in turn purify the water. The saleable products from the aquaponics system are therefore fish and crops/vegetables. Aquaponics systems vary in size and sophistication, from DIY systems to packaged plug-and-play units, and from family/hobbyist systems to commercial aquaponics.


Technology 17
Smart Irrigation (optimised irrigation using weather forecasts)
Smart Irrigation Control technologies for irrigation have been developed to apply irrigation to the landscape based on plant water needs while conserving increasingly limited water resources. One such technology (Rachio 3) uses weather information, wireless communication and apps to create a simple-to-use irrigation controller for crop farmers.


Technology 18
Buried irrigation diffusers
Buried diffuser technology is a new technique for underground irrigation which can be used for trees (fruit trees, forest trees, ornamental trees) and shrubs, vegetables in fields and in greenhouses and plants in containers, pots or boxes. Evaporation is lowered to a minimum; this technology is also a solution for making use of surplus water in the rainy months.


Technology 19
Plant cocoon
The plant cocoon is the ideal alternative for drip irrigation. The Waterboxx plant cocoon is made from polypropylene (plastic). It retains the irrigation water in the box within reach of the tree's roots, increasing the irrigation efficiency. The box can be reused.


Technology 20
Facilitating irrigation with saline water
Facilitating irrigation with saline water. This technology ensures that the salts remain dissolved in water and those not absorbed by the plant are carried off below the rhizosphere. Salts are no longer crystallized in the soil pores and no longer inhibit the nutrition of the plant. This technology reduces water consumption up to 30% while improving yields and crop quality. It's a plug-and-play solution with minimal maintenance and negligible electricity consumption – less than a standard 10W lamp, with easy connection to solar panel arrays. This technology is considered to be particularly useful in Malta, where a number of wells are experiencing salinity problems.


3. Methodology

3.1 Brief

This report relates to Activity 2 of the tender – ***Tender for Market Research on water demand management technologies (Ref Number: EWA/CFT/6/2018***. In total this Project comprises 5 Activities:

- Activity 1 – Assess current market penetration
- Activity 2 – Water saving technologies
- Activity 3 – Consultation meetings
- Activity 4 – Applicability Matrix
- Activity 5 – Dissemination of Results

The aim of Activity 2 being primarily based on desk research. It consisted of collating information on technologies of relevance that are currently not available on the local market and provide a snapshot of such technologies: potential water savings, economic benefits, pricing and payback period, ease of installation. Ultimately, 20 different items/devices/appliances which are applicable for water demand management and efficient water use needed to be identified.

3.2 Identification of technologies

When determining the water saving technologies to focus on, the experts focused on seven (7) criteria, these being – the technology's:

- Water saving potential,
- Suitability to the local context,
- User acceptance,
- Affordability in absolute terms and/or when compared to savings,
- Ease of installation/retrofitting,
- Ease of use,
- Ease of market penetration and eco-friendliness

This report illustrates 5 technologies that are being proposed for each industry under review (in line with the tender document). Nonetheless as clearly evidenced in the table below, some technologies may be easily adopted by other sectors.

Ref no.	**Technology**	**Residential**	**Commercial**	**Tourism**	**Agriculture**
1.	Flood check				
2.	Grey water recycling home system				
3.	Water Recycling Shower				
4.	Water-saving (front loading) washing machines				
5.	Water pebble				
6.	Toilet with integrated wash hand basin				
7.	Shower start device for public showers				
8.	Recyclable plastic beads for Commercial Laundries				
9.	Car wash water recycling systems				
10.	Waterless Urinals				
11.	Device providing real-time information				
12.	Hot water control system				
13.	Smart Wi-Fi Water Sensor				
14.	Nozzle Dual Flow Pro technology				
15.	Activates Filter Media				
16.	Aquaponics				
17.	Smart irrigation				
18.	Buried irrigation diffusers				
19.	Plant cocoon				
20.	Facilitating irrigation with saline water				

	Indicates that in our report the technology in question has been placed under that respective sector
	Indicates that such technology may be adopted by the sector

Ref no.	Technology	Water saving potential	Suitability to the local context	User acceptance	Affordability in absolute terms and/or when compared to savings	Ease of installation/ retrofitting	Ease of use	Ease of market penetration and eco-friendliness
1.	Flood check	2	2	2	2	3	3	2
2.	Grey water recycling home system	1	1	1	1	2	2	1
3.	Water Recycling Shower	3	2	1	1	2	3	1
4.	Water-saving (front loading) washing machines	3	3	3	3	3	3	3
5.	Water pebble	2	2	2	2	3	3	2
6.	Toilet with integrated wash hand basin	3	3	1	3	2	2	2
7.	Shower start device for public showers	3	2	2	2	3	2	2
8.	Recyclable plastic beads for Commercial Laundries	3	3	3	3	3	3	2
9.	Car wash water recycling systems	2	2	1	1	2	2	1
10.	Waterless Urinals	2	3	2	3	2	2	3
11.	Device providing real-time information	2	2	2	2	1	2	2
12.	Hot water control system	2	2	1	2	2	3	2
13.	Smart Wi-Fi Water Sensor	3	3	3	3	2	3	3
14.	Nozzle Dual Flow Pro technology	3	3	3	3	2	3	3
15.	Activates Filter Media	3	3	2	2	3	3	3
16.	Aquaponics	2	2	2	2	2	2	1
17.	Smart irrigation	3	2	2	3	2	2	2
18.	Buried irrigation diffusers	3	3	1	1	2	2	1
19.	Plant cocoon	3	2	1	2	1	2	2
20.	Facilitating irrigation with saline water	3	3	2	2	2	3	2

1 = lowest score
2 = neutral score
3 = best score

4. Results

4.1 Residential

A. Technology 1: Flood Check

Overview

The flood check valve is a flood prevention device designed to protect property from internal flooding by monitoring the water supply. The flood check device automatically switches off the main water supply if it detects a water leak, preventing water wastage, water damage, excessive insurance premium renewals and giving the homeowners peace of mind.

Availability

Available on request.

Technical Specifications (Specification Sheets)

Floodcheck is a product developed by an international company established in the UK in 2011, with a commitment to reducing internal floods in the home and workplace to avoid water being wasted. With over 50 years' experience in the industry, the company has been delivering flood intelligence to protect properties and preventing water damage.

Product Description

The Floodcheck Auto valve is a water leak detection device which offers 24-hour protection against internal flooding by monitoring your water supply.

The WRAS Approved device is fully automated and easy to install. Available in UK and EU sizes, 15mm and 22mm, the Floodcheck Auto valve is suitable for both residential and commercial properties.

Functions / Features

The standard (basic valve only) Auto has these functions.

- **Time Out Protection**: This turns the water OFF if water has been running for more than 15 minutes.
- **Excess Flow Protection**: This turns the water OFF if it senses that there has been a burst pipe or there is an abnormal flow of water.
- **24 Hour Non-use Protection**: This will turn the water OFF if no water has been used for 24 hours.
- **Reset Button**: This resets the system and allows water to flow again.

These are stand alone, fully integrated independent functions, and require no external wiring or connections

THE WATER CONTROL SWITCH

The Water Control Switch makes controlling the Auto Valve much easier. It can be installed on a convenient wall or in an accessible location rather than where the stopcock is situated.

It replicates the controls on the Auto Valve and has three other very useful features.

- **The bypass feature** – Turns the monitoring off for 1 hour
- **The Vacate Mode** – Allows you to turn the water OFF for short periods of time. e.g. when away for a few days or on holiday.
- **The Wet Pad Detectors** – Sensors for leaks in vulnerable areas like washing machines and dishwashers (Wetpads™ can be purchased separately)

In the event of a power cut a 9 Volt PP3 (supplied) can be used to maintain operation.

Price

€250

Payback Period

Insurance companies in the UK claim that homes are 13 times more likely to suffer damage from a water leak than a fire.

A water leak that goes undetected for 24 hours will result in a water loss of almost 15,000 litres. A tap that was not closed in a vacation home that was detected a week later would result in a water loss of more than 50,000 litres.

Floodcheck costs €250 (and one can get a 30% discount from home insurance premiums in the UK if Floodcheck is installed).

Assuming that Floodcheck was triggered 4 times within 15 years, with each trigger saving an average of 30,000 litres each time, the water savings amount to 120,000 litres. Each flood event will push the household water consumption beyond the subsidised quota, and therefore has to be charged at €5.14 for every cubic metre (1000 litres). Therefore, the amount of money saved equates to €617. Therefore, with **only 2 flood events avoided, Floodcheck would have paid for itself** (this does not include damages caused by flooding).

B. Technology 2: Grey Water Recycling Home System

Overview

A greywater recycling technology designed to collect bathroom and washing machine water, cleans and disinfects it, saving water by recycling 85% of total in-house domestic water used. The water is clean, clear and safe and meets international standards. It can be utilised for several purposes including lavatory flushing and the washing machine. Some systems can also recycle grey water from the washing machine.

Availability

Available on order.

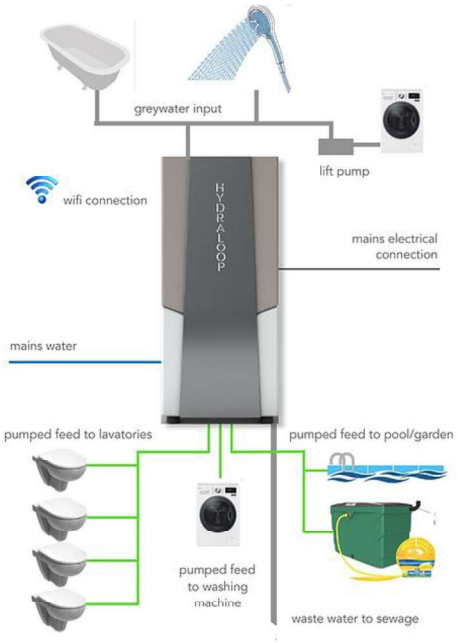
Technical Specifications (Specification Sheets)

Operating Principle

The system is specifically designed for houses. The water from the shower, bath and washing machine gets collected into the system. The system uses a unique patented water treatment technology which does not use conventional filters or membranes to treat the water, which clog and need regular maintenance. The technology - that is the heart of the system - removes dirt, soap and other pollution without using a filter. The treatment systems combine 5 technologies to remove dirt, soap and other particles from the water; Sedimentation, Flotation, Dissolved Air Flotation, Enforced Skimming and an Aerobic Bioreactor. The 6th technology, which is the final treatment, is disinfection using UV light.

The system regularly cleans itself, automatically. Because of this, maintenance requirements are low. The water quality offered is clean, clear, safe and certified to meet the most stringent international standards. The system only uses 20 Watts electricity during treatment, resulting in a net electrical consumption of approximately 200 kWh/year.

A schematic drawing of the Hydraloop system is presented below.



The system is an internationally patented technology.

An upgraded version of the basic model is available, which allows owners to decide and prioritise for which purpose they want to use their Hydraloop water. You can setup the system to first supply reuse water for lavatory flushing and for the washing machine. However in summer you could change your setting to irrigating your garden first. In areas where topping up your swimming pool with mains water is not allowed, you may wish to switch your system to top up your swimming pool first. The remainder of the cleaned reuse water can then be used for lavatory flushing or your washing machine. All this will be done completely automatically based on the settings you make in the App.

SPECIFICATIONS

General information	
Dimensions	Width: 80cm Depth: 34cm Height: 185cm
Power Supply	110/220-volt, 24-volt internal
Power Consumption	20 Watts during treatment Expected power consumption per year ±200 kWh
Product Water Quality	COD_5 (mg/L) < 10 TSS (mg/L) < 10 Turbidity (NTU) < 5 E. coli (MPN/100mL) < 14 pH 6.0 - 9.0

Basic system	
Greywater from:	Shower Bath
Reuse for:	Lavatories Washing machine
Backup	Mains water to Hydraloop
Hydraloop Wastewater	To sewage
Noise level	±40 dB during treatment
Wi-Fi	In house and necessary

Upgraded system	
Greywater from:	Shower Bath Washing machine
Reuse for:	Lavatories Washing machine Garden Swimming pool
Backup	Mains water to Hydraloop
Hydraloop Wastewater	To sewage
Noise level	±40 dB during treatment
Wi-Fi	In house and necessary

Price

Basic system: €3,750

Upgraded system: €4,400

Payback Period

BASIC SYSTEM 2

The system manufacturers claim that the basic system will recover 43% of the water used in a household (based on a daily per capita water consumption of 120 litres per day, of which 55 litres (or 46%) is being used in the shower/bath). It is designed for a family of 4/5 persons.

Therefore, for a family of 4, using 100 litres of water per person per day, with a basic system, the volume of water saved is:

43% x 4 persons x 100 litres/person/day x 365 days/year = 62,780 litres a year.
In this case the water is recycled to the toilets and the washing machine.

Given a purchase price of €3,750 for the basic system; and using a water tariff of €1.3965 per cubic metre, the monetary savings amount to €88 a year. From this one has to deduct the cost of electricity, calculated at €21 a year, for a net monetary saving of €67 a year. **There is no realistic payback for this system**.

UPGRADED SYSTEM 3

The upgraded system is designed for a larger family of up to 6/8 persons. Besides the shower and bath water, upgraded system also recycles 70% waste water from the washing machine. The upgraded system recycles 85% of the water used in the house; which can be fully utilised if there is a garden or swimming pool.

Using an upgraded system, with a family of 7, the savings go up to:
85% x 7 persons x 100 litres/person/day x 365 days/year = 217,175 litres a year.

Given a purchase price of €4,400; the monetary savings increase substantially to €303 a year. Assuming an electricity consumption of 700 kWh a year, the net monetary savings are revised to €230 a year. The net savings increase to €1,043 a year if one considers the highest water tariff rate of €5.1395. In this situation, **the payback is 4.2 years**.

C. Technology 3: Water Recycling Shower

Overview

This technology is a digitally controlled recirculating shower system, a first of its kind. It uses a small amount of water, which is continuously purified, recirculated and comfort-corrected to the ideal temperature and pressure. It presents an innovative, new way to save water and energy for an immediate impact, without compromising the shower experience.

Availability

To be available in Malta in Q3, 2020

Technical Specifications (Specification Sheets)

How it works:

1. Smart sensors analyse water 20 times per second, disposing of dirty water.
2. Unwanted particles are removed, and bacteria is neutralised from the remaining water using two different purification technologies.
3. Cleaned water is recirculates back up to the showerhead.
4. Real-time savings and consumption data are collected by the shower computer and made available on the Cloud.

Wastewater from the shower is collected and treated to remove bacteria and fine particles (using proven microfiltration and UV technology). A smart monitoring system analyses the water quality continuously, disposing of water that does not meet the required quality. Clean water is recirculated back to the showerhead and reused. The recycling system includes a pump and a heater to bring the water temperature back to the required temperature. The performance of the system is continuously monitored and recorded.

Specifications[1]	
Connections	M G15 (1/2")
Flow, hot and cold	9 litres per minute each
Pressure range, hot and cold	3 – 10 bar
Temperature range (cold)	4°C – 30°C
Temperature range (hot)	40°C – 70°C
Hardness range	3°dH – 10°dH
Electrical power	230 VAC / 50 Hz / 16 Amp
Power usage, one-phase	Typical 2.5 kW / max 3.7 kW
Residual current device	Required
Remote access	Wi-Fi 2.4 GHz
Internet connection	Required

[1] https://orbital-systems.com/product/

Price

€5250, expected sales price.

Payback Period - for a 5 minute shower

The product manufacture claims that this product can deliver 90% savings in water, and 80% savings in energy.

For a typical Maltese family of 2.67 persons per household[2], with each member of the household using the shower 3 times a week, for a duration of 5 minutes per use, and the shower issuing 7.7 litres per minute, the household water consumption would amount to:
2.67 persons/household x 7.7 lpm x 5 minutes per use x 3 times a week x 52 weeks a year = 16,036 litres a year.

By reducing the incoming water to only 10% of previous (i.e. 90% savings), savings amount to 14,430 litres a year. Using the range of water tariffs in Malta (depending on whether one is a low consumer or a high consumer), the monetary savings (for water only, not energy) are between €20 to €75 a year. Clearly at a purchase price of more than €5000, **there is no realistic payback**.

Payback Period: for a 15 minute shower

The product manufacture claims that this product can deliver 90% savings in water, and 80% savings in energy.

For a typical Maltese family of 2.67 persons per household, with each member of the household using the shower 3 times a week, for a duration of 15 minutes per use, and the shower issuing 7.7 litres per minute, the household water consumption would amount to:
2.67 persons/household x 7.7 lpm x 15 minutes per use x 3 times a week x 52 weeks a year = 48,108 litres a year.

By reducing the incoming water to only 10% of previous (i.e. 90% savings), savings amount to 43,297 litres a year. Using the range of water tariffs in Malta (depending on whether one is a low consumer or a high consumer), the monetary savings (for water only, not energy) are between €60 to €225 a year. Clearly at a purchase price of more than €5000, **there is no realistic payback**.

[2] https://nso.gov.mt/en/publicatons/Publications_by_Unit/Documents/02_Regional_Statistics_(Gozo_Office)/Regional%20Statistics%20MALTA%202017%20Edition.pdf

D. Technology 4: Very efficient water-saving (front loading) washing machines

Overview

Washing machines are among the biggest water consumers in Maltese households. Old washing machines may be using 100 – 170 litres per wash; the average washing machine may use 87 litres per wash (23 US gallons). However, modern advanced technology can bring this figure down to 46 litres (for a 10 kg load). One such washing machine that employs the most advanced water (and energy) saving technology. We have opted to select a water-efficient front loader washing machine instead of a top loader, because the former is more popular, and will make a greater impact on the Maltese population.

Availability

Available on order

Technical Specifications (Specification Sheets)

Specifications	
Capacity (kg)	10
Energy Efficiency Class	A+++
Annual Energy Consumption**(AE_c) (kWh)	190
Energy Consumption of the Standard 60°C Cotton Programme at Full Load (E_t.60) (kWh)	0.960
Energy Consumption of the Standard 60°C Cotton Programme at Partial Load (E_t.60.1/2) (kWh)	0.750
Energy Consumption of the Standard 40°C Cotton Programme at Partial Load (E_t.40.1/2) (kWh)	0.750
Power Consumption in 'off-mode' (P_o) (W)	0.50
Power Consumption in "left-on mode" (P_l) (W)	0.70
Water Consumption per Cycle - l/cycle	52
Annual Water Consumption (AW_c) (l)	11440
Spinning Efficiency Class	B
Maximum Spin Speed (rpm)	1400
Remaining Moisture (%)	53
Programme Time of the Standard 60°C Cotton Programme at Full Load (T_t.60) (min)	235
Programme Time of the Standard 60°C Cotton Programme at Partial Load (T_t.60.1/2) (min)	200
Programme Time of the Standard 40°C Cotton Programme at Partial Load (T_t.40.1/2) (min)	200
Duration of the "left-on mode" (Tl) (min)	N/A
Noise Level - Washing (dB)	54
Noise Level - Spinning (dB)	75
Built-in	No

Price

€452

Payback Period

REPLACING AN OLD WASHING MACHINE WITH A MODERN WATER-EFFICIENT WASHING MACHINE

The (UK) cost of a new washing machine is €452. The industry standard is 220 uses per year, for annual water consumption of 10,120 litres a year.

Using an old washing machine for an equivalent number of loads results in annual consumption of 29,700 litres a year.

The water savings, therefore, amount to 19,580 litres a year. Using a water tariff rate of € 5.1395 / m^3, the monetary savings amount to €100.63 a year, for a payback period of 4.5 years (on water savings only).

Note: We have applied the non-subsidised water tariff because, with such a water-inefficient washing machine, the likelihood is that the family exceeds the subsidised quota.

CHOOSING THIS WATER-EFFICIENT WASHING MACHINE INSTEAD OF A NORMAL MODERN WASHING MACHINE

A standard 10-kg washing machine purchased from a local stockist costs €848.99. Assuming that freight costs to Malta bring the selling cost from €452 to €550, this price is still competitive with the standard washing machine available that uses 30% more water (13220 litres/year) than the water-efficient model. Therefore**, the payback, in terms of water savings, is immediate by comparison**.

E. Technology 5: Water pebble

Overview

The water pebble is a clever device that monitors the water going down the plug hole when you shower. Memorising your first shower and using it as a benchmark, water pebble then indicated, via a series of 'traffic lights, flushing gently from green through to red, when you finish showering. Each time you shower your Waterpebble automatically fractionally reduces your shower time helping you to save water without needing to think about it. it is considered to be very effective with children as they consider it fun, and compete with the water pebble by getting out of the shower before it triggers red.

Availability

Available to purchase online.

Technical Specifications (Specification Sheets)

Operating Principle of the Water Pebble

The water pebble is an eco-friendly water activated shower times that helps train you to reduce your time in the shower. The water pebble is a simple gadget to use.

1. Once the water pebble is placed by the drain, it senses the water flowing around it, so there is no need to switch it on or off!
2. Each time you shower, Waterpebble Interactive lights up to indicate:
    - Green: start showering
    - Yellow: you're half way through
    - Red: after 4 minutes – end of shower?
3. A series of soft flashing lights indicate how much time you are spending compared to the benchmark, when it flashed red your time is up. "it's like disco in the shower :)"

Specifications

There is very little one can provide by way of specification. It is battery powered device, made from polypropylene, and lasts one million blinks.

The water pebble is programmable. To program your pebble, click the restart button on its base, then place it near your shower drain. It measures your eater usage on the first try and flashes future finishing times against this benchmark, reducing suggested stop times by 5-7 seconds each shower.

Price

€11

Payback Period

The battery life of the water pebble is rather long. You can expect it to last up to two years. Even if you take 4-5 showers a day, it will last 9-12 months. That around 1500 showers.

Assuming that the water pebble helps in reducing a 7-minute-long shower to 4 minutes, at a showering rate of 7 litres per minute, that's 21 litres of water saved per shower. For 1500 showers, the amount of water saved within the lifetime of the gadget totals 31,500 litres.

With a water tariff ranging from €1.395 - €5.14 for 1000 litres, **the gadget pays itself in less than 100-375 showers**, depending on the applicable tariff.

4.2 Commercial

A. Technology 1: Toilet with Integrates Wash Hand Basin

Overview

The Toilet with integrated wash hand basin saves water by allowing the same water to be used for two purposes. Fresh water is first used for hand washing and then flows into the cistern to ultimately flush the toilet. Therefore the water used for the flushing the toilet is reused water.

Availability

Available on order.

Technical Specifications (Specification Sheets)

Specifications	
Product Type	Close coupled
TRAP TYPE	S Trap
P TRAP SET OUT - MIN. (MM)	185
P TRAP SET OUT - MAX. (MM)	185
S TRAP SET OUT - MIN. (MM)	140
S TRAP SET OUT - MAX. (MM)	140
INLET TYPE	Bottom Inlet
MATERIAL	Vitreous China
WELS STAR RATING AND FLOW RATE	WELS 5 Star Rated, 4.5/3 (3L average flush)

Price

€750

Payback Period

Tests carried out on the integrated toilet with integrated hand basis show that there are 70% savings when compared to a conventional toilet/sink combination.

Considering that the product is installed in a restaurant which opens for lunch and dinner and has 50 places, 6 days a week, which over a 7-hour period will accommodate 250 patrons, of which half of these will use the restroom and 2 in. one. integrated toilet/wash hand basin unit. To these add 20 uses by restaurant staff.
If a conventional toilet/wash hand basin system results in a water consumption of 15 litres per use, the savings amount to (125+20) uses per day x (70%) savings x 15 litres/use x 6 days/week x 52 weeks/year = 475,000 litres a year.

The additional cost of the integrated toilet/wash hand basin over a separate conventional toilet and wash hand basin combination is €60.

The monetary savings, at the applicable water tariff of €2.375 per 1000 litres equates to €1,128 a year. For two units, the **payback is less than 2 months**.

B. Technology 2: Shower Start Device for Public Showers

Overview

The Shower Start is a device that is fitted to shower head, and which stops the water flow once the required (hot) temperature is attained. The user then reactivates the water flow by manual intervention. The water savings arise from the fact that while waiting for the hot water shower users tend to move away from the shower and do something else (get shampoo, soap etc.) and only return to the shower once they are convinced that the shower is dissipating hot water. This results in an unnecessary waste of water and energy.

Availability

Available for purchase from site[3].

Technical Specifications (Specification Sheets)

How it works[4]:

1. Turn on the shower

Cold water exits…

Continue with your typical routine – the things you do while waiting or the shower to become warm.

2. Shower Start kicks in

When the water reaches 95˚F (35˚C), ShowerStart automatically lowers the flow to a trickle – saving hot water until you're ready to get in.

3. Ready when you are

You know your shower is warm, so pull the cord to resume fill flow and begin showering.

Features:

- Helps your hot water last longer — saves gallons every shower.
- Enjoy the freedom to multitask instead of waiting, waiting, waiting for your hot water to arrive.
- Stops showers from running on and on when no one's in them.
- Let's you know when your shower's ready.
- Won't change your shower head's feel or flow.
- Attaches to your choice of shower head.
- This product can help a building earn Water Efficiency points in the LEED Green Building Rating System.

Specification:

- Chrome polish finish
- Dimensions: 2" x 1.81"
- Removable lanyard
- 1/2 in. NPT connection
- For use in showers with static water pressures >30 psi
- 3-year warranty

[3] https://www.showerstart.com/products/showerstart-tsv
[4] https://thinkevolve.com/pages/showerstart-tsv

Price

€27

Payback Period

Assuming that 4 Shower Smart devices are attached to 4 public showers in a sports (5-a-side football) complex with 6 football pitches, with a rotation of a game per hour for 4 hours a day during the week, and 8 hours during Saturdays and Sundays.

The shower delivery rate is 10 litres per minute. Assuming that 80% of players shower after the game, and the water in the pipes cool in the one-hour gap between showers. Let us assume that each Shower Start device saves 30 seconds of water delivery.

The water savings – for the 4 showers combined are therefore:
4 showers x ((5 x 4) + (2 x 8)) uses per week x (30/60) minute x 10 litres/minute x 52 weeks/year = 35,360 litres a year.

Using the applicable water tariff of € 2.375 per 1000 litres, the savings in monetary terms equate to € 84 a year (water only, not energy). At a purchase cost of 4 x €27 = € 108, **the payback period is 15 months**.

C. Technology 3: Recyclable plastic beads for Commercial Laundries

Overview

An innovative technology that uses recyclable plastic beads to cut down on water use by 80%. As they tumble through the cycle, the beads "lift the stains away from the laundry in the wash, like a million tiny hands performing flexing motions on the fabric of each item in the wash." A special extraction cycle separates the beads from the load, cleans them and adds them back while the cycle runs. Their weight causes them to drop to the bottom of the washer when the cycle finishes.

Availability

Available on order

Technical Specifications (Specification Sheets)

The beads are spheroidal shaped polymers which achieve better results while saving water and reducing costs. Able to last for thousands of cycles, the beads use low levels of water and chemistry to deliver a gentle mechanical action that removes dirt, stains and stray dyes in washing domestic, industrial and high-performance workwear.

They also improve dye penetration and fixation in leather re-tanning, denim manufacturing and textile processing far more efficiently and effectively than traditional methods.

The beads are a patented technology so detailed specifications are not available.

The beads cannot be purchased on their own, but with a specially designed washing machine.

Washing machine	
Machine capacity	36kg
Cylinder Size	Ø990 mm x 660 mm (Ø39.0" x 26.0")
Cylinder Volume	508 L (17.9 cu ft)
Water Inlets (2)	3/4 BSPT
Water Inlet Pressure	2-3 bar [3 Bar Max] (29-43.5psi [43.5 psi Max])
Drain Pipe	90 mm (3.5") OD
High Extract	Up to 750 RPM
G-Force	Up to 311 g
Heating (Electric)	XE36C02-xxxL: 18 kW XE36C02-xxxE: 27kW
Control	7" touch screen
Net Weight	1900 kg
Dimensions (C x B x A)	1540 mm x 1320 mm x 2170 mm

Drive Motor Size	4 kW
Drive System	Inverter / Variable Frequency Drive
Power	400 V (± 10%) x 3ph x 50Hz (EU) 208-220 V x 3ph x 60Hz (US)
Wash Formulas	Up to 50
Rated Current (typical circuit breaker)	XE36C02-215H / S: 30 A (40 A breaker) XE36C02-215L: 55 A (70 A breaker) XE36C02-215E: 70 A (90 A breaker) XE36C02-400S: 20 A (20 A breaker) XE36C02-400E: 50 A (50 A breaker)
Door Diameter (Loading Aperture)	Ø500 mm (Ø19.7")
Recommended Centreline Height	1230 mm (48.4")
Noise Level	<85 dB (at workstation position)
Steam Inlet	1/2 BSPT
Steam Pressure	1.5 Bar Max (21.5 psi Max)
Drain Height	6 11/16" (170mm) – Dimension E
Air Supply Inlet	8mm OD Hose
Air Pressure	0.4-0.6 MPa (58-87 psi)
Air Flow Rate	<1 CFM (avg.), 10 s @ ≈6 CFM (1/cycle)
Clearance above the machine (Dimension D)	200 mm (7.9")
IP Rating	IP54

Price

€14,000 (load capacity is 36kg)

Payback Period

The 36kg washing machine costs £12,500 (€14,000). A standard 35 kg washing machine (make: Primus) costs £9,200 (€10,300).

Consider a commercial laundry washing 72,000 kg of laundry a year. This would equate to approximately 2000 washes using these washing machines (approx. 5 – 6 washes a day, 365 days a year).

The washing machine uses 4.5 litres of water per kg of laundry washed, while the Primus (standard) washing machine uses 16 – 20 litres, let's say 20 litres.

The volume of water used by standard washing machine: 1296 m3/year

Volume of water used by the washing machine: 324 m3/year

Volume of water saved: 972 m3/year (or 75% savings). In terms of monetary savings, at a water tariff of €2.375/m3, this equates to €2,300 a year.

The difference in the purchase price: €3,700. Therefore, the **payback period is 1.6 years** (in terms of water savings only).

If one had to also consider savings in chemicals, energy and maintenance, the payback period goes down to only 5 months.

D. Technology 4: Car Wash Recycling Systems

Overview

There are various types of water recycling systems for car washes. However, all systems include a pit which captures the dirty/soapy water that runs off the cars which is temporarily stored until it is treated and normally recycled in the early rinses of the subsequent washes and used in the mixing with detergents. It may also be used in the high-pressure washer.

Availability

Available on request.

Technical Specifications (Specification Sheets)[5]

The t2-Bio vehicle wash water recycling system has been developed to recycle car wash and commercial vehicle wash water where waxes and/or hydrocarbons must be removed. The T2-Bio provides clean recycled water which is second to none. With the capability to recycle all the water collected from the washing process, the T2-Bio will also work on a completely closed loop basis, allowing washing to be carried out on sites where there is limited to zero drainage. Biological filtration has been natures way of cleaning water for millions of years and the T2-Biouses this natural process to produce clean recycled water from the vehicle wash effluent. Available with above ground collection tanks, the T2-Bio can be installed with minimal civil requirements.

Features and Benefits:

- Water storage included
- Skid mounted pumps and controls
- Fully automatic
- Auto water circulation when not in use
- 12-month warranty
- Backed by Nationwide Service Team
- Flow rates to suit consumer requirement
- Biological filter bed
- Electrically controlled 'auto top up'
- Can work on 'closed loop' basis
- Suitable for all types of vehicle washing
- Turnkey packages available

Model	Ltr/min	Typical layout L x W x H (mtrs)	Power supply	Water supply	Delivery weight
T2-100Bio	150	4.2 x 1.3 x 1.6	20A 415w	32mm	550kg
T2-200Bio	230	4.2 x 1.3 x 1.6	20A 415w	32mm	725kg

[5] https://bywaterservices.co.uk/index.php

Price

€ 13,500 – 16,500 for a small water recycling system

Payback Period : calculated on the basis of groundwater pumped from a private borehole

On the basis of 100-cars-per-day average (hand wash, not automatic brush wash, which uses much more water), assuming 15 litres per minute for 5 minutes per vehicle, 7 days a week, volume of water used per year equates 2,737,500 litres a year.

It is claimed that car wash recycling systems can recover 95% of this amount. The water savings therefore amount to 2,600,625 litres a year.

Assuming a groundwater pumping cost of €0.25 per cubic metre, the monetary savings amount to €650 a year. These systems carry an operational cost of €1,500 a year in consumables, parts and electricity, so **there is no payback**.

Payback Period : calculated on the basis of mains water

On the basis of 100-cars-per-day average (hand wash, not automatic brush wash, which uses much more water), assuming 15 litres per minute for 5 minutes per vehicle, 7 days a week, volume of water used per year equates 2,737,500 litres a year.

It is claimed that car wash recycling systems can recover 95% of this amount. The water savings therefore amount to 2,600,625 litres a year.

Assuming a mains water cost of € 2.375 per cubic metre, the monetary savings amount to € 6175 a year. The system costs around € 15,000, and carries an operational cost of €1,500 a year in consumables, parts and electricity.

The payback period is therefore 3.2 years.

E. Technology 5: Waterless Urinals

Overview

Waterless urinals are, as the name implies, urinals that do not flush with water. Waterless urinals have been commercially available in some international markets since the 1990s, but, to date, have failed to make a presence in Malta. Waterless urinals can save between 57,000 and 170,000 litres of water per urinal per year, depending on the amount of water used in the water-flushed urinal for comparison purposes, and the number of uses per day. For example, these numbers assume that the urinal would be used between 40 and 120 times per business day. The biggest single issue with waterless urinals is of course odour control and scale build up. However, there are various technologies available today that mitigate this problem. What is being proposed here is a retrofit kit i.e. converting an existing flushing urinal into a waterless urinal. Almost all standard urinals can be converted to waterless, whether the urinals are newly purchased or were installed many years ago.

Availability

Available to purchase online.

Technical Specifications (Specification Sheets)

Operating Principle of the (Microbiological) Waterless Urinal

How they work:

- The replaceable cartridge contains a chemical block which dispenses selected strains of harmless microbial spores together with cleaning agents.
- Urine touches the block and carries the spores into the waste pipe.
- The spores are activated by the urine and become live micro-organisms (microbes). The microbes break down urine into odourless components and use the trap or u-bend as the seal against odour from the drains.
- The microbes create enzymes to break down the urine so that they can 'feed' on the contents.
- 'Feeding' causes the microbes to multiply creating an environment that breaks down urine and is hostile to bacteria that cause the unpleasant odours.

The retrofit kit for conversion to waterless and for the first 3 months of waterless operation includes:

4. 1 x Urinal Maintenance Device cartridge designed to dispense beneficial microbes and other active ingredients over a 3-month period.
5. 1 x 38mm (1.5') special waste outlet fitting into which the cartridge is inserted. This waste outlet fits the vast majority of UK urinals. If you require a different size outlet, please select the appropriate one in the option box at the bottom of this page.
6. 1 x 5 litre container of Gentworks Bactericidal Cleaner concentrate to use for weekly dosing and regular cleaning.

Urinal Maintenance Devices are simply retrofitted into existing pipework. They combat smells and blockages whilst eliminating the need for water. The contents of the standard Waterless Start-up Kits enable urinals to

operate with no flushing for a period of 3 months, after which new cartridges will be required. Microbes dispensed by the cartridges break down the uric acid salts and other contents of urine, while regular use of Bactericidal Cleaner helps keep the pipework free from body fats, hair and other debris.

STANDARD (MODEL A)

This model was specifically designed for waterless use but is also successful in low-flushing environments. It is the model that is recommended for retrofitting flushing urinals to waterless.

BACTERICIDAL CLEANER

The Bactericidal Cleaner is supplied in 5 litre containers. Apart from being an effective cleaner, it is also very effective for dissolving stale urine, uric scale and body-fat deposits.

FEATURES:

- Dissolves urine
- Kills bacteria
- Removes scale and stains
- Removes body fat from showers and swimming pool surrounds
- Safe on chrome, stainless steel and other metal surfaces
- Non acidic
- Leaves a pleasant, lingering fragrance

Price

€ 57 for a single start-up kit for 1 urinal for 3 months; €27/unit for 32 urinals every 3 months.

Payback Period

Based on Gentworks survey data from hundreds of sites, the average annual water use per urinal is approximately 120 cubic metres (m^3) per year. However, usage varies from around 29m^3 to 235m^3, depending on the level of flush control already implemented.

Urinals with properly calibrated flush controllers will typically be using less than 50m^3 per year. However, most are flushing much more than expected because the controllers are not correctly calibrated or have failed completely.

Using the 120 m^3 figure and considering the retrofitting of 32 urinals in a large office building, the annual savings amount to 3840 m^3 per year. Using the applicable (non-residential) ARMS tariff of € 2.375/ m^3, the annual monetary savings amount to € 9120 per year.

The cost of retrofitting 32 urinals and purchasing the cartridges and cleaner for one-year operation is € 3500.

The payback period is therefore 4 – 5 months.

4.3 Tourism

A. Technology 1: Device providing real-time information

Overview

This technology is designed for hotels; it saves water by providing real-time information on showering practices to the hotel operator but also to the guest. This information assists hotel managers to adjust the hotel's water supply and water heating systems (pumps and boilers) to optimise the water delivery service, while making the guest aware of the resources being used in showering. From experience it has been established that hotels equipped with this technology have cut their water use by 20%

Availability

Availability on request.

Technical Specifications (Specification Sheets)

Specifications

- The system comprises two devices:

1. A sensor is installed on the ceiling in the shower cabin and communicates with the Wi-Fi. The sensor registers and activates once a person enters the shower cabin and the water is turned on and off. All data from the Sensor is sent to a cloud from where the hotel can collect information.
2. A display is installed at eye level within the shower cabin. It automatically communicates with the Sensor. With the different images and text visible, the Display provides valuable data about the shower behaviour. The Display encourages the user to turn off the water and spend less time during use.

- Dimensions:
    - Sensor = 10 x 10 x 2.8 cm
    - Waterproof display = 8.6 x 8.6 x 2.6 cm

Operating Principle of the Aguardio System6

How does it work:

1. When entering the shower cabin, the device automatically turns on.
2. During showering the Display provides information about the shower.
3. The Sensor automatically collects data with references to water, temperature and humidity.
4. The data is collected and sent to a cloud – it's simple!

[6] https://www.aguardio.com/solution/

Sensor collects data about:

- Water running time
- Average shower time
- Number of showers
- Nudging measurements
- Humidity
- Temperature

How to install it in a few minutes:

1. Insert batteries into both devices.
2. Connect Sensor to the Wi-Fi by using the Aguardio App.
3. Install Sensor and Display in the shower cabin.
4. Done.

Price

€150 (price based on a quotation for 100 units)

Payback Period

The water savings and payback[7] for an Aguardio system for a 100-room hotel is presented below:

Business Case input	
No. of rooms	100
Price level per room per night	€135
Occupancy rate	80%
Price on hot water incl. heating per m³	€9.00

Overview: Environmental Effects	
Water reduction	429 m³
Reduction in CO_2 emission	2.0 ton
kWh reduction	19,517 kWh

Overview economic effect per year	€	Payback
Investment	**15,000**	
Annual savings hot water	4,289	
Annual savings refurbishment of bathrooms	1,918	
Annual savings optimization of ventilation system	467	
Total annual effect operation	**6,674**	**2.2**
Annual effect occupancy rate	3,203	
Annual effect price erosions	3,942	
Total annual effect branding	**7,145**	**2.1**
Total annual effect operation and branding	**13,819**	**1.1**

With this example the estimated water savings per guest night is 7.3 litres.

Capital expenditure: € 15,000 to equip 100 rooms.
Water savings : 7.3 litres/guest night x 1.5 guests/room x 100 rooms x 80% occupancy x 365 days/year = 319,740 litres a year

At a commercial tariff of €2.375 per cubic metre, the monetary savings amount to €759 a year. **The payback period is therefore 19.8 years.**

[7] https://www.aguardio.com/prices/

Note: *This payback period does not take into account the savings in water heating and the other benefits arising from the technology (data on shower usage patterns which may result in better management of room services, ventilation, hot water management etc.).*

B. TECHNOLOGY 2: HOT WATER CONTROL SYSTEM

Overview

This control system is designed for hotels saves water by circulating the ambient temperature water in the hot water lines back to the water heater. This is water that is normally run to drain. Apart from the water benefits, the system also delivers hot water at a lesser time than just letting the water run down the drain—the usual scenario.

Availability

Available to purchase online.

Technical Specifications (Specification Sheets)

OPERATING PRINCIPLE

The manufactures of Hot Water Recirculation Systems that deliver hot water on demand, reduce water waste, and conserve energy.

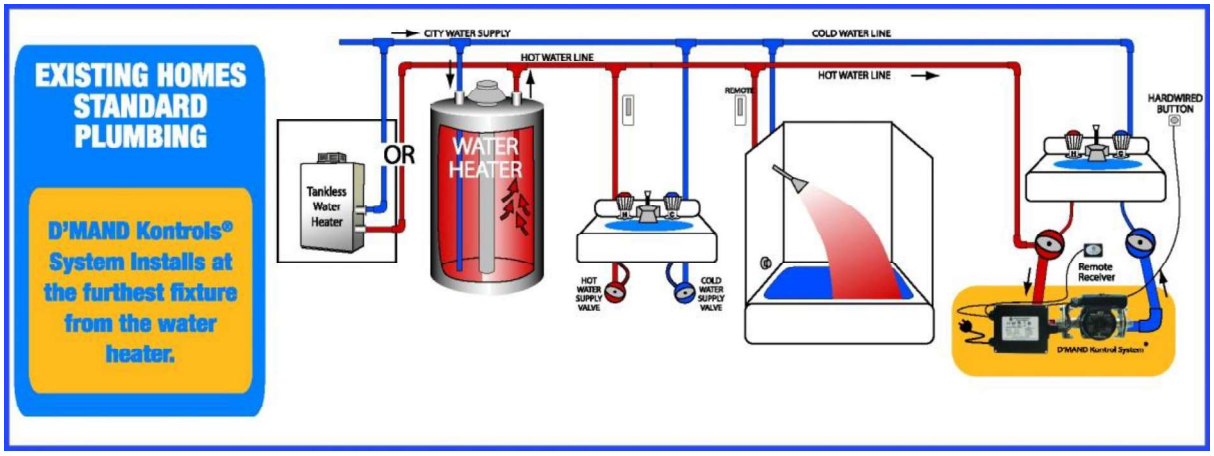
The Hot Water Pumps send cold water in the plumbing line back to the hot water heater, via the cold water or dedicated return line, while simultaneously bringing hot water to all fixtures on that plumbing line, in a matter of seconds.

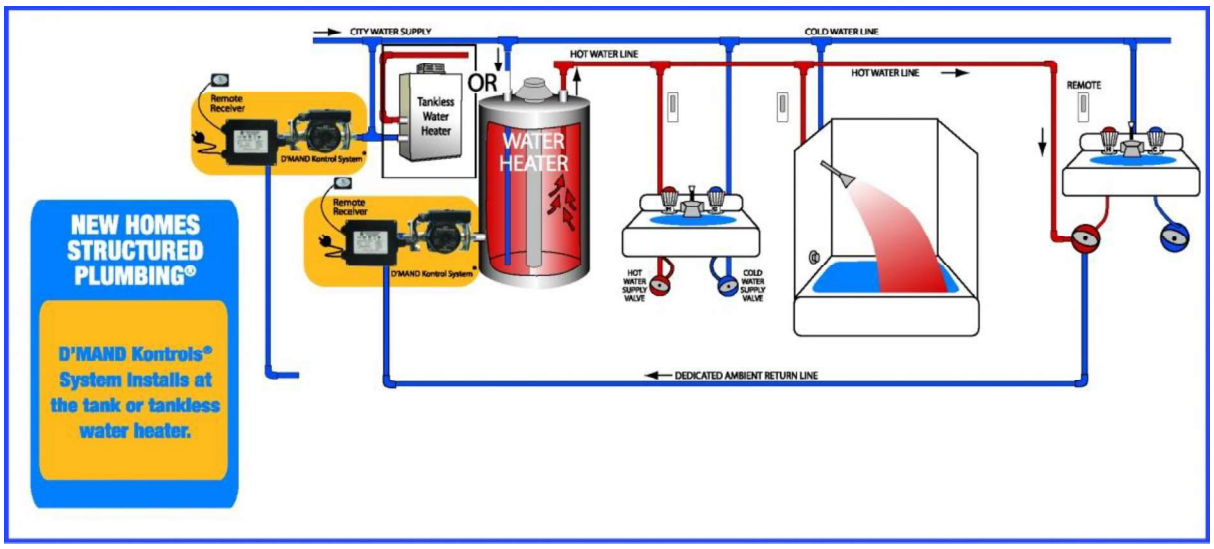
Unlike other hot water recirculation pumps, the system does not allow hot water into the cold-water line and delivers hot water to the furthest fixtures on-demand, rather than on a timer-based system.

Because Recirculation Systems are utilized, it saves the user money, whereas other pumps that utilize timer-based recirculation systems cost the user hundreds of Euros in energy expenses every year.
The Recirculation System saves water by reducing the user's wait time for hot water, thus reducing the water the user runs down the drain.

The Hot Water Recirculation Systems also reduce energy use by diminishing the amount of unused water wasted down the drain, thus cutting down on sewage and treatment costs.
The Recirculation Systems are compatible with tank or tankless water heaters and work with solar hot water heaters as well. The pumps are NOT water heaters, rather they ARE hot water delivery systems. You do not need to have a dedicated return line to use an the System, as it easily retrofits underneath the fixture furthest from the water heater.
The ACT system can be installed in existing hotels (i.e. a retrofit) or in new build.
The ACT system is best suited for small to medium sized hotels, hostels and guest houses. For bigger hotels a conventional boiler/calorifier/continuous hot water circulating system may be better suited.

Schematic diagrams for either installation is shown below.





A typical System includes an electronic circuit board, thermo-sensor mounted in lead free bronze volute, 3/4" threaded stainless steel flanges, and internal check valve. Recommended for use with standard plumbing systems in buildings larger than 360 m2. with tank water heaters or pipe runs over 30 lineal metres between a tankless water heater and installation location of the System.

SPECIFICATIONS:

C3-100 ACT D'MAND KONTROL System	
Flow range	0-68 litres per minute
Head range	0-5 meters
Motors	2-Pole Single Phase
Min. fluid temperature	0° C
Max. fluid temperature	110° C
Max. working pressure	10 bar
Connectors	Male adaptors
HP Max speed	.116hp
Voltage (max. spd.)	115W/ 245 Watts
Approx. ship weight	3.2kgs

Price

€1470

Payback Period

It is estimated that some 12 – 25 litres of water are lost before hot water issues from the shower or tap. To this add another 3 – 10 litres being lost until the user returns to the shower/tap and actually uses the water.

Consider a small hotel with 10 rooms, average occupancy 80%, with 3 visits to the restroom per guest.
Volume of water wasted per year:
(18 + 6) litres per visit x 3 visits x 10 rooms x 365 days/year = 262,800 litres a year.

At the applicable commercial water tariff of €2.395 per cubic metre; this amounts to monetary savings of €630 a year.
At a system cost of €1,470, this represents a **payback of 2.3 years** (calculated on water savings only, not including savings in heat energy).

C. Technology 3: Smart Wi-Fi Water Sensor

Overview

Increasingly, hotels are building water storage systems underground (instead of the traditional roof tanks). Although this provides benefits in terms of water quality, it makes leaks from water tanks more difficult to detect. This technology consists of a Smart Wi-Fi Water Sensor, which acts as a flood and leak detector, giving an alarm and App notification alerts. Having a sensor installed around an underground tank/reservoir, with a channel excavated to drain any water to the sensor will catch out a leak which may go undetected for months or years. One such flood sensor is produced by Wasserstein.

Availability

Available for purchase online.

Technical Specifications (Specification Sheets)

Operating Principle

The installation and operation of this device is very simple plug and play.

The Smart Sensor is placed in a strategic location where water from a leak is likely to accumulate. It is battery powered, and it can operate in standby mode for over 6 months thanks to its optimised energy use.

It should be installed with the flat metal contacts touching the floor (it can also be wall mounted if it considered that the leak may issue from the wall of the reservoir). If water is sensed, the sensor gives an instant notification of any water leakage (as well as notification on the battery level of the device).

The water alarm features an ultra-loud 120db alarm and a 360-detecting angle which is very sensitive to water. It can detect pooling, dripping water, and high levels of moisture.

The audible alarm compliments the notification by Wi-Fi, in areas that are out of reach or having poor signal.

Specifications	
Wireless coverage	45m
Battery specification	CR2-3V x 1
Standby current	13μA
Working current	65mA
Working temperature	0°C ~ 40°C
Operating humidity	20% ~ 85%
Wi-Fi standard	IEEE801.11b/g/n
Wireless type	Wi-Fi 2.4GHz

Price

€29

Payback Period

This sensor only costs € 29, so at the applicable commercial water tariff of €2.395 per cubic metre, if it manages to detect **a single leak event of a magnitude of more than 12 cubic metres, it would have already paid for itself**.

To put leakages in context, a dripping tap dripping 60 drops per minute wastes 21 litres a day. A leak from a pump may issue more than 100 litres per minute, so within 2 hours the breakpoint volume of 12,000 litres is reached within only 2 hours. If the leak happens at night, it may be 6 – 8 hours until the leak is visually detected.

D. Technology 4: Nozzle Dual Flow Pro Technology

Overview

Nozzle Dual Flow Pro technology from Altered takes water flow reduction from faucets to the extreme. The patent pending atomization technology converts water into millions of droplets (effectively a mist) instantly drenching the users' hands, with only 2% of the water used during a normal hand wash (i.e. 98% savings). Specifically designed for public areas, it comes with an anti-theft feature.

Availability

Available to purchase online[8].

Technical Specifications (Specification Sheets)

Operating Principle

The Nozzle Dual Flow Pro device can be fitted to a standard faucet in a public restroom.

It delivers full functionality: it can be used in Mist Mode (98% water savings), or if the user wants a higher flow it can be adjusted to Spray Mode (which still delivers 85% water savings compared to regular taps).

Key features for Pro Version

180° Switch

Enhanced Spray Mode

Updated Anti-Theft

Optimized for Public Areas

The Altered: Nozzle Dual Flow Pro	
Dimensions (inner socket dimension)	Sized taps: • Standard (20.8mm) • Junior (18mm) • Tom Thumb (15mm)
Material	Lead free brass (chrome handle)
Filter	Metal mesh 0.4mm
Water pressure	29-116psi / 2-8 bar
Water temperature	Max 192° F / 89° C
Flow Rate (3 BAR pressure)	Mist mode: 0.21 litres/minute Spray Mode 1.1 liters/minute (Spray Mode 2.6 liters/min. removed restrictor plug)

[8] https://www.alteredcompany.com/shop-17/dualflowpro

Price

€31.20

Payback Period

Considering that six of these products are installed in two restrooms (male/female) close to a breakfast room/restaurant in a hotel of 75 rooms offering full board service, with 100 places, open for business 7 days a week, all year long. Hotel occupancy rate: 80%.

Assuming that there is an average of 1.5 guests per room, with the guests all being seated for breakfast, and with half of them having lunch and dinner at the hotel. Let us assume that half of these use the restroom after using the restaurant.

The number of uses therefore equates to:
1.5 guests/room x 75 rooms x 80% occupancy x (1 + 0.5 + 0.5) uses per guest per day x 50% probability of using the restroom x 365 days a year = 32,850 uses of the restrooms every year.

If a conventional tap results in a water consumption of 7 litres per use (1 minute at a flow rate of 7 litres per minute), the volume of water consumed amounts to 229,950 litres a year.

Assuming an average water savings of 90% when using the Nozzle Dual Flow device, the water savings are calculated at 207,000 litres a year.

The monetary savings, at the applicable water tariff of €2.375 per 1000 litres equates to €1,495 a year. For six units, **the payback is less than 2 months**.

E. Technology 5: Activated Filter Media

Overview

Activated Filter Media (AFM) is an activated filter media specially developed for swimming pool filters, made from recycled green and brown glass. The water-saving advantages arise from the fact that AFM (unlike standard filtration sand) is bio-resistant and prevents bacterial growth. This allows for less frequent and shorter backwashes, which is the major consumer of water in a swimming pool

Availability

Available on order.

Technical Specifications (Specification Sheets)

Product description

Activated Filter Media is a direct replacement for sand, doubling the performance of sand filters without the need of additional investments in infrastructure. This implies that AFM can also be introduced as a retrofit solution to existing swimming pool filtration systems.

AFM resists biofouling, bio-coagulation and transient wormhole channelling of unfiltered water and never needs to be recharged or replaced. Proven lifetime of more than 20 years.

AFM is a highly engineered product manufactured from a specific glass type, processed to obtain the optimum particle size and shape. It is then exposed to a 3-step activation process to increase its surface area by up to 300 times for superior mechanical and electro-static filtration performance.

AFM® benefits at a glance:

- more than doubles the performance of an existing filtration system without the need for additional investments is not subject to biodynamic instability and will never allow untreated water to pass the filter
- substantially lowers chlorine oxidation demand by up to 50%
- lowers backwash water demand by an average of 50%
- is expected to last for the life of the filtration system
- provides quick return on investment

Specifications:

AFM Grade 1 specification	
Bulk bed density	1250 kg/m^3
Effective size	0.45mm
Sphericity	0.75-0.80
Uniformity coefficient	1.6 - 1.8
Aspect ratio	2 - 2.4
Specific gravity	2,4 kg/l

Organic contamination	< 50g/ton
Colour purity	> 98%
AFM® is supplied in	21 kg 25 kg 1000 kg
AFM® is available in	4 grades

Operating criteria for Filters to work with AFM

Operating Criteria	
Filtration velocity	1 - 30 m/h
Backwash velocity	40 - 50 m/h
Backwash duration	3 - 10 minutes
Max. operating differential pressure	0.5 bar
Water pH limits	3 - 9
Water temperature limits	1 - 100°C

Price

€1.60/kg

Payback Period[9]

It is claimed by the product manufacturers (and backed by scientific evidence) that the use of AFM media in filters reduces the amount of filter backwash water by 50%.

For a commercial swimming pool in a hotel, measuring 30m long x 10m wide with an average depth of 1.2m (volume = 360 m^3), which needs to be backwashed once a day during summer and twice a week in the rest of the year.

Backwashing requirement using standard filtration sand (flow velocity 60 m/h for 5-6 minutes, filter area 2.00 m^2):

- Backwashing water in summer: 990 m^3
- Backwashing water in the remaining 9 months: 858 m^3
- Total backwash water requirement: 1758 m^3/year

[9] Note: This calculation does not factor in the fact that AFM lasts more than 20 years, while standard sand must be replaced every 5 years. It also does not include the labour cost of refilling the filters.

Backwashing requirement using AFM media (flow velocity 45 m/h for 4 minutes, filter area 2.00 m2):

- Backwashing water in summer: 540 m^3
- Backwashing water in remaining 9 months: 468 m^3
- Total backwash water requirement: 1008 m^3/year

Water savings: 759 m^3/year

Monetary savings from water saved: €2.375/ m^3 x 759 m^3/year = € 1802/year

Monetary savings from water saved, when using bowser water: € 1.90/ m3 x 759 m3/year = €1442/year

Purchase cost of 2400 litres (approx. 3000 kg) of AFM media at € 1.60/kg = €4800

Purchase cost of 2400 litres (approx. 3750 kg) of standard sand at € 0.30/kg = €1125

Difference in capital expenditure: € 3675

Payback period, when using mains water: € 3675 divided by € 1802/year = 2.0 years

Payback period, when using bowser water: € 3675 divided by € 1442/year = 2.5 years

4.4 Agriculture

A. Technology 1: Aquaponics

Overview

Aquaponics is the term that is applied to a system of aquaculture in which the waste produced by farmed fish or other aquatic creatures supplies the nutrients for plants grown hydroponically, which in turn purify the water. The saleable products from the aquaponics system are therefore fish and crops/vegetables. Aquaponics systems vary in size and sophistication, from DIY systems to packaged plug-and-play units, and from family/hobbyist systems to commercial aquaponics.

It should be pointed out that aquaponics can also be made to work with shrimps, oysters and even kelp (for the production of sodium alginate).

Availability

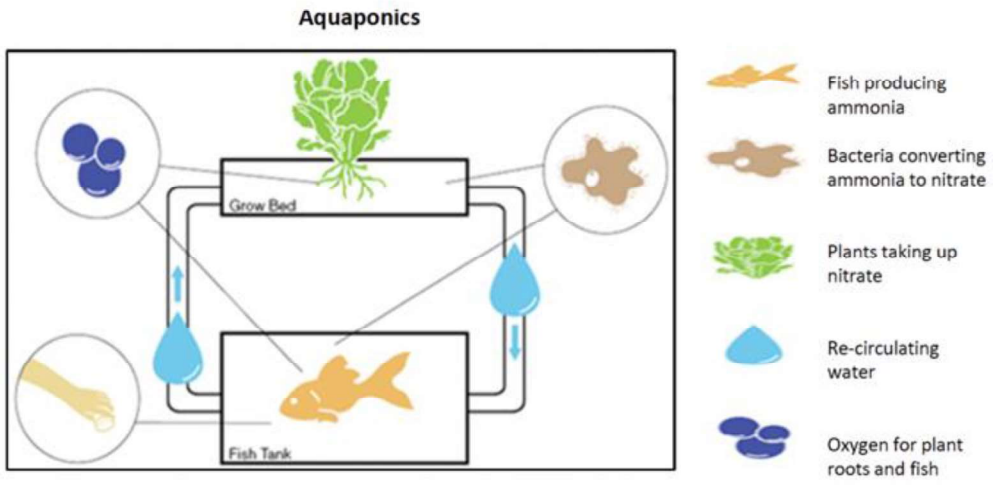
Available on request.

Technical Specifications (Specification Sheets)

AQUAPONICS SYSTEMS CONSISTS OF TWO PARTS:

A grow-bed where crops grow in a fertile sand-gravel mixture and a tank for the fish (sometimes the grow bed is installed above the fish tank, to save space). The two parts depend on and complement each other — the fish tank provides water and organic nutrients to the plants in the grow-bed, while the plants clean the water before it returns to the fish tank.

A schematic diagram for an aquaponics system is shown below:



MAIN COMPONENTS:

- Grow bed

- Fish tank

SECONDARY COMPONENTS:

- aerator: constantly aerates the water allowing for more oxygen to enter the promoting better fish health, and more rapid plant growth.
- pipes: pipes (usually PVC) are what transport the water in between the various stages of the cycle.
- lights: the lights provide the radiant energy needed for plants to photosynthesize.
- pump: the pump is the main electrical source that pushes the water.

Price

€ 2450 for a 23 m^2 system; € 3730 for a 46 m^2 system.

Payback Period

As with hydroponics you get 'more crop per drop'. That is for the same yield of crops, the quantity of water used is substantially less than for conventional cultivation (even using drip irrigation) by virtue of the fact that very little water is lost in evaporation and there is no loss in the soil.
Aquaponics delivers the same water savings as hydroponics, but also delivers another saleable product – fish.

Let us consider this DIY system to assess the economics of the system:
For a 46 square metre system, cost of components is € 3730. This system uses 85 Watts of electricity, which is € 8.00 a month); € 3.50 -7.00 of fish food per month; and € 5.50 – 7.00 of seeds and potting media per month for an operational cost of € 20 a month.

The system will produce 100 – 200 kg of vegetables and 15-20 kg of fish per month, depending on what varieties of vegetables you grow, how much attention you pay to them, and how much sunlight you get in your location.

Assuming you would have to pay at least € 8 per kg for organic produce, that means you will be producing between € 800 – € 1600 of high-quality food per month with the system. Even at the low end of these numbers, **the system pays for itself within the first five months of operation**, not counting any value from the fish.

B. Technology 2: Smart Irrigation Control

Overview

Smart Irrigation Control technologies for irrigation have been developed to apply irrigation to the landscape based on plant water needs while conserving increasingly limited water resources. One such technology (Rachio 3) uses weather information, wireless communication and apps to create a simple-to-use irrigation controller for crop farmers.

Availability

Available to order online[10].

Technical Specifications (Specification Sheets)

Rachio 3	
In the box	Rachio 3 Smart Sprinkler Controller Power supply with 6-ft cord Mounting hardware Quick start guide
App compatibility	iOS 10.3+ Android 4.4+ Required to connect the controller to Wi-Fi. Web app available on most browsers.
Integrations	Works with: • Nest • Amazon Alexa • Apple HomeKit • The Google Assistant • IFTTT • Wink • Control4 • Nexia
Zones	8-zone and 16-zone models
Dimensions	9.1" x 5.5" x 1.4"
Weight	1.05lbs
Power requirements	Connected to the AC power adapter included. DC Transformers are not supported.
Power supply	External transformed (6ft cord – 2.1mm x 5.5mm female barrel plug)
Transformer input	120 VAC ~ 60Hz 300mA
Transformer output	24 VAC 1000mA
Zone output (24 VAC)	Compatible with 24 VAC Solenoids

[10] https://www.rachio.com/rachio-3/

Operating temperature	-4˚F to 140˚F
Wi-Fi connection	2.4 or 5 GHz wireless network signal available at the installation location
Sensors	• Rain sensor (wired & wireless normally closed sensors • Soil sensors (wired & wireless normally closed sensors) • Wired flow sensors
Wire terminals	Smart wire terminals sense which zones are active, and provide feedback if your irrigation system might have a problem
Master valve	Compatible with master valve, pump relay or indexing valve.
Warranty	2-year warranty
Power disruption	In the event of Wi-Fi outage or intermittency, the controller's memory retains the last saved schedule received from the Rachio cloud and maintains the schedule until an update can be downloaded.
Optional outdoor enclosure	Custom outdoor enclosure is available. Enclosure is weatherproof and allows for hardwiring.

Price

€210 (€300 with wireless flow meter)

Payback Period

Experts estimate that as much as 50 percent of water used in irrigation is wasted due to overwatering caused by inefficiencies in irrigation methods and systems (Watersense, US EPA). Irrigation control technologies can significantly reduce overwatering by applying water only when plants need it.

Traditional clock- or timer-based controllers adhere to pre-set schedules, which can lead to unnecessary watering, overwatering that damages vegetation, and other costly inefficiencies.
Smart controllers use local weather data to automatically adapt watering schedules to onsite conditions. Acting like a thermostat for your irrigation system, smart controllers tell the system when to turn on and off.

For a Maltese farm with a cultivated area of 1 hectare (10,000 m2 or 9 tumoli), growing fresh vegetables, the irrigation requirement is estimated at 9,000 m^3 per year[11].

[11] https://nso.gov.mt/en/News_Releases/Archived_News_Releases/Documents/2012/News2012_056.pdf

Going on the information that a Smart water controller can reduce water demand by 50%, the savings total 4500 m^3 of water a year. This equates to a monetary saving of € 900 - € 1125 a year (using a pumping cost of € 0.2 - €0.25 per cubic metre).

A smart controller coupled with a wireless flow meter (to provide data on actual water consumption and monitors and stops leaks) costs around €300. **So the payback is less than 1 year**.

C. TECHNOLOGY 3: BURIED IRRIGATION DIFFUSERS

Overview

Buried diffuser technology is a new technique for underground irrigation which can be used for trees (fruit trees, forest trees, ornamental trees) and shrubs, vegetables in fields and in greenhouses and plants in containers, pots or boxes. Evaporation is lowered to a minimum; this technology is also a solution for making use of surplus water in the rainy months.

Availability

Available on request.

Technical Specifications (Specification Sheets)

Buried irrigation is a new solution:

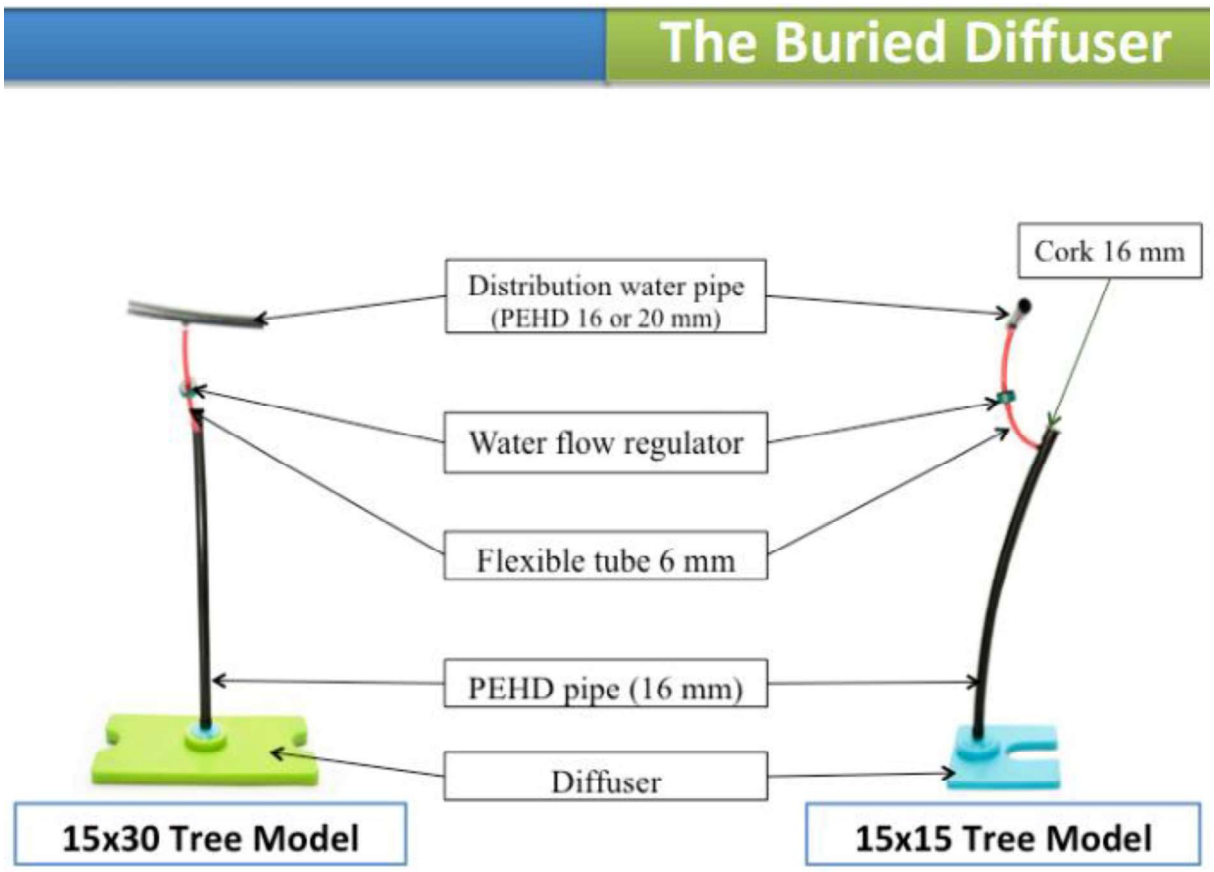
- to save irrigation water, energy, fertilizer, etc.
- 0% waste by evaporation
- 2 times less water than the drip irrigation
- 3 to 5 times more yield than drip irrigation
- very simple installation and use
- not expensive
- innovative with high commercial potential
- allows anticipated irrigation during the rain period and no irrigation during the dry period
- allows the injection and the conservation of water in the deep soil layers

This technology has been developed in Tunisia.

Components of the Buried Diffuser are:

- 1 diffusing part (15 x 15 or 15 x 30)
- 1 vertical 16mm connection pipe (50cm long)
- 1 water flow regulator (dosing emitter)
- 2 flexible pipes 5mm (5 till 7cm long each)
- 1 cork 16mm
- 1 gasket 5mm
- 2 connectors 5mm
- 1 connector 16mm

These components can be seen in the image below.



Price

€3.50 per diffuser

Payback Period: Example based on citrus trees cultivated in Malta

For a Maltese farm, cultivating an area of 1 hectare (10,000 m2 or 9 tumoli) with citrus fruit trees, the irrigation requirement is estimated at 319 m3 per year.

Assuming that the trees are grown 3 metres apart. This means that in an area of 1 hectare, a farmer can grow 1000 trees. One diffuser is required per tree, so the number of diffusers is 1000, at a capital cost of €3500 (based on unit price of €3.50) or €2000 (if ordered in bulk).
This technology uses only 30% of the water used in drip irrigation. The water savings (over drip irrigation) therefore amount to 223 m3 a year, for monetary savings of € 45 - € 56 a year (using a pumping cost of € 0.2 - € 0.25 per cubic metre).

The payback period is therefore between 62 to 78 years if based on the unit price of €3.50 (for small quantities), or 36 to 44 years if based on the unit price of €2.00.

D. TECHNOLOGY 4: PLANT COCOON

Overview

The plant cocoon is the ideal alternative for drip irrigation. The plant cocoon is made from polypropylene (plastic). It retains the irrigation water in the box within reach of the tree's roots, increasing the irrigation efficiency. The box can be reused.

Availability

Available to purchase online or by order[12].

Technical Specifications (Specification Sheets)

The plant cocoon allows for the growing of trees with 90% less water than drip irrigation.

Other benefits are:

- It is a cheap technology that costs approximately € 2.30 per planted tree (it can be used 10 as much as times)
- It is an organic way of growing, so the use of pesticides is close to nil
- The survival rate is average over 90%. Read the convincing reports of the University of Valladolid of a 5 year research program with 24,000 plant cocoons
- It is an ideal solution for urban city farming to grow vegetables with over 75% less water use
- The plant cocoon creates an incredible strong and deep penetrating root system.

The plant cocoon is made from polypropylene (plastic). The trees or shrubs that you plant with the plant cocoon only need the box for 9 to 12 months. This means that, due to the high quality of the box, you can use the box at least 10 times. You can plant in 10 years, 10 trees, shrubs or vegetables with 1 plant cocoon. Per year and per plant, the box would cost you €2.

Plant cocoon	
Size	47 x 25cm
Weight	1400g

The plant cocoon benefit package includes:

- 1 paper manual (if you want a free digital version, please click here);
- 10 plant cocoons (basins - green);
- 10 plant cocoons (covers - cream);
- 10 midplates (black);
- 10 caps (blue);
- 20 tubes (blue);
- 10 anti-evaporation covers (white);
- Included 10 Growsafes (to protect your tree/plant against animals. For more information, click here);

[12] https://www.groasis.com/shop/consumers/plant-trees-in-a-water-saving-way

- Included: 100 wicks.

Price

€20 for 1 in a pack of 10 (Total would be €200)

Payback Period

From studies carried out in Arizona, a young orange tree would need 10 litres per day on average, or 3650 litres per year13. The manufacturer of the Waterboxx claims 90% savings in water. That is, 3285 litres a year.

At a water cost of €0.2 - €0.25 per cubic metre, the savings amount to €0.66 - €0.82 a year. At a purchase cost of €2.00, **the payback period is 2.5 to 3.0 years**. The item has a lifetime of 10 years (10 regrowth's).

[13] https://extension.arizona.edu/sites/extension.arizona.edu/files/pubs/az1151.pdf

E. TECHNOLOGY 5: FACILITATING IRRIGATION WITH SALINE WATER

Overview

Facilitating irrigation with saline water. This technology ensures that the salts remain dissolved in water and those not absorbed by the plant are carried off below the rhizosphere. Salts are no longer crystallized in the soil pores and no longer inhibit the nutrition of the plant. This technology reduces water consumption up to 30% while improving yields and crop quality. It's a plug-and-play solution with minimal maintenance and negligible electricity consumption – less than a standard 10W lamp, with easy connection to solar panel arrays. This technology is considered to be particularly useful in Malta, where a number of wells are experiencing salinity problems.

Availability

Technical Specifications (Specification Sheets)

SYSTEM F-A 00[14]

The Aqua-4D® F-A 00 system is composed of:

- Command 30F
- TU 60G-A

Technical Data

Command 30F

Mechanical construction	
Dimensions	L x l x p: 161 x 126 x 62 mm
Weight	0.5kg
Housing material	Polycarbonate
TU 60 connector	Binder Serie 423, 4 poles, female
Protection index	IP 43

Power supply	
Supply voltage	100…240V-, 47…63 Hz
Power consumption	Max. 9W

Ambient conditions	
Ambient temperature	0…40˚C
Storage temperature	0…60˚C

[14] https://aqua4d-irrigation.com/wp-content/uploads/2018/11/MKT-DS-018-02-EN_Datasheet-Aqua-4D-F-A-00-A.pdf

Electromagnetic compatibility	Emissivity and immunity in accordance with IEC 61000-6-1 and IEC 61000-6-3
Surge protection	In accordance with IEC 61000-4-5
Relative humidity	0…95%, without condensation

TU 60G-A

Mechanical construction	
Length (between mating surfaces)	436mm
Max. external diameter	61mm
Connection	Threaded union nut G 1.5", female
Adapters	PVC 32mm, female coupling
Size rating	1" (DN 25)
Weight	1.7kg
Connecting cable length	150cm
Connector	Binder Serie 423, 4 poles, male
Maximum flow rate	60 L/min (3.6m³/h, 1l/s)
Nominal pressure	PN16

Ambient conditions	
Protection index	IP 65
Ambient temperature	0…50°C
Storage temperature	0…60°C
Installation temperature	10…50 °C

Materials and authorisations	
Material	PVC-U

Water temperature	**Maximum pressure**
20 °C	16 bar, 232 psi
40 °C	10.3 bar, 149 psi
60 °C	4 bar, 58 psi

SYSTEM F-A PRO[15]

The F-A 00 system is composed of:

- Command F Pro
- TU 360G-A + TU 60G-A

[15] https://aqua4d-irrigation.com/wp-content/uploads/2018/11/MKT-DS-018-02-EN_Datasheet-Aqua-4D-F-A-Pro.pdf

Technical Data

Command F PRO

Mechanical construction	
Dimensions	L x W x D: 264 x 154 x 96 mm
Weight	1.5-2.1kg (depending on configuration)
Housing material	Polycarbonate
TU 360 connector(s)	Binder Serie 423, 4 poles, female
TU 60 connector(s)	Binder Serie 423, 4 poles, female
Synchronisation connectors	Binder Serie 423, 4 poles, male
Alarm report connector	Binder Serie 423, 4 poles, male

Power supply	
Supply voltage	100…240V-, 47…63 Hz
Power consumption	Max. 50W

Ambient conditions	
Protection index	IP 65
Ambient temperature	0…45°C
Storage temperature	-25…60°C
Electromagnetic compatibility	Emissivity and immunity in accordance with IEC 61000-6-1 and IEC 61000-6-3
Surge protection	In accordance with IEC 61000-4-5
Relative humidity	0…95%, without condensation

TU 360G-A + TU 60G-A

Mechanical construction TU 360G-A	
Length (between mating surfaces)	804mm
Max. external diameter	104mm
Connection	Threaded union nut G, 2 3/4", female
Adapters	BSP threaded, 2" female coupling
Size rating	2" (DN 50)
Weight	6.6kg
Connecting cable length	280cm
Connector	Binder Serie 423, 5 poles, male
Maximum flow rate	360 L/min (21.6m³/h, 6l/s)
Nominal pressure	PN16

Mechanical construction TU 60G-A	
Length (between mating surfaces)	436mm
Max. external diameter	61mm
Connection	Threaded union nut G 1.5", female
Adapters	PVC 32mm, female coupling
Size rating	1" (DN 25)
Weight	1.7kg
Connecting cable length	150cm
Connector	Binder Serie 423, 4 poles, male
Maximum flow rate	60 L/min (3.6m³/h, 1l/s)
Nominal pressure	PN16

Ambient conditions	
Protection index	IP 65
Ambient temperature	0…50˚C
Storage temperature	0…60˚C
Installation temperature	10…50 ˚C

Materials and authorisations	
Material	PVC-U

Water temperature	Maximum pressure
20 ˚C	16 bar, 232 psi
40 ˚C	10.3 bar, 149 psi
60 ˚C	4 bar, 58 psi

Price

€3050

Payback Period

For a Maltese farm, cultivating an area of 1 hectare (10,000 m2 or 9 tumoli) with fresh vegetables in greenhouses, the irrigation requirement is estimated at 11,600 m3 per hectare per year (average of 10,813 and 12,350m3/ha/year)16.

[16] https://nso.gov.mt/en/News_Releases/Archived_News_Releases/Documents/2012/News2012_056.pdf

The manufacturers of the technology claim that the product can reduce water consumption by 30%. This equates to a water saving of 3,480 m3 a year, which at a groundwater pumping cost of €0.2 - €0.25 per cubic metre results in a monetary saving of €700 - €870 a year. The cost of the unit rated at 3.6 m3/hr is €3050. At this purchase cost, **payback works out at 3.5 to 4.5 years**.

For greenhouses cultivating flowers, where the water requirement is higher at 18,460 m3/ha/year, the water savings are calculated at 5540 m3/year for monetary savings of €1100 – 1400 a year, and **an improved payback of 2.2 - 2.7 years**.

EWA/CFT/6/2018 – Market Research on Water Demand Management Technologies

Activity 3 – Draft

Date: 05/05/2020

Author: Ramon Muscat

Version: 1

Contents

1. Executive Summary

This report presents the findings of endeavours undertaken as part of **Activity 3** that consisted of the collation of feedback on the identified technologies (that formed an integral part of Activities 1 and 2) by the different stakeholders. Various activities were undertaken to collate feedback as identified here below.

It was deemed opportune to analyse both technologies identified under Activity 1 and Activity 2 (not solely Activity 2), as preliminary research evidenced that certain technologies under Activity 1 were deemed to be of relevance and indeed more enticing that certain technologies identified under Activity 2. We thus sought a holistic approach to collate a more accurate picture (comprising all technologies) that would also assist in the drawing up of Activity 4 that form part of the overall project deliverable.

Focus groups

Focus groups were carried out for the residential, tourism and agriculture sectors.

Residential - 2 focus groups were conducted. EMCS sought to have between 8 to 10 participants for each focus group. A total of 9 and 8 individuals participated in the sessions. Furthermore, in the planning stage, EMCS ensured that the participants of each session comprised individuals of different age groups, levels of educations and regions. This was done to provide a representation, in so far as possible, that was similar to the local population.

Both focus groups were held at the EMCS Ltd premises and participants were provided with beverages and some snacks.

Tourism - 1 focus group session was conducted at EMCS premises. A total of 12 entities were contacted, of which 7 turned up on the day. Participants were provided with beverages and some snacks.

Agriculture - 1 focus group was conducted. This session was carried out at the Mgarr Farmers Association premises, to facilitate participation of the target audience. A total of 8 farmers attended this session

On average each session lasted 90 min.

Attendance for each focus group was taken and photographic evidence was also documented.

Face-to-face and email

Face to face meetings and email correspondence where used for the industry sector, the suppliers, plumbers and architects. These methods were opted for once attendance for the focus group sessions was not

forthcoming. Such methods enabled us to facilitate matters for the target audiences and collate the necessary feedback on the technologies under review.

Face-to-face - The face to face meetings were held at the premise of the participant. On average each session lasted 60 minutes. A total of 8 entities/individuals were targeted through this medium.

Email - To ensure that all options were sought to collate the necessary feedback, the target audience was also asked whether they would be willing to assist remotely, through the exchange of emails. This medium proved particularly useful following the COVID-19 outbreak. In total 26 entities were contacted through this method, with 7 providing feedback by the time this report was finalised.

This method involved a number of email exchanges to collate feedback on the technologies and also answer any queries the participants had on one or more technologies.

Annexed to this document are the attendance sheets and images of the focus groups.

2. Methodology

2.1 Brief

This report relates to Activity 3 of the tender – ***Tender for Market Research on water demand management technologies (Ref Number: EWA/CFT/6/2018***. In total this Project comprises 5 Activities:

- Activity 1 – Assess current market penetration
- Activity 2 – Water-saving technologies
- Activity 3 – Consultation meetings
- Activity 4 – Applicability Matrix
- Activity 5 – Dissemination of Results

Activity 3 revolved around several consultation sessions with the main water using stakeholders. In line with the tender document stakeholders were broadly segmented into the following categories:

I. Residential;

II. Industrial;

III. Agriculture; and

IV. Tourism

In this respect, the aim of such Activity revolved around collating feedback from stakeholders on the water-saving technologies identified in the previous Activities.

EMCS was responsible for identifying and selecting participants. Participants comprised a mix of males and females and included different age groups and varying levels of education. Furthermore, both focus group sessions incorporated individuals from all 6 regions of the Maltese islands as per National Statistics Office (NSO) classification (these being: Southern Harbour region, Northern Harbour region, South Eastern region, Western region, Northern region and Gozo). Both focus group sessions were organised at EMCS offices.

The presentations that were used for the distinct consultations and the flow of questions utilised are attached as Annexes to this report.

The list of attendees and photos taken during the focus group sessions are also incorporated as an Annex to this report.

3. Results

3.1 Residential

3.1.1 Set up & organisation

In line with the tender document, a total of 2 focus groups were organised. In total 17 persons attended (9 for the first focus group and 8 for the second). Individuals ages varied from 22 to 70 and comprised a wide array of occupations including pensioners, housewives, individuals involved in clerical work, elementary occupations as well as those in a managerial role.

Furthermore, the education background of participants was quite varied and had at one end those that had acquired an MSc degree and at the other end, participants that had completed secondary schooling.

A review of the location of residence of participants evidences that these came from the various distinct regions comprising the Maltese islands[1].

3.1.2 Findings

The results presented here below are broadly segmented into:

- Feedback on currently available technologies - as per technologies identified under Activity 1
- Feedback from potential technologies currently not available on the island - as per technologies identified under Activity 2
- Concluding remarks

FEEDBACK ON CURRENTLY AVAILABLE TECHNOLOGIES

Technology 1 - Restrictors for showers

All participants viewed this product positively, both in terms of cost outlay and the likelihood of investing in such technology. The participants of both focus groups, irrespective of their age, gender or location of residence, were in accord that an investment of under €10 and a payback period of under 2 months was "worth it".

[1] as per NSO classification

Technology 2 - Water-saving shower head

All respondents perceived this technology positively. They all agreed that the price tag was favourable and would entice households to invest in such technology. That said, some respondents commented that their likelihood of investment was dependent on the style of the showerhead. From the discussions that pursued, it transpired that for some, the showerhead style was a primary factor taken into consideration when it came choosing a showerhead.

Technology 3 - Kitchen tap aerators

This product had mixed views from the participants. While most appreciated the concept of this technology, numerous participants from both residential focus groups had an issue with the design of the product presented. From the discussions that ensued it became evident that for the majority of the participants, the tap style was an important aspect that was taken into consideration when determining the most apt kitchen tap. Among the comments voiced in relation to this technology was the importance of making sure the filter was always clean. Furthermore, there was consensus among one focus group, that such technology would lose its effectiveness if households washed the plates by filling up the sink.

Technology 4 - Re-using brine from domestic ROs

Only 2 participants from the 19 attendees indicated having an RO system. 1 in the first focus group and the other in the second. A discussion on the technology evidenced that one participant that had invested in a domestic RO had done nothing with the wastewater from the RO system. Investing further to re-use the wastewater by product was seen to be a hassle. The other participant that had already invested in a RO had positive view on the technology. He indicated that he did invest in a larger tank to make sure the wastewater collated would be well diluted and avoid any potential adversities. Overall, this technology attained mixed reviews.

Technology 5 - Rainwater harvesting system

In total 6 participants indicated having a well. From the discussion that ensued it transpired that the vast majority (5) actively used the well water either for watering of plants, washing of floors or similar. One participant also used this water for showering.

Negative comments voiced (particular in comparison with the previous technologies discussed) were:

- One has to think in advance if the well water is to be used for flushing and/ or other utilities.
- Nowadays people live in flats so this technology was not viewed to not apply to such target audience.

Some commented that for dwellings to embark on such technology it was best to be compulsory.

FEEDBACK ON POTENTIALLY AVAILABLE TECHNOLOGIES

Technology 1 - Flood check

Both focus groups had mixed feelings with regards to this technology. The main issues highlighted related to:

The cost of this technology. The main argument being that not enough claims happen due to floods and it, therefore, might not be feasible to invest in such a technology.

Scepticism on its effectiveness. Some participants were unconvinced this technology would catch a tap being left open for a while. Of all participants the elder age groups (55 and over) were more risk-averse and consequently favourable to this technology.

Technology 2 - Greywater recycling home system

Overall this technology was not viewed to too positively. As a general comment, participants found this technology to be too bulky, especially when taking note of today's smaller dwellings. The price of the technology was another common issue voiced across the two focus groups. On the topic participants (particularly from 1 group) were of the opinion that the quantity of grey water that would be recycled would not justify such an investment in their household.

One participant noted that this technology could potentially be an option for a small community/ building block.

Overall, none of the participants were interested in this technology.

Technology 3 - Water recycling shower

Participants had positive views on the concept of this technology. Nonetheless, overall they felt that the price was exorbitant. Indeed, in the discussions that ensued it became evident the price was a primary factor that would discourage them from purchasing such a technology.

Other adverse comments voiced related to whether the recycled water would be potable (or whether in fact it was hazardous) - this was of concern primarily for participants with kid/s. Another issue voiced was that this technology required forward planning and was not a technology that could be retrofitted into an existent bathroom.

Technology 4 - Very efficient water-saving (front-loading) washing machines

In view of the technology under review, the moderator sought to attain a better understanding of how old participants' washing machines were. On average half the participants (both focus groups together) had their washing machine for 4 years or more, while the rest had relatively new washing machines (had purchased one

two years ago or more recently). Among the former, there were a number that had their washing machine for over 6 years.

When determining the primary factors considered when opting for one washing machine as opposed to another, the two factors that attained highest responses related to:

- The brand
- Electrical saving classification

From the discussions it transpired that water saving was not a primary decision-making factor in the purchase process. That said, a number of participants would consider the water savings if there existed some form of classification (similar to what exists for electricity).

Technology 5 - Water pebble

This technology was viewed very positively for families with children. Participants were in accord that this technology was a fun and educational tool that could instigate kids to become more conscious of their water usage patterns. While agreeing in principle to such comments, some participants indicated commented that such technology would be ineffective with older children since they were likely not to take heed of the lights and continue to shower (since the technology does not physically stop the water flow) but only gives a warning light. In this respect, one participant noted that an annoying sound could possibly be more effective in having someone stop showering.

CONCLUDING REMARKS

Overall, opinions on the technologies were similar for both groups. The most favoured technologies for the currently available technologies were:

- Restrictors for showers and
- Water-saving showerhead.

The primary advantage of these technologies being that they could be retrofitted and did not require a considerable investment, while still making a difference in terms of water efficiency.

A look at the technologies that are currently not available on the market highlighted that the one that attained the highest positive response was the water-saving washing machine. The primary factors in this regard being that this item is found in the majority of households and is a technology that is constantly being used, therefore the water-savings are likely to be high.

3.2 Tourism

3.2.1 Set up & organisation

In line with the tender document, 1 focus group was organised. In total 7 persons attended[2]. Individuals comprised maintenance managers and operation managers.

3.2.2 Findings

The results presented here below are broadly segmented into:

- Feedback on currently available technologies - as per technologies identified under Activity 1
- Feedback from potential technologies currently not available on the island - as per technologies identified under Activity 2
- Concluding remarks

FEEDBACK ON CURRENTLY AVAILABLE TECHNOLOGIES

Technology 1 - Industrial water-saving dishwashers and pre-rinse spray valve

Overall participants showed interested in this technology and there was consensus among this target audience that water wastage for cleaning the dishes was considerable and indeed a considerable cost to their organisations.

When discussing the payback period, some participants were sceptical that the technology under review could attain the results indicated[3]. Others found the technology to be interesting, realistic and achievable.

Technology 2 - Water-saving industrial washing machines

Overall, participants had neutral views on this technology. Reason being that participants noted that the majority of hotels tended to subcontract the bulk of their laundry to third parties.

From the discussions there were mixed views and opinions as to the amount of water used per kilogramme of fabric cleaned in old washers when compared to new ones.

[2] Numerous entities were contacted. A total of 9 confirmed attendance and 7 eventually turned up on the day
[3] Following the focus group session, we carried out further clarifications and internal discussions/workings. All focus group participants were once again contacted via email with confirmation that the presented figures were correct.

Technology 3 - Pressure regulating valves

Overall this technology did not attain positive reviews.

One participant indicated that his entity had experienced issues with this technology. Elaborating further, the participant mentioned that this technology was installed in their hotel, however they had considerable issues as they realised that they jammed up over time causing issues to the water supply. The hotel then took the decision to remove all pressure regulating valves. The participant views such a decision positively as the entity does not have any more issues with water supply.

A number of participants mentioned that they prefer inverters to the technology under review to carry out the same function .

Technology 4 - Swimming pool evaporation rates

From the onset it was noted that this technology was not relevant to all participants and targeted specifically entities with large swimming pools.

Overall, participants did not have a good reaction to this technology.

Some participants noted that while they had never used this technology, they had heard negative reviews in that there was no effect on the evaporation rate. As a consequence, there was consensus among all that had swimming pools that this technology was not something that they would invest in.

When discussing this technology one participant mentioned the consequence it may have on the hotel's image if a guest happens to be allergic to this product. The general view among all those present was that the tourism sector would not be willing to take this risk.

Technology 5 - Greywater recycling

Overall participants held the opinion that this technology was primarily useful for entities that were still in the planning/ construction phase. On this issue, there was consensus that one had to prepare for this technology, as it required advanced planning and specific piping to function. Some other concerns voiced related to whther an establishment would need to employ a chemist or a person who understood how to regulate the system, as that would be an additional cost that the entity (hotel) might not be willing to fork out. On the topic, the participants agreed that it would seem more feasible if a pipeline was constructed by the government who would supply all hotels with 2nd class water (similar to what is being done with the agriculture industry).

FEEDBACK ON POTENTIALLY AVAILABLE TECHNOLOGIES

Technology 1 - Device providing real-time information

When presented with this technology the participants' instant reaction was that, in their view, the majority of guests would not be bothered about the amount of water they were using. From the discussion that ensued, there was consensus among participants that overall, guests would not be bothered as they felt that they were paying for their stay (and this was not cheap for certain hotel night stays) and therefore, such sum 'enabled' them to use as much water as they felt necessary and should not limit them in any way.

Technology 2 - Hot water control system

Overall, this technology did not attain positive reviews from participants, with only 1 participant indicating an interest in this technology. The general feedback being that if the shaft was relatively close enough to the shower one would not have an issue. Therefore, the amount of water wasted would be minimal and therefore it would not be worth it for the hotel to invest in such a technology.

Technology 3 - Smart Wi-Fi water sensor

When presented with this technology, the participants showed considerable interest in the concept of this technology That said, some participants became doubtful when they became aware of the price to purchase such a technology, with the low price being perceived to indicate an inferior quality technology that would not live up to its claims. Participants felt that it was "too good to be true".

Technology 4 - Nozzle dual flow pro technology

A common opinion shared by all participants on this product was that they/ the entities they worked with had already invested in a technology that provided the same benefits as this technology, by investing in tap aerators. The participants were in accord that this technology was probably more ideal for a home more than it was for an accommodation establishment.

The majority of participants also indicated that in het common areas of their respective establishments the technology of their hand mixers comprised a sensor. It was argued that this system was highly beneficial as less water was wasted and the possibility of leaving a tap open was eliminated.

Technology 5 - Activated filter media

The majority of participants indicated that they generally used sand that would have to be changed every five years (on average).

On discussing the technology under review, the initial feedback was overall positive. That said, one participant was concerned should there be a malfunction that resulted in pieces of glass (that formed an integral part of this technology) ending up in the pool as this could be hazardous. On highlighting such possibility, other participants positive outlook on the product diminished with the general comment being that customers' health and safety was of paramount importance and that any potential shortcomings of the technology would by far outweigh the potential benefits of water savings from the technology. Consequently, it was not risking (and investing in such technology).

CONCLUDING REMARKS

Overall, among current technologies currently available on the market, technology 1 - Industrial water-saving dishwashers and pre-rinse spray valve attained the highest positive response.

A review of the technologies that are currently not available evidenced that Technology 3 - Smart Wi-Fi water sensor attained the highest positive response. That said the 'cheap' price did raise a few eyebrows as to its realistic effectiveness.

Technology 5 - Activated filter media also attain positive reviews, though this was primarily targeting establishments with large swimming pools. Furthermore, one would need to confirm that this technology did not pose a health and safety risk.

Additional points that were mentioned throughout the focus group (though they did not directly relate to the technologies).

- The participants mentioned that it would be opportune for the water corporation to employ someone who worked in the tourism field. Their argument being that such a stance would enable the corporation to better understand the sector's requirements and consequently be able to assist them more.
- There was consensus among all participants that, by and large, the majority of guests were not aware of the amount of water that they used when staying in a hotel. The general feeling being that guests (and people in general) are more aware/ conscious of saving electricity than about saving water.
- The participants who had areas with landscaping mentioned that landscaping could end up utilising a considerable amount of water. Consequently, they also had to take into consideration certain landscaping technologies to minimise water costs.

- It is also important in educating the people who will have the final say, as the majority look into making a profit and therefore certain long-term saving technologies are immediately written off.
- It is a constant battle in trying to educate the employees' mentality as that is something that needs to change.

3.3 Agriculture

3.3.1 Set up & organisation

1 focus group was organised. In total 8 persons attended. The participants' ages varied and comprised both younger aged participants and more experienced ones.

In view of the difficulties encountered to conduct a second focus group, feedback was also collated from individual farmers.

3.3.2 Findings

The results presented here below are broadly segmented into:

- Feedback[4] on currently available technologies - as per technologies identified under Activity 1
- Feedback[4] from potential technologies currently not available on the island - as per technologies identified under Activity 2
- Concluding remarks

FEEDBACK ON CURRENTLY AVAILABLE TECHNOLOGIES

Technology 1 - Hydroponics

The majority of the participants heard about this technology but none of them had it set up. Some participants mentioned that the water that one would need had to be very good. Elaborating further mon this issue it was noted that a RO might be required, which would be an extra expense.

Some participants noted that they had heard an expert stating that a hydroponics system should be their last resort and that a they should only invest in such a technology if they have bad soil.

Another point that was mentioned was that during the summer the water warms up and this in turn damages the roots of the plant.

One farmer noted that with such a technology one had to be very precise. This was viewed to be of concern as it was deemed easy to make mistakes. The same farmer noted that a mistake would adversely affect the whole production process and thus the consequences would be devastating to the farmer.

[4] Feedback collated from the focus group and individual correspondence are collated and presented together

Technology 2 - Soil moisture controller

Some farmers indicated to have heard about such a technology.

From the discussions, one farmer noted that he had heard positive comments about this technology.

Overall, the majority of farmers that participated in this study found the price to be fair. That said, some did question what sort of maintenance (and consequent costs) would be required.

Technology 3 - Rain sensors

Farmers deemed this technology to be similar to a tensiometer.

Overall feedback from the farmers was positive, with all showing and interest in this technology. That said, from the discussions it transpired that it would be important for the technology to provide an element of flexibility. In this respect farmers commented the need for them to be able to programme the technology dependent on the product they were growing as different products required different amounts of water.

Technology 4 - Use of New Water

Overall, farmers expressed positive views on the new water. From the discussion farmers tended to agree that, while on the one hand it is good water, they noted that it was not apt to use only new water for their produce. The general comment here being that new water did not contain all the necessary nutrients.

Furthermore, though they had positive views on the actual water there were negative views on its distribution. A number of farmers mentioned that supply was limited, and some of their colleagues did not give due consideration to this and pumped up excessive amounts that left others with nothing. Another comment voiced in relation to supply was that there was a of 2 months period where there was no new water due to faults. Consequently, one could not rely exclusively on new water. The general view overall being that system in place for taking the water needed to be reviewed and upgraded.

Technology 5 - Using water-efficient varieties of crops

The farmers were in accord and emphasised that they were conscious and careful when it came to the crops they planted. They noted that this was paramount as at the end of the day they had to pay water and electricity bills.

Another point raised with respect to the choice of crops was that their choice was dependent on the market. Farmers ultimately sought to produce crops that were going to sell. It was ultimately the consumer who dictated on which products they were to focus on.

FEEDBACK ON POTENTIALLY AVAILABLE TECHNOLOGIES

Technology 1 - Aquaponics

All the farmers participating in this study barring one were not interested in this type of technology. The primary issue voiced related to the complexity and the newness of this technology. From the discussions farmers' resistance to change transpired with the farmers finding it difficult to change their systems of watering and feeding their crops.

The farmer that showed interest in the technology understood that there needs to be an element of acceptance towards changing the way crops are grown and was not disheartened by the need to learn and adapt.

Technology 2 - Smart irrigation control

Several points were raised by the participants when they reviewed this technology.

A primary point raised that although technology was viewed to positively with farmers appreciating its benefits, they felt that it was not feasible to rely exclusively on the technology. The general comment being that farmers know their land and know when an area needs watering and how much is needed. It was felt that technology could never replace such knowledge.

On the topic, one farmer indicated that he knew 3 people who had cow farms and had a similar technology in place. The farmer noted that 2 of the 3 farms had opted to get rid of the technology as it was not working for the better for them and preferred to revert back notwithstanding the investment that had been made.

Technology 3 - Buried irrigation diffusers

Overall, participants felt that this technology would be more suited for people growing trees.

As the discussions carried on, participants noted another factor that limited the effectiveness of this technology. There was general consensus that there was a realistic possibility that the roots would end up damaging the technology (as the roots tend to grow towards where the water is being dispensed from).

Technology 4 - Plant cocoon

The participants had an issue with the technology as it is made of plastic and therefore, they might not be available in some years. The participants were informed that biodegradable ones were also available, but they were still not convinced by this product.

Technology 5 - Facilitating irrigation with saline water

When discussing this technology, a number of participating farmers questioned why a technology to use saline water was being suggested rather than have a strategy in place to collate and use rainwater rather than have rainwater flow into the sea. The general feeling was that it was opportune that the responsible entity/ies first seek to save the rainwater and subsequently look into these technologies. On this topic, one farmer expressed his concern at the rate of construction that was going on noting that "if the land is going to be covered by concrete how can one expect the water table to be replenished if the water cannot pass through".

CONCLUDING REMARKS

Overall the participants agreed that their favourite technologies from the ones available locally were the soil moisture controller and the new water. With regard to the second set of technologies, views were varied with no specific technology standing out. Overall farmers were sceptical as to how ideal such technologies were for the Maltese farmer.

Other comments noted:

- A number of farmers are now using peat bags. Some of the farmers did not like this concept but others found them to be beneficial and helping their production.
- The participants mentioned and stressed on the importance of not allowing the rainwater to go to waste into the sea. They noted that it was imperative to finds ways to save and store this water to replenish the water table.

3.4 Industries

3.4.1 Set up & organisation

This group of participants were spoken to on a one-to-one basis. The primary reasons for opting for this approach related to a) difficulty in instigating companies to attend a meeting, b) inability to meet up following the restrictions imposed due to the COVID-19 outbreak. The researchers contacted the companies via email. The researchers provided the companies with the technologies under review and sough to get their feedback on them.

A total of 24 were contacted with 5 companies giving their feedback by the time of writing of this report. The sectors these companies operate in are:

- The financial sector
- The health sector
- Automobile industry
- Beverage company
- Nursing and residential care

3.4.2 Findings

The results presented here below are broadly segmented into:

- Feedback on currently available technologies - as per technologies identified under Activity 1
- Feedback from potential technologies currently not available on the island - as per technologies identified under Activity 2
- Concluding remarks

FEEDBACK ON CURRENTLY AVAILABLE TECHNOLOGIES

Technology 1 - Flushing toilets with manual stop

None of the participants had this technology installed. From the feedback collected it transpired that in most instances, entities had opted for dual flush toilets (technology 2) instead. Overall there was consensus that to reap the benefits of such a technology, employees needed to be made aware of its benefits and understand its function to save water.

Technology 2 - Dual flush toilets

All 5 participants indicated having this technology installed within their respective companies. From the feedback collected it is evident that an element of education is needed to reap maximum benefit from this technology. In this respect, three of the participants shared a similar experience in needing to make their employees aware of how to use the technology to save water. One participant noted that the company found it particularly hard to educate its clients that fall primarily within the elderly category.

A positive comment voiced on this technology was that it could be retrofitted.

Technology 3 - Technologies that displace water in the flushing cistern

For all the participants, barring one, this technology was not useful to them. Main reasons being because the toilet cistern was concealed or because the toilet cisterns were new and did not require such a technology installed. One company noted that it had experience with this technology and found that it did not receive the desired results. The primary comment being that there was nothing stopping them from flushing again, and in so doing defeat the whole purpose of the technology.

Technology 4 - Eco-timer for faucets on wash hand basins

Some participants noted that they had this technology installed it in certain areas of their business though not in all the areas. Overall comments and views were positive, with participants noting that this technology was useful in the common areas. This view was shared amongst all the participants.

Technology 5 - Collection of air-conditioner condensate for landscaping/toilet flushing

Not all participants had such a technology installed though the overall view of this technology was positive. Companies identified different uses for this water. One company collected this water and mixed it with the harvested rainwater to then use for flushing and irrigation. Another company gathered this water and used it for steam in some of their operating processes. Another company used this water mixed with the rainwater that they collect to wash cars.

FEEDBACK ON POTENTIALLY AVAILABLE TECHNOLOGIES

Technology 1 - Toilet with Integrates Wash Hand Basin

The companies reviewing the technologies had mixed views about this technology.

A point raised by some related to the technology's design. In this respect, one participant found that due to its design the technology could be messy and was therefore not practical. Another participant noted that the idea

was innovative though the design would need to be revisited. One participant found that it would not be hygienic enough for their facilities.

Technology 2 - Shower Start Device for Public Showers

This technology had positive views from all the participants. That said, some did point out that in their view this technology would only be viable if it was used for the showers of the employees (and not their residence).

Technology 3 - Recyclable plastic beads for Commercial Laundries

This technology did not apply to all the participants.

Overall, companies could/ would consider this technology if their washing machines had to be changed. Nonetheless, the general feeling being that unless their current washing machine needed replacement, it would not be worth the expense.

One other participant indicated that this technology would not be considered by his entity. The participant explained that (in his view) such a technology would not clean the linen well enough for the standards their company had to meet.

Technology 4 - Car Wash Recycling Systems

N/A. None of the participants found that this technology would be useful to them.

Technology 5 - Waterless Urinals

The views on this technology were mixed. Some of the participants found it to be innovative and to be a useful technology whereas some other found that it was not hygienic enough.

An issue voiced by one related to their company having a communal bathroom at their workplace. Such an investment would only be practical should they have toilets that segregated genders.

CONCLUDING REMARKS

Participants were overall familiar with the currently, locally available technologies, and a number of the them had some of these technologies installed. Overall, the most favourable technology from the ones already available on the local market related to the dual flush toilets - Technology 2.

On the other hand, most of the technologies analysed (except for technology 4) attained favourable views with none proving to be favoured more than others. The specifics of the entities sectors of activity with their distinct requirements and modus operandi likely to instigate preference for one technology as opposed to another.

3.5 Suppliers

3.5.1 Set up & organisation

This group of participants were contacted on a one-to-one basis or via correspondence. This was done as initial research evidenced that different suppliers have different types of customers that would not enable a meaningful discussion. Correspondence was opted for when certain suppliers found it difficult to set a date/time for a face-to-face meeting, this notwithstanding the researchers' flexibility to meet up when most convenient for them.

Every supplier was reviewed prior to the visit to know what technologies were most appropriate for them. The researchers provided the suppliers with the technologies to get their feedback on them.

In total 6 participated in this Activity.

3.5.2 Findings

The results presented here below are broadly segmented into:

- Feedback on the technologies for the residential sector. Further, split into currently available technologies - as per technologies identified under Activity 1 and potential technologies currently not available on the island - as per technologies identified under Activity 2
- Feedback on the technologies for the industry sector. Further, split into currently available technologies - as per technologies identified under Activity 1 and potential technologies currently not available on the island - as per technologies identified under Activity 2
- Feedback on the technologies for the agricultural sector. Further, split into currently available technologies - as per technologies identified under Activity 1 and potential technologies currently not available on the island - as per technologies identified under Activity 2
- Concluding remarks

Residential Sector

Feedback on currently available technologies

Technology 1 - Restrictors for showers

Some suppliers noted that they have this technology readily installed in their products.

It was noted that overall, residential owners do not ask for this product. Conversely, hotel owners give due consideration to this technology. On this topic, one supplier elaborated further and indicated that overall people are not aware of such technology. They therefore promote the effectiveness of such technology in their store, where a video is regularly played on their store screens to educate the public and show how much water could be saved.

Adverse comments on this technology related to:

One other participant indicated that this technology tends to clog up very easily. It was also noted that although restrictors can easily be cleaned, people tend to find it to be a hassle. The same supplier noted that instead of this technology he promoted a double step tap that allows for either a half flow or a full flow.

One supplier, who does not stock such a product, thought that the technology was somewhat expensive. Having said that, the same supplier did note that it is was a technology that could easily be implemented.

Technology 2 - Water-saving shower head

Overall, mixed reviews were collated.

Not all suppliers stocked this product. The main reasons for this being:

- Some felt that this technology was not apt for the Maltese water, as such technologies tend to clog up and cause issues for the customer.
- The stocking of substitute products such as restrictors.

A number of suppliers held the same opinion that due to a lack of awareness people do not ask for such products.

In line with the above, one supplier mentioned that it was primarily hoteliers that sought for such products. That said, it was also noted that an issue faced by the accommodation industry was that of finding a balance between good pressure and water saving.

Technology 3 - Kitchen tap aerators

One supplier of kitchen taps was not aware that this technology existed as he relied on his foreign supplier who had never informed him of such a technology. That said, the technology was viewed to positively, to the extent that the same supplier noted that he would be looking into the possibility of stocking them for his products.

One supplier was sceptical about this technology. In his view customers were unlikely to opt for such a technology as it was difficult to affix to distinct mixers. Elaborating further it was noted that customers tend to give primary importance to the ascetics of their kitchen rather than its functionality/ cost savings.

Once again, the general view among suppliers being that overall people are unaware of how much water they use. On this topic, a couple of suppliers held the same view - that the price of water would need to increase for people to act.

Technology 4 - Re-using brine from domestic ROs

The views received for this technology were opposing. One participant held a positive view on the technology as RO systems were becoming more popular, and therefore the purchase price for such technology was going down. Such a stance made the technology an opportune investment to save wastewater.

One supplier held the view that this technology could damage the Ros pump and lead to leaks. This particular supplier mentioned that if customers opt for this option the guarantee on the RO system is voided.

A €70 grant[5] was given to all those buying an RO.

Technology 5 - Rainwater harvesting system

The overall view on this technology was positive. Some argued that such a technology should be a must for all as the water can have so many uses. One other supplier mentioned that the government ought to provide both first- and second-class water to households. In this way it was available for all and everyone could make use of it.

Feedback on potentially available technologies

Technology 1 - Flood check

Overall comments were positive.

A good number of suppliers participating in the study held the view that this product was a very good initiative as it would be a preventative technology. There was consensus among this cluster of suppliers that the price would probably not adversely affect uptake. One supplier mentioned that insurance companies should suggest such a technology. On discussing this issue further, the supplier noted that there are certain investments that one makes that cost a lot more (than the technology under review) and are only used once.

[5] https://mfin.gov.mt/en/Services/Pages/Grants.aspx

One supplier held the view that this technology would probably only work on large leaks and therefore it might not be worth investing in.

Technology 2 - Greywater recycling home system

The main issue that was brought up by the majority of suppliers was that this technology is too large and too expensive for it to reach the masses.

Another issue raised related to its size, with several commenting that the technology was too large to fit in an apartment "someone would not want to spend so much money on a technology that is going to take up so much space".

One supplier mentioned that this idea would need to be put forward by the architects and designers as they have an influential role. This same supplier has seen such systems done through piping in upmarket households. The overall comment being that potentially, this technology could successfully target a niche segment.

Technology 3 - Water recycling shower

Overall, comments were not favourable for this technology.

One supplier mentioned that he would not promote a product like this and would rather promote a shower system that had a timer.

Another issue related to the price. In this respect two suppliers mentioned that such a product was too expensive for people to invest in. The design was another aspect mentioned that was likely to deter uptake. Furthermore, not being able to retrofit this technology was another issue raised.

Technology 4 - Very efficient water-saving (front-loading) washing machines

The issue of lack of awareness among the public was again voiced. On this issue, one supplier who specialises in selling washing machines explained that people do not seem to understand that one's clothes still get clean by using less water. The general perception among locals seems to be that clothes clean when a lot of water is being used.

On a similar point, it was noted that people lacked awareness as to the amount of detergent one had to use. On this topic, one supplier urged that it was very important for people to understand that putting more detergent increased the amount of water used (as more water would be needed to wash off the detergent). The end result being that households were wasting more electricity and water.

Technology 5 - Water pebble

There was consensus among suppliers that this product was very suitable for children.

There was agreement that such a technology was suitable for reducing the amount of water used as well as educating them on how to save and care for water. Elaborating further, one supplier suggested that it would be ideal to introduce in schools so that children do not waste water when washing their hands.

CONCLUDING REMARKS

Overall, a primary comment that stood out amongst all the suppliers for those in residential homes related to the lack of awareness of water saving amongst the population.

In terms of preferred technologies, there was not one that stood out. Opinions varied and primarily depended on the suppliers' target audiences (that were distinct and varied).

Furthermore, technologies that could be retrofitted were preferred as such technologies could consequently be targeted to all households. When technologies cannot be retrofitted there is the risk that people view it as a hassle and an extra cost thereby further hindering them from investing in such technology/ies.

INDUSTRIAL SECTOR

Feedback on currently available technologies

Technology 1 - Flushing toilets with manual stop

The general comment was that such products were brand dependant.

The main comment voiced being that people were highly unlikely to change their whole flushing system and it was likely to be seen as an extra cost that individuals were not willing to incur if their current one was still working.

One supplier commented that customers do not ask for this type of technology and therefore they do not supply it.

Technology 2: Dual flush toilets

Overall this technology was preferred to technology 1. It was pointed out that this technology had in fact become a standard in most flushing mechanisms. One supplier mentioned that it would be helpful to have a campaign indicating and informing people between the 2 flushes. This would aid in the intent of decreasing water consumption.

Technology 3: Technologies that displace water in the flushing cistern

Suppliers had limited knowledge of this technology.

On discussing the technology, one supplier stated that the mechanism would not work for a dual flush (as it cannot have less water). Queries raised related primarily to how often a technology like this would need to be changed, and whether frequent use (such as office toilets) would require the technology to be frequently changed.

Technology 4: Eco-timer for faucets on wash hand basins

All the suppliers participating in the study found this technology to be a very suitable option. Main points raised related to it being hygienic and that one saved on water. One supplier commented that although he had positive views on the technology, he does not stock it as it targets primarily hotels.

Noteworthy, the price of this technology seemed somewhat unrealistic for one supplier.

Technology 5: Collection of air-conditioner condensate for landscaping/toilet flushing

Overall comments were favourable. It was noted that nowadays nearly all working environments had air-conditioners installed due to Malta's hot summer climate. Furthermore, some noted that air conditioners waste a lot of water.

The general feeling being that this technology was an easy solution for people to adopt and in that way, save water.

Feedback on potentially available technologies

Technology 1: Toilet with integrated wash hand basin

This product did not have positive feedback.

The 2 main reasons voiced being:

1. The aesthetic
2. The discomfort one would experience when washing hands.

Consequently, suppliers felt that it was not a technology that people would purchase and therefore it would not be worth investing in.

Technology 2: Shower start device for public showers

The views and opinions on this product differed from one supplier to another.

Some suppliers preferred the idea of having a push-button shower with a timer rather than this technology. Others found the technology to be very interesting. That said, there was consensus that they needed more evidence as to its practicality/ efficiency.

Another supplier noted that if people had to enter a shower and find this technology, they would not know how to use it, though it could be a potentially good technology for hotels too.

Technology 3: Recyclable plastic beads for commercial laundries

One supplier provided most feedback on this technology. This supplier whose main business relates to the selling of washing machines did not view this technology positively. It was noted that the technology was a major shift from locals' current views and perceptions. Elaborating further the supplier argued that locals want to see water in their washing machines to know that their clothes are being properly cleaned.

Technology 4: Car wash recycling systems

N/A - No feedback was forthcoming on this technology.

Technology 5: Waterless urinals

Suppliers had mix views on this technology.

On the one hand there were those that were sceptical on how clean these waterless urinals would be. Such suppliers could not comprehend how urinals would remain clean if no water was being used.

On the other hand there were those that looked favourably at this technology. One supplier noted that he was aware that such a product existed because his foreign supplier had such a product in stock. The supplier showed interest and indicated that he would be looking into it and noted that potentially hotels could be a potential client of such technology. Another supplier mentioned that this technology would be suitable for bars.

CONCLUDING REMARKS

Overall there were mixed views for the various technologies under review. Some suppliers were sceptical about some technologies while others found the same technologies intriguing. The views on the above 10 technologies varied from one supplier to the other.

The feeling among suppliers was that numerous technologies currently available on the local market were already in installed in a number of hotels/commercial buildings. That said, the price of the technologies presented where overall not viewed to be a stumbling block and were deemed to be relatively easy to implement/ install and required very little infrastructural changes.

It was also noted that a number of the identified technologies also had a great potential to be transferred over into a residential/domestic setting, and a good number already have.

Overall, the general feeling was that different industries were always seeking to decrease their carbon footprint, whilst making financial savings. In this regard, for the industry, the water saving laundry and waterless urinals were viewed to have very good potential. On the domestic side, the Flood checker was also identified to potentially be very useful, and could be scaled up also to industrial and commercial applications for relatively minimal investment.

Most of these technologies ought to be explored further in relation to the distinct needs of each individual customer.

It was also noted that most of the identified technologies could potentially become industry standards in a few years' time.

TOURISM SECTOR

No feedback was forthcoming.

AGRICULTURAL SECTOR

Feedback on currently available technologies

Technology 1 - Hydroponics

It was noted that some farmers and some home users do make use of Hydroponics.

Technology 2 - Soil moisture controller

Those participating in the study noted that, to date, this technology was not really sought after. It was noted that this could be linked to customers not being aware of its benefits or of how it functioned.

Positive remarks for this technology related to it being very water-efficient especially when paired with drip irrigation and professionally installed.

Technology 3 - Rain sensors

Some suppliers import this technology with their irrigation systems.

It was noted that these systems are mainly used for turf irrigation and it is not common to find them on farms, to irrigate the fields. Once again this could be linked as farmers not being aware of the benefits or of how they derived from such technology. As with the previous technology, rain sensors are viewed to be very water-efficient especially when paired with drip irrigation.

Technology 4 - Use of New Water

This technology has gained ground among farmers.

Technology 5 - Using water-efficient varieties of crops

Feedback on this was limited as the suppliers participating in the study focused primarily on tools and machinery not crops.

Feedback on potentially available technologies

Technology 1 - Aquaponics

Suppliers had little feedback to provide on technologies they did not supply.

Technology 2 - Smart irrigation control

Suppliers had little feedback to provide on technologies they did not supply.

Technology 3 - Buried irrigation diffusers

The overall feedback was not positive. Main point raised in this regard being:

that this was not feasible for the agriculture industry. Elaborating further, the main issues voiced related to the technology being viewed to be a rather expensive system for a professional farmer as it has 16mm tubing suitable to be installed underground.

it was noted that this type of irrigation could be sold to the Government departments, landscaping companies, villas and gardens.

Technology 4 - Plant cocoon

No feedback was provided

Technology 5 - Facilitating irrigation with saline water

No feedback was provided.

CONCLUDING REMARKS

Overall, a controlled drip irrigation system when installed professionally with a controlled timer, solenoids and the proper drippers or drip pipes was deemed to be highly effective for the agriculture sector. That said it was noted that for this system to be 100% perfect one had to have it professionally designed to avoid any use of excess water. The same comments prevailed for the pop-up irrigation system for turf irrigation.

That said, the limited feedback collated on new technologies limits the potential weighting on the usefulness and effectiveness of all technologies under review.

3.6 Architects and Plumbers

3.6.1 Set up & organisation

With the unprecedented boom in construction, the target audiences are currently inundated with work. This made our endeavour in collating feedback for this activity arduous. In total 5 individuals participated in this study.

3.6.2 Findings

The results presented here below are broadly segmented into:

- Feedback on the technologies for the residential sector. Further, split into currently available technologies - as per technologies identified under Activity 1 and potential technologies currently not available on the island - as per technologies identified under Activity 2
- Feedback on the technologies for the industry sector. Further, split into currently available technologies - as per technologies identified under Activity 1 and potential technologies currently not available on the island - as per technologies identified under Activity 2
- Feedback on the technologies for the tourism sector. Further, split into currently available technologies - as per technologies identified under Activity 1 and potential technologies currently not available on the island - as per technologies identified under Activity 2
- Feedback on the technologies for the agricultural sector. Further, split into currently available technologies - as per technologies identified under Activity 1 and potential technologies currently not available on the island - as per technologies identified under Activity 2
- Concluding remarks

Residential Sector

Feedback on currently available technologies

Technology 1 - Restrictors for showers

Overall feedback received was positive. Some participants noted that they promote such technologies while others noted that they generally do not go into much detail. From their end plumbers noted that they generally are not involved in the decision-making process and install what the client purchases.

One plumber noted that he was under the impression that he has seen this technology selling for a lower price.

Technology 2 - Water-saving shower head

Once again, the feedback overall for this technology was positive. That said, comments were made that, among a segment of the target market, the design was considered to be of primary importance in their decision-making process.

From their end, some were sceptical to propose specific technologies as they feared that their clients could perceive this negatively and think that they were promoting a technology solely to get a commission. It was noted that in instances, such decisions were often left in the hands of the designer.

Another point raised related to the importance placed by the brand name in the decision-making process. Here one participant noted that his clients were influenced greatly by brand name/s.

Technology 3 - Kitchen tap aerators

Overall views on this technology were positive.

As the technology could be easily installed by the clients themselves with no previous experience in installations was viewed to positively.

The minimal investment required was also positively viewed.

Technology 4 - Re-using brine from domestic ROs

Overall, participants noted that it was not uncommon for them to propose water saving technologies (comprising this). That said, there were a multitude of endeavours one could embark upon to save water, that it was then up to the client to decide which to go for. That said, some architects did note that they had instigated their clients to take on such a technology.

It was also noted that this technology was rarely installed by the plumbers. The plumber mentioned that more often than not, it was generally the people who supplied the RO who were responsible to install the whole system.

When asked whether such a system could adversely affect the RO pump, feedback varied, though overall, participants did not think that this was the case. participants indicated that this was dependent on the number of floors it would need to pump up the water and the strength of the pump.

Technology 5 - Rainwater harvesting system

Overall comments were favourable, with the general feeling being that this approach was adopted in several houses. That said, it was also noted that such technology does not target all dwellings (such as flats/ apartments and similar). I

With respect to costings, one plumber noted that the cost was likely to exceed €200, as the pump alone generally cost €200.

Feedback on potentially available technologies

Technology 1 - Flood check

Mixed views were voiced about this technology. Some felt that peace of mind was viewed to positively, while others were sceptical as to its effectiveness. Ae plumber also queried whether the technology would work on the piping here in Malta since the piping used is not copper.

Technology 2 - Greywater recycling home system

Overall this technology was viewed positively and instigated interest.

It was noted that it was not the first time that they installed systems to recycle greywater, though this involved a thought process to install "… another set of piping is done to take the 'dirty' water to another tank and it is then used for flushing or landscaping".

There was consensus that such technology could potentially target a specific target audience - villa owners still in the construction phase.

Technology 3 - Water recycling shower

Participants had mixed views. Some felt that Technology 2 - Greywater recycling home system could possibly be more opportune, while others questioned the likeability of this technology (in terms of design).

One plumber indicated scepticism and mentioned that when a technology becomes very complex there are usually plumbing problems.

Among some, price was considered to be a deterrent to its successful penetration in the local market.

Technology 4 - Very efficient water-saving (front-loading) washing machines

Overall, participants were in accord that they were generally not involved and consequently had no influence in the purchase decision process of washing machines.

Technology 5 - Water pebble

Overall comments on this technology were positive. Participants found this innovative technology 'interesting' and likely to instigate curiosity among kids.

INDUSTRIAL SECTOR

Feedback on currently available technologies

Technology 1 - Flushing toilets with manual stop

Overall discussions on toilet flushing evidenced that this was not commonly installed. Furthermore, it was noted that other technologies (such as the duel flush) were more common and often installed.

Technology 2: Dual flush toilets

As indicated earlier, this was a commonly installed flushing. The general feeling being that this had become a norm, though participants were not convinced that such installations were done specifically for water serving purposes. A plumber, agreeing with this comment noted that it was only in rare occasions that an installed flushing system was not dual flush. In such instances they generally installed a single flush system.

Technology 3: Technologies that displace water in the flushing cistern

Overall comments were positive. Participants commented that the investment needed was minimal. The plumber industry commented that this technology could not be used for dual flush toilets as otherwise there would not be enough water available.

With respect to the amount of water displaced, some participants were sceptical as to how effective such a technology was in discarding of solids.

Technology 4: Eco-timer for faucets on wash hand basins

This technology attained mixed reviews. While some commented positively, others noted that there were other technologies - such as the use of sensors that were more effective.

A plumber mentioned that most commercial buildings had this technology installed. It was also noted that since this technology is a more complex it was more likely to have technical issues.

Technology 5: Collection of air-conditioner condensate for landscaping/toilet flushing

While viewing this technology positively, some participants queried the amount of water collected to make the investment worth the while.

It was also noted that one had to consider the possibility that not enough water was collected, if a flushing used exclusively this water.

Another concern raised was that such water was not necessarily appropriate to use the water for landscaping, as it could damage the plants.

Feedback on potentially available technologies

Technology 1: Toilet with integrated wash hand basin

In theory the concept was viewed to positively. That said, some noted that the design left much to be desired, and that there were more interesting models available, though aware that the price would increase. One participant did not view this technology positively indicating that he did not think it would be hygienic.

There was consensus among this group that this technology was opportune in those instances where space was an issue.

Technology 2: Shower start device for public showers

Mixed views were collected on this technology. Some participants were sceptical on its effectiveness. Furthermore, the general feeling was that such technology was unlikely to instigate interest.

Some participants had neutral views on this technology and were uncertain whether it was worth investing in/installing or not.

Technology 3: Recyclable plastic beads for commercial laundries

No feedback was collected on this technology.

Technology 4: Car wash recycling systems

No feedback was collected on this technology.

Technology 5: Waterless urinals

This technology was viewed to with interest.

One plumber indicated that such a technology had recently entered the local market. He too had personally fitted a few. The overall view was positive with the same plumber mentioning that they were viewed to positively. From the discussions, it was noted that this technology utilises a special filter which allows for cleaning.

CONCLUDING REMARKS

Overall architects indicated that they are in the front seat in instigating customers to invest in water saving technologies. That said, it was ultimately the client that decided.

From their end plumbers have limited say in the purchasing decision process of clients. They generally installed whatever the client requested/ purchased.

In terms of technologies - those that can be retrofitted were viewed to positively and the cost involved was deemed as opportune to instigate individuals to purchase.

Other additional comments

The need for a building regulation

One architect emphasised that a building regulation needed to be created that collated all. it was noted that the Chamber of Architects had put forward a framework[6]. This also included a section for a water conservation regulation.

Use of Tanks

We received mix views as to the usefulness of tanks. One architect was of the belief that tanks were no longer a necessity. On the other hand, another noted that tanks were important as they provided good pressure throughout the system and also where would the rainwater go to be reused.

Plumbing planning

Not all the target audience was involved in the planning stage of plumbing. It was also noted that when dealing with developers, value was not taken into consideration.

[6] A_Modern_Building_Construction_Regulation_Framework_for_Malta_FINAL.pdf

Plumbing code

The idea of having a plumbing code was viewed to positive as it would allow for consistency and standards maintained. It was noted that there should be a plumbing license in the same was as there is a licence for electrical installation.

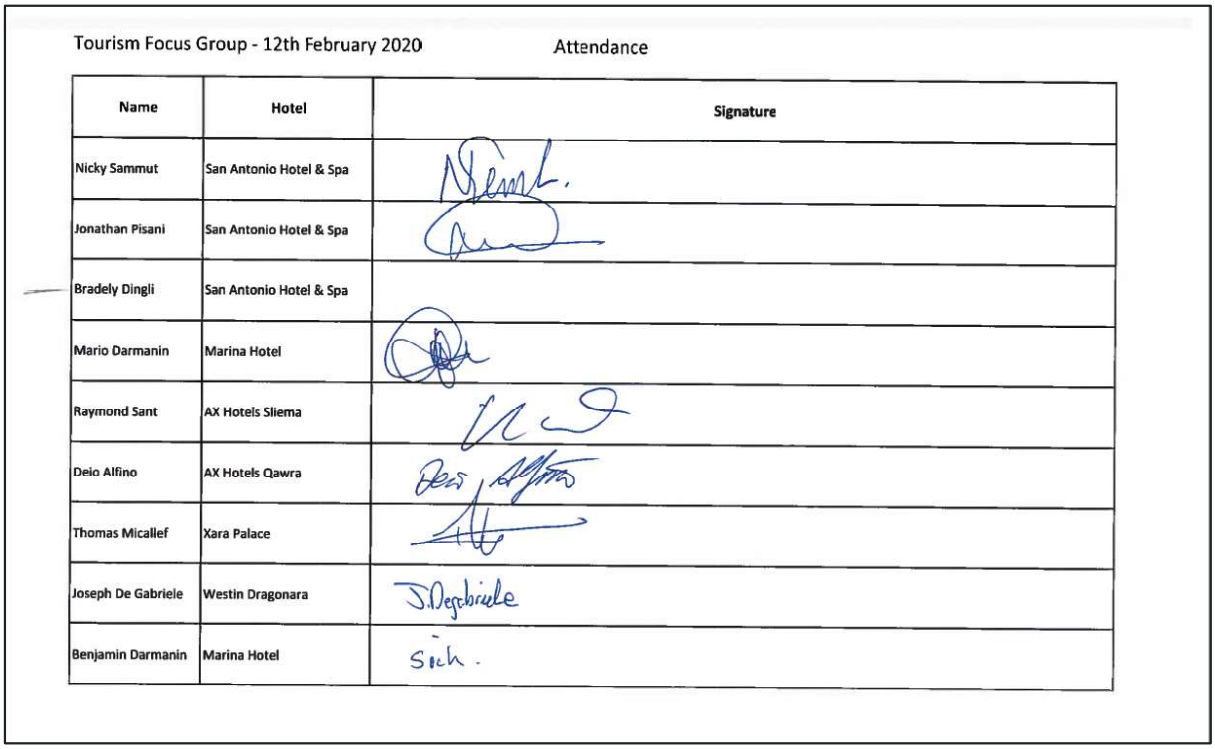
Ownership of wells

One comment that was made clear by the majority of architects interviewed related to the issue encountered with the ownership of the well in apartments. There was consensus that such water should be used by all. To be effective and implemented in needed to be backed up by law.

Grants

One architect mentioned that the way grants were currently structured needed changed. The focus should on the outcome rather than on a specific product. By way of example, the grant should be given on the amount of water saved and not the technology X per se. The reasoning being that in this way one would be able to choose the technology more suited to their specific needs and circumstances.

Annex 1: Attendance Sheets



Tourism Focus Group - 12th February 2020 Attendance

Name	Hotel	Signature
Nicky Sammut	San Antonio Hotel & Spa	
Jonathan Pisani	San Antonio Hotel & Spa	
Bradely Dingli	San Antonio Hotel & Spa	
Mario Darmanin	Marina Hotel	
Raymond Sant	AX Hotels Sliema	
Deio Alfino	AX Hotels Qawra	
Thomas Micallef	Xara Palace	
Joseph De Gabriele	Westin Dragonara	
Benjamin Darmanin	Marina Hotel	

Residential Focus Group 1 - 13th February 2020 Attendance

Name	Signature
Joanna Camenzuli	Jcamenzuli.
Charlotte Zammit	
Maryanne ~~Cachia~~ Caxha	Caxha
Michael Cachia	Michael Cachia
Shirley ~~Buttigieg~~ CUTAJAR	
Catherine Caruana	Catherine Caruana.
James Cook	James Cook
Geogria Agius	Georgia Agius
Derrick Farrugia	~~Derrick~~

Residential Focus Group 2 - 17th February 2020 Attendance

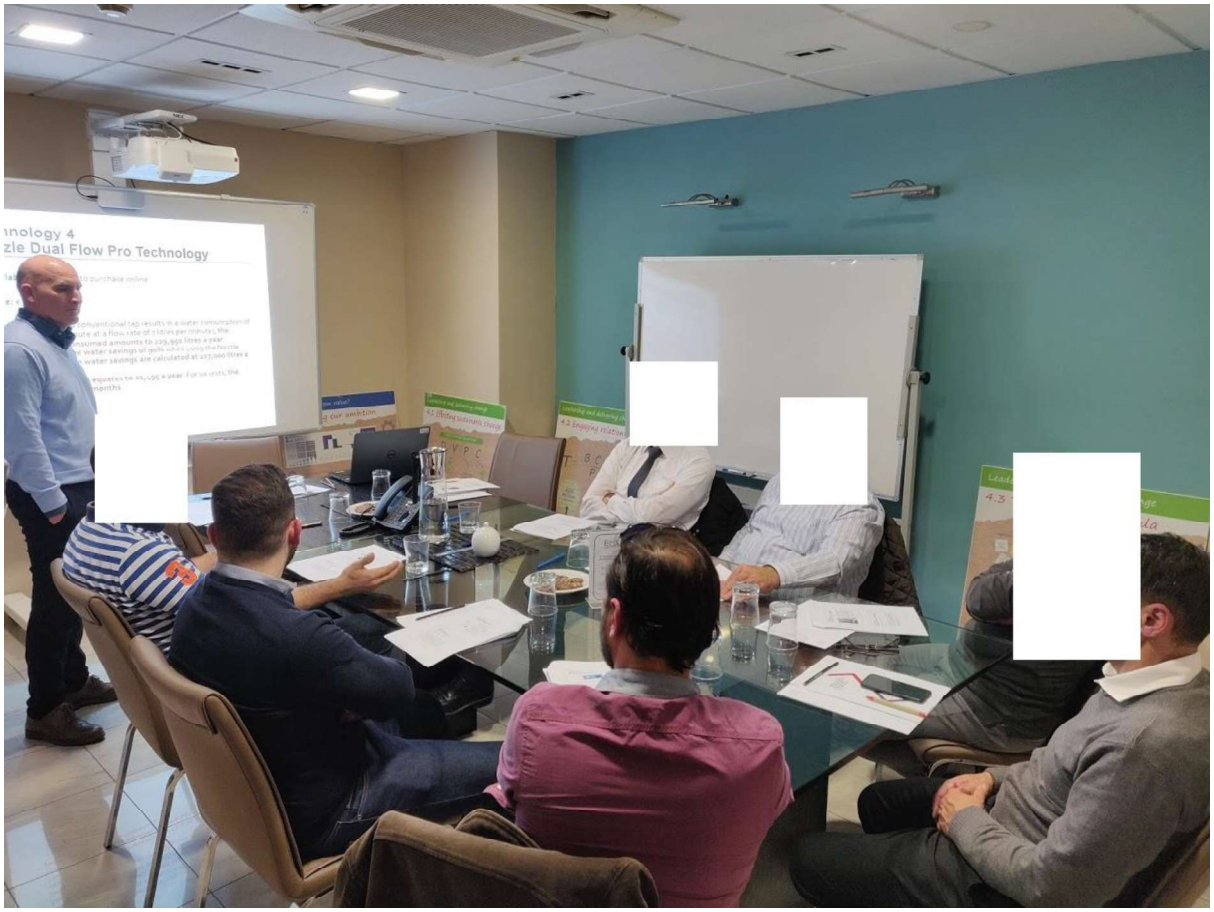
Name	Signature
Claire Micallef	claire micallef
Natalie Polidano	
Kristy Schembri	Kristy Schembri
Charles Tedesco	Charles Tedesco
Benjamin Flores Martin	
Edwin Camenzuli	
Maria Degorgio	Maria Degorgio
Rachel Galea	R. Galea.

Agriculture Focus Group - 10th March 2020

Name & Surname	Signature
STEPHEN BEZZINA	
Joseph Borg	Joseph Borg
John Mary Camilleri	
Wistin Muscat	Wistin Muscat.
MARY CAMILLERI	M Camilleri
Iman Borg	I. Borg
Anthony Sammut	Anthony Sammut
Vincent Camilleri	

Annex 2: Photo Evidence

Tourism Industry Focus Group



Agriculture Industry Focus Group

Residential focus groups

EWA/CFT/6/2018 – Market Research on Water Demand Management Technologies

Activity 4

Date: 22/07/2020
Author: Ramon Muscat
Version: 1

Contents

1. Notes to the Applicability Matrix

1.1 Water saving potential classification

A scoring of 5 was given if savings of more than 30,000 litres per year.
A scoring of 4 was given if savings between 2000 and 30,000 litres per year.
A scoring of 3 was given if savings between 1000 and 2000 litres per year.
A scoring of 2 was given if savings between 500 and 1000 litres per year.
A scoring of 1 was given if savings less than 500 litres per year.

1.2 Energy Requirements Scoring

Regarding energy requirements:
If a device saves energy (apart from water) it was rated with a 5.
If a device uses no energy whatsoever, it was also rated with a 5.
If a device is a low energy consumer it was given a 4;
A scoring of 3 or less was given for devices with increasing energy consumption.

2. Residential

		Water saving potential	Market cost	Payback period	Ease of installation	User acceptance	Energy requirements (where applicable)	Maintenance and upkeep	Overall
Residential	Technology	Score	Score	Score	Score	Score	Score	Score	Score
Technology 1	Restrictors for showers	4	5	5	5	5	5	4	33
Technology 2	Water-saving shower head	4	4	4	5	3	5	4	29
Technology 3	Kitchen tap aerators	4	5	5	5	4	5	4	32
Technology 4	Reuse water that is discarded from dc	5	4	5	3*	3	5	4	26
Technology 5	Rain water harvesting	5	2	2	2	3	4	3	21
Technology 6	Flood check	2	2	3	3	2	5	4	21
Technology 7	Grey water recycling home system	5	1	1	2	2	3	2	16
Technology 8	Water recycling shower	5	1	1	2	1	5	3	18
Technology 9	Water saving (front loading) washing	4	4	3	4	4	5	4	28
Technology 10	Water pebble	4	5	4	5	3	2	4	27

*if DIY

TECHNOLOGY 1: RESTRICTORS FOR SHOWERS

This technology was positively viewed because of it's market cost. It is also a technology that can be easily installed.

TECHNOLOGY 2: WATER SAVING SHOWER HEAD

This technology was not positively viewed by participants because of the design of the shower head. The reasoning was that if the design was appealing, they will be more likely to go for it.

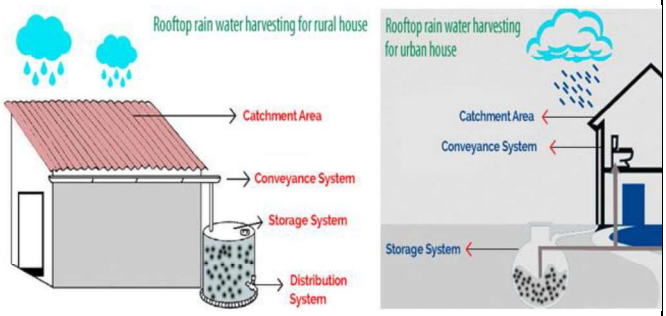
TECHNOLOGY 3: KITCHEN TAP AERATORS

Some were sceptical - main comment being that if the technology lowered the flow of water in the kitchen, then it would take longer to fill a pot of water etc.

TECHNOLOGY 4: RE-USING BRINE FROM DOMESTIC ROS

This technology was viewed positively by those with an RO and those without.

TECHNOLOGY 5: RAINWATER HARVESTING SYSTEM



This was appealing only if the system was in place beforehand, otherwise it was seen as too much of a hassle to retrofit.

TECHNOLOGY 6: FLOOD CHECK

Only worth it if you have a flood - these were deemed to be rare in Malta

TECHNOLOGY 7: GREY WATER RECYCLING HOME SYSTEM

This was perceived to be too expensive.

TECHNOLOGY 8: WATER RECYCLING SHOWER

Too expensive and perceived to be a complex technology. Another factor mentioned was that this technology could not be retrofitted

TECHNOLOGY 9: VERY EFFICIENT WATER-SAVING (FRONT LOADING) WASHING MACHINES

Overall feedback was that such a technology would be considered it their current appliance needed to be changed. However, some indicated that the brand was of importance too when choosing a washing machine.

TECHNOLOGY 10: WATER PEBBLE

User acceptance was rated as 3 because it is perceived to be mainly targeted towards children.

3. Tourism

		Water saving potential	Market cost	Payback period	Ease of installation	User acceptance	Energy requirements (where applicable)	Maintenance and upkeep	Overall
Tourism	Technology	Score	Score	Score	Score	Score	Score	Score	Score
Technology 1	Industrial Water Saving Dishwashers and Pre-Rinse Spray	5	3	5	4	2	5	4	28
Technology 2	Water saving industrial washing machines in hotels	5	3	4	4	2	5	4	27
Technology 3	Pressure regulating valves	5	4	5	3	2	5	4	28
Technology 4	Swimming pool evaporation rates	5	4	5	5	1	5	4	29
Technology 5	Grey water recycling	5	2	2	1	3	3	3	19
Technology 6	Device providing real-time information	3	3	2	3	2	5	4	22
Technology 7	Hot water control system	3	3	3	3	3	5	4	24
Technology 8	Smart Wi-Fi water sensor	4	5	5	4	3	4	3	28
Technology 9	Nozzle dual flow pro technology	4	5	5	4	4	5	4	31
Technology 10	Activated filter media	4	4	3	4	3	5	4	27

Technology 1: Industrial Water Saving Dishwashers and Pre-Rinse Spray Valve

This technology would appeal to a hotel that needs to change their dishwasher. It was the general feel that if the product does not need to be changed then it won't be.

Technology 2: Water Saving Industrial Washing Machines in Hotels

It was noted that this technology would not really enticing as several hotels outsource their laundry washing.

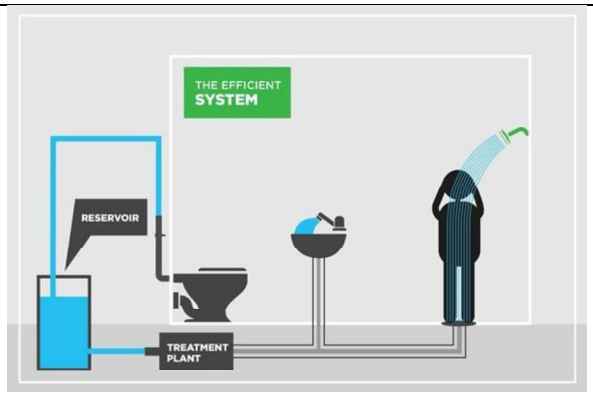
Technology 3: Pressure Regulating Valves

The hoteliers did not find this technology useful; some had had it in place and removed it.

TECHNOLOGY 4: SWIMMING POOL EVAPORATION RATES

Several people were sceptical about this product because it could tarnish the hotel's reputation if someone was allergic to it - a risk many were not willing to take.

TECHNOLOGY 5: GREY WATER RECYCLING

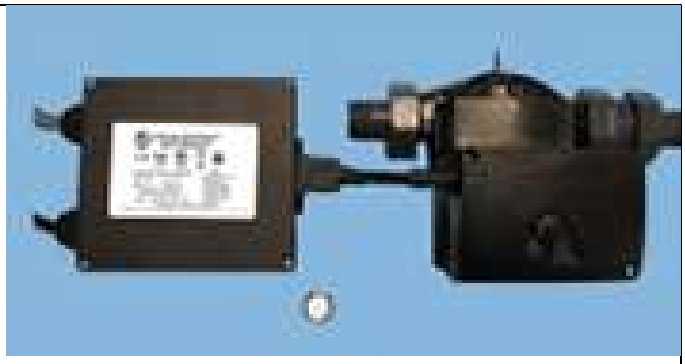


This is a technology that cannot be retrofitted so would only apply to hotels that are being built or undergoing a full refurbishment.

TECHNOLOGY 6: DEVICE PROVIDING REAL-TIME INFORMATION

Hoteliers did not think that the provision of information on the amount of water utilised would make guests more conscious.

TECHNOLOGY 7: HOT WATER CONTROL SYSTEM



The sector was sceptical as to the ease of installation and upkeep for such technology.

TECHNOLOGY 8: SMART WI-FI WATER SENSOR

In view of its cheap cost, the sector was sceptical on how reliable the technology was.

TECHNOLOGY 9: NOZZLE DUAL FLOW PRO TECHNOLOGY

This technology was seen as being more ideal for a residential home more than a hotel.

TECHNOLOGY 10: ACTIVATED FILTER MEDIA

The sector perceived this technology to be dangerous.

4. Commercial

		Water saving potential	Market cost	Payback period	Ease of installation	User acceptance	Energy requirements (where applicable)	Maintenance and upkeep	Overall
Commercial	Technology	Score	Score	Score	Score	Score	Score	Score	Score
Technology 1	Flushing toilets with manual stop	5	4	4	3	3	5	4	**28**
Technology 2	Dual flush toilets	4	3	3	3	5	5	4	**27**
Technology 3	Technologies that displace water in the flushing cistern	4	5	5	5	3	5	4	**31**
Technology 4	Eco-timer for faucets on wash hand basins	4	4	3	3	4	5	4	**27**
Technology 5	Collection of air-conditioner condensate for landscaping/toilet flushing	4	3	2	2	3	4	3	**21**
Technology 6	Toilet with Integrates Wash Hand Basin	4	3	5	3	1	5	4	**25**
Technology 7	Shower Start Device for Public Showers	4	5	4	4	3	5	4	**29**
Technology 8	Recyclable plastic beads for Commercial Laundries	5	1	4	4	3	5	4	**26**
Technology 9	Car Wash Recycling Systems	5	1	1	2	*	3	3	**15**
Technology 10	Waterless Urinals	5	4	4	5	3	5	3	**29**

TECHNOLOGY 1: FLUSHING TOILETS WITH MANUAL STOP

Overall, people would rather have a dual flush.

TECHNOLOGY 2: DUAL FLUSH TOILETS

Already widely used by most.

TECHNOLOGY 3: TECHNOLOGIES THAT DISPLACE WATER IN THE FLUSHING CISTERN

Only useful for those who have a single flush.

TECHNOLOGY 4: ECO-TIMER FOR FAUCETS ON WASH HAND BASINS

Positive views as deemed to improve hygiene (as opposed to having to touch).

TECHNOLOGY 5: COLLECTION OF AIR-CONDITIONER CONDENSATE FOR LANDSCAPING / TOILET FLUSHING

Viewed to be probably only worth it for large organisations (that have landscaping).

TECHNOLOGY 6: TOILET WITH INTEGRATES WASH HAND BASIN

Two negative comments voiced towards this technology related to the perceived discomfort to wash ones hands and its design.

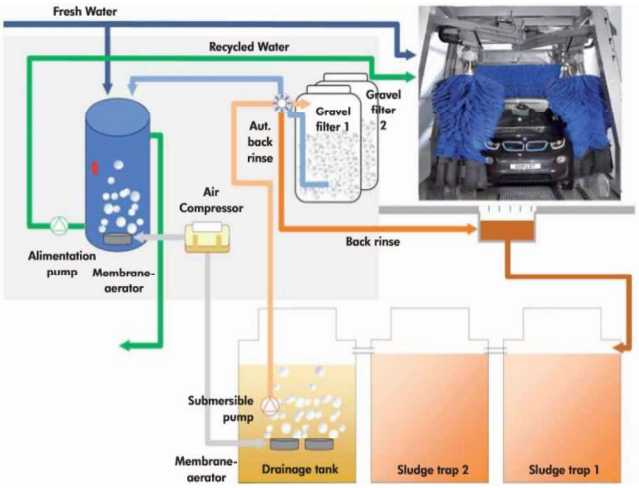
TECHNOLOGY 7: SHOWER START DEVICE FOR PUBLIC SHOWERS

Overall, the sector did not see the positives of this technology.

TECHNOLOGY 8: RECYCLABLE PLASTIC BEADS FOR COMMERCIAL LAUNDRIES

Overall, companies could/ would consider this technology if their washing machines had to be changed.

TECHNOLOGY 9: CAR WASH RECYCLING SYSTEMS



*Not able to classify as no car washing companies provided feedback

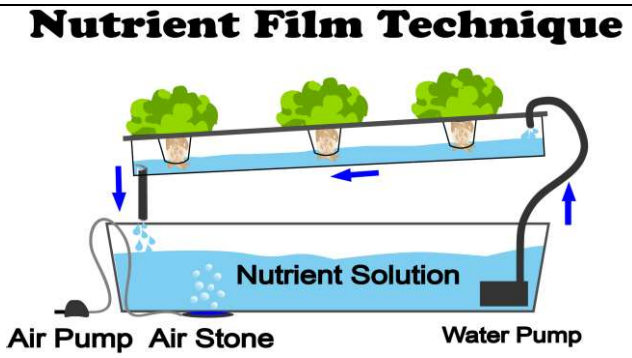
TECHNOLOGY 10: WATERLESS URINALS

The general perception was that this technology would not be very hygienic.

5. Agriculture

		Water saving potential	Market cost	Payback period	Ease of installation	User acceptance	Energy requirements (where applicable)	Maintenance and upkeep	Overall
Agriculture	Technology	Score	Score	Score	Score	Score	Score	Score	Score
Technology 1	Hydroponics	5	3	3	3	3	3	2	22
Technology 2	Soil Moisture Controller	4	3	5	4	3	4	4	27
Technology 3	Rain sensor	4	4	4	4	4	4	4	28
Technology 4	Use of New Water	5	5	5	4	4	1	3	27
Technology 5	Using water-efficient varieties of crops	4	4	3	5	4	5	4	29
Technology 6	Aquaponics	4	3	5	3	3	3	3	24
Technology 7	Smart Irrigation Control	5	3	4	3	3	4	3	25
Technology 8	Buried irrigation diffusers	3	4	1	3	3	5	2	21
Technology 9	Plant cocoon	4	4	3	4	2	5	3	25
Technology 10	Facilitating irrigation with saline water	4	3	3	2	2	3	2	19

TECHNOLOGY 1: HYDROPONICS

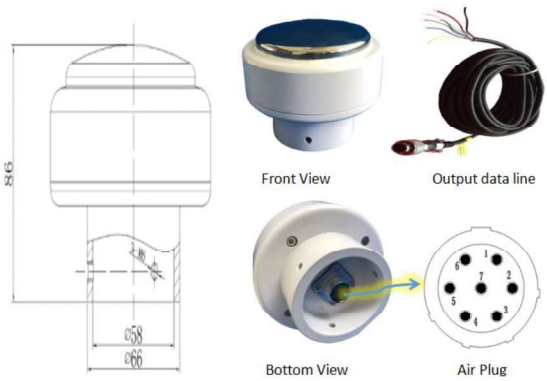


Perceptions varied - and was dependent on the type of farmer and the crops they are growing.

TECHNOLOGY 2: SOIL MOISTURE CONTROLLER

The sector was sceptical as to how it would work in practice. Furthermore farmers wondered how many they would actually need to cover their whole field.

TECHNOLOGY 3: RAIN SENSOR

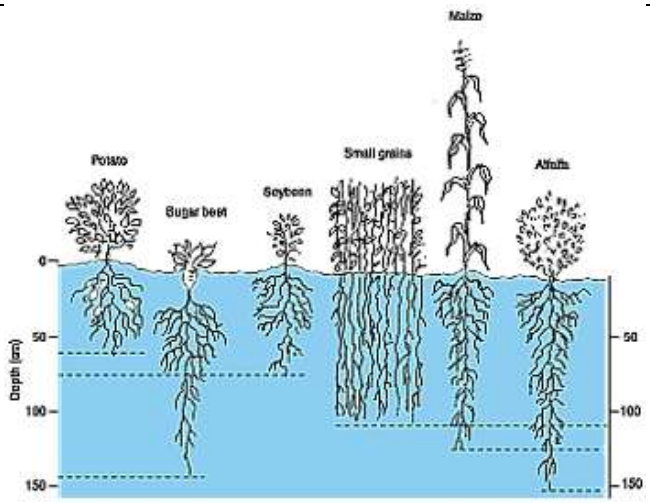


The sector expressed similar views to technology 2 above.

TECHNOLOGY 4: USE OF NEW WATER

Positive views on the concept - That said, farmers did point out a number of issues (both in terms of quality and availability).

TECHNOLOGY 5: USING WATER-EFFICIENT VARIETIES OF CROPS

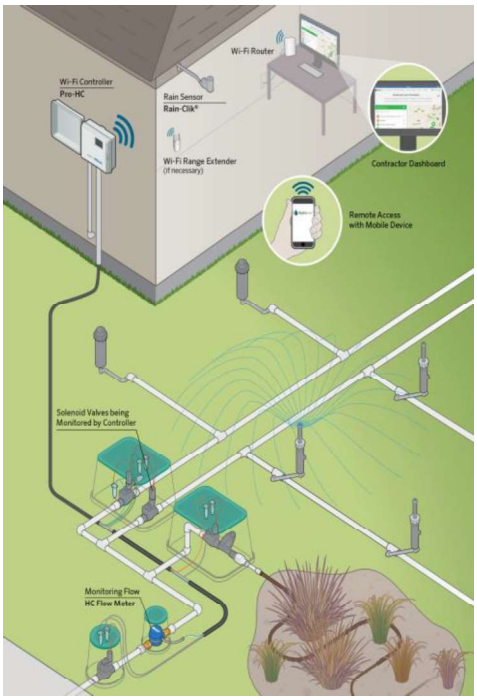


The farmers were in accord and emphasised that they were conscious and careful when it came to the crops they planted.

TECHNOLOGY 6: AQUAPONICS

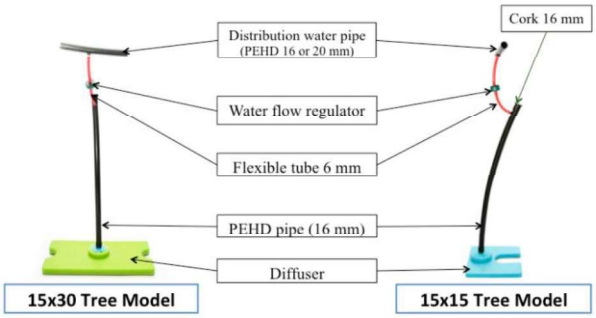
Farmers worried that a lot of maintenance and technical assistance would be required.

TECHNOLOGY 7: SMART IRRIGATION CONTROL



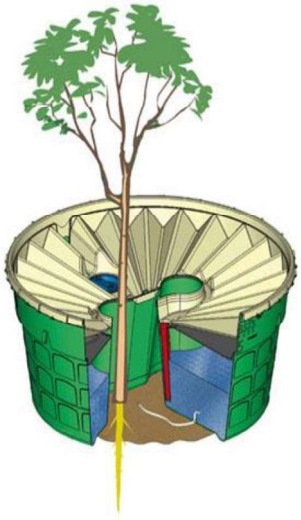
Overall, farmers felt that the technology was too technical for them to handle.

TECHNOLOGY 8: BURIED IRRIGATION DIFFUSERS



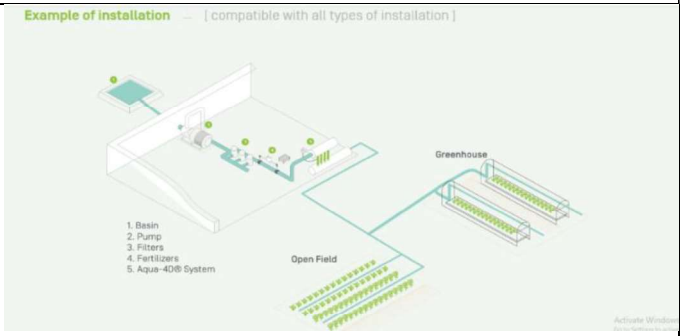
Farmers commented that roots were likely to attack this technology and therefore a lot of maintenance would be required.

TECHNOLOGY 9: PLANT COCOON



Main adverse comments related to the likely need to change it often, and that such technology would only be beneficial for those who have trees.

TECHNOLOGY 10: FACILITATING IRRIGATION WITH SALINE WATER



Overall it was felt that this technology was too technical for the average farmer and that consequently they would need technical assistance.

EMCS Ltd.
Level 2, Regional Business Centre,
University Heights,
Msida MSD 1751
Malta

EWA/CFT/6/2018 – Market Research on Water Demand Management Technologies

Activity 5

Date: 01/10/2021
Author: Ramon Muscat
Version: 1

EMCS TAX > ADVISORY

Contents

1. Overview

This report presents the findings of Activity 5 - this being the final activity of the tender - Tender for Market

In view of COVID-19 and the restrictions, it was decided that this activity would be carried out online while still targeting the intender sectors, namely:

- The residential sector
- The industrial sector
- The agricultural sector
- The tourism sector
- Water retailers and users involved in the water fitting industry

The objectives of this Activity being: *to inform the participants of the water saving technologies which are currently available on the market/or can be introduced on market and the potential water saving benefits (including economic benefits) resulting from the adoption of this technology.*

This Activity was organized in collaboration with the Energy and Water Agency.

EMCS was responsible for the drawing up of the participants list and to inviting the meeting participants and speakers for the conferences.

2. Dissemination of Results

The Dissemination of Results Conferences were held on Tuesday 28th September 2021, and Thursday 30th September 2021. The conferences were held online through Zoom.

EMCS carried out an online publicity campaign that specifically targeted the respective sectors. Furthermore, a number of personalised emails were also send out

Attendees could sign up for the conference by emailing info@emcs.com.mt, francesca.camenzuli@emcs.com.mt or calling +356 2777 2777. Late registrations were also accepted.

A total of 46 people attended these conferences. The attendees were:

- Local residents
- Individuals from the business sector
- Farmers
- Individuals from tourism sector
- Water demand technology suppliers

Both conferences were hosted by EMCS Ltd. The conferences consisted of a presentation that included a brief explanation of the project and an explanation of the different water demand technologies identified to be the top 5 in the applicability matrix. The key experts were also present on the day with Ing. Mario Schembri, the expert engineer also delivering part of the presentation and answered questions in the open discussion that followed at the end of each session.

As some individuals indicated a willingness to attain the information, but were unable to attend, the events were recorded, and links sent to interested individuals. The PowerPoint presentations were also available (to both attendees and those who were unable to attend).

3. Conference Agenda

3.1 Conference 1

Date: September 28, 2021

Venue: Zoom Meeting

Target Audience: Residential, Businesses, Tourism and Water Demand Technology Suppliers

Part 1 | 09:00 till 10:30 | Residential and Businesses including Water Demand Technology Suppliers

09:00	Welcome
09:05	Introduction
09:15	Presentation on the Water Demand Technologies Applicability Matrix relating to Residential Homes and Businesses | EMCS with Mario Schembri
10:00	Q&A Discussion
10:25	Closing

Coffee Break | 10:30 till 11:00

Part 2 | 11:00 till 12:30 | Tourism including Water Demand Technology Suppliers

11:00	Welcome
11:05	Introduction
11:15	Presentation on the Water Demand Technologies Applicability Matrix relating to Tourism | EMCS with Mario Schembri
12:00	Q&A Discussion
12:25	Closing

3.2 Conference 2

Date: September 30, 2021

Venue: Zoom Meeting

Target Audience: Agriculture and Water Demand Technology Suppliers

Part 1 | 11:00 till 12:30 | Agriculture including Water Demand Technology Suppliers

11:00	Welcome
11:05	Introduction
11:15	Presentation on the Water Demand Technologies Applicability Matrix relating to Agriculture | EMCS with Mario Schembri
12:00	Q&A Discussion
12:25	Closing

4. List of Attendees

4.1 Conference 1 | Part 1

The attendees for this conference were the general population, businesses and suppliers

Name	Surname	Name	Surname
Joanna	Vella	Esprit	Barthet
Darren	Chetcuti	Jacqueline	Giordmania
Stephanie	Portelli	Natalie	Polidano
Rebecca	Camenzuli	Etienne	Camenzuli
Chris	Aquilina	Anne Marie	Degabriele
Redianne	Saliba	Jason	Kerman
Pamela	Sammut	Anne Marie	Schembri
Maria	Borg	Denise	Chappell
Mario	Vella	Tiziana	Gatt
Michelle	Galea	Roberta	Vella
Anthea	Attard	Rachel	Camilleri
Steve	Vella	Faith	Spearing
Shaun	Abdilla		

4.2 Conference 1 | Part 2

The attendees for this conference were of the people coming from the business sector, the tourism sector and suppliers.

Name	Surname	Name	Surname
Joseph	Sammut	Raymond	Sant
Martina	Borg	Rachel	Camilleri
Diane	Cilia	Sofia	Lundquist

Matthew	Attard	Eric	Pavia
Sarah	Rossi	Edwina	Cassar Pullicino
Julia	Camilleri	Chris	Bonello
Elisa	Caruana	Pierre	Axiaq
Chris	Bonello	Mary	Camilleri
Alexia	Curmi	Roberta	Vella

4.3 Conference 2

The attendees for this conference were of the farmers and suppliers.

Name	Surname
Chris	Bonello
Pierre	Axiaq
Mary	Camilleri

4.4 Additional endeavours to disseminate the information

A number of stakeholders were interested in the conference but were unable to attend. These stakeholders were sent the recording of the conference and the presentation. Proof of these emails can be found in Annex 1. An email was sent to the below stakeholders:

Name	Surname	Name	Surname
Ben	Farrugia	Etienne	Magri
Brian	Restall	Dustan	Hamilton
Rita	Vella	Dominic	Borg
Chris	Magro	Sam	Cremona
Chris	Bonello	Marietta	Caruana
Michael	Schembri	Godfrey	Camilleri

5. Presentations

5.1 Conference 1 | Part 1

Applicability Matrix | Residential

- The top five technologies for the residential sector are:

Technology	Score (out of 35)
Restrictors for showers	33
Kitchen tap aerators	32
Water-saving shower head	29
Water-saving (front loading) washing machine	28
Water pebble	27

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Applicability Matrix | Commercial

- The top six technologies for the commercial sector are:

Technology	Score (out of 35)
Technologies that displace water in the flushing cistern	31
Shower Start Device for Public Showers	29
Waterless Urinals	29
Flushing toilets with manual stop	28
Dual flush toilets	27
Eco-timer for faucets on wash hand basins	27

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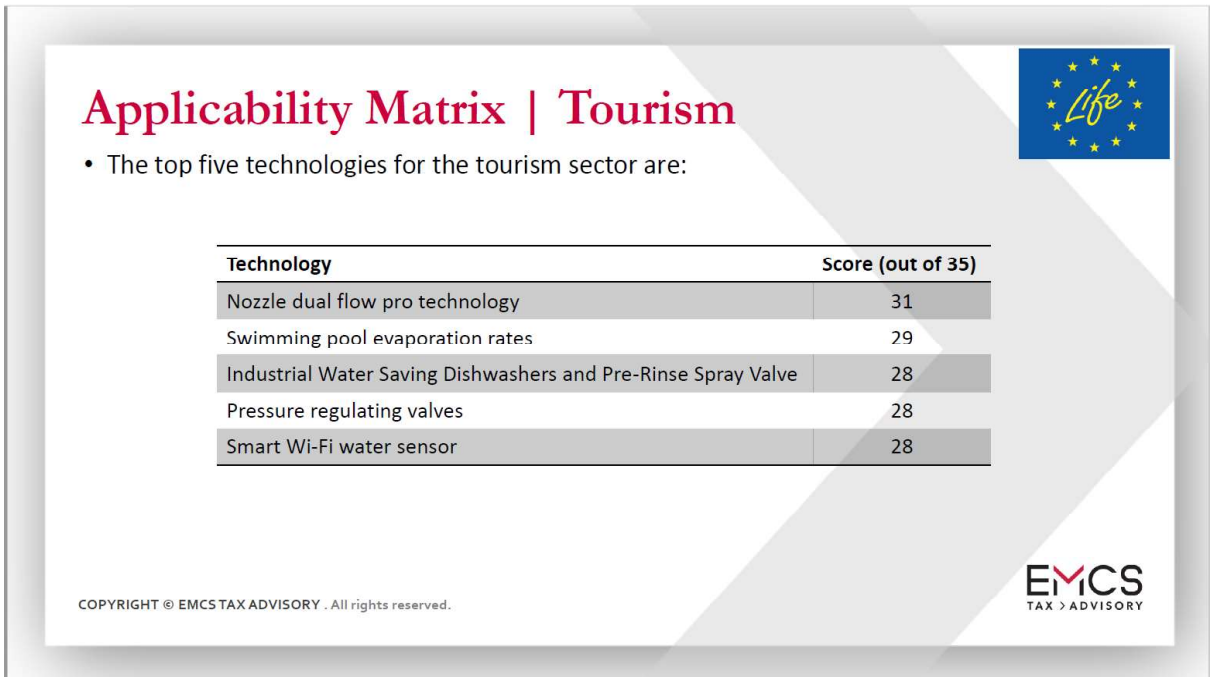
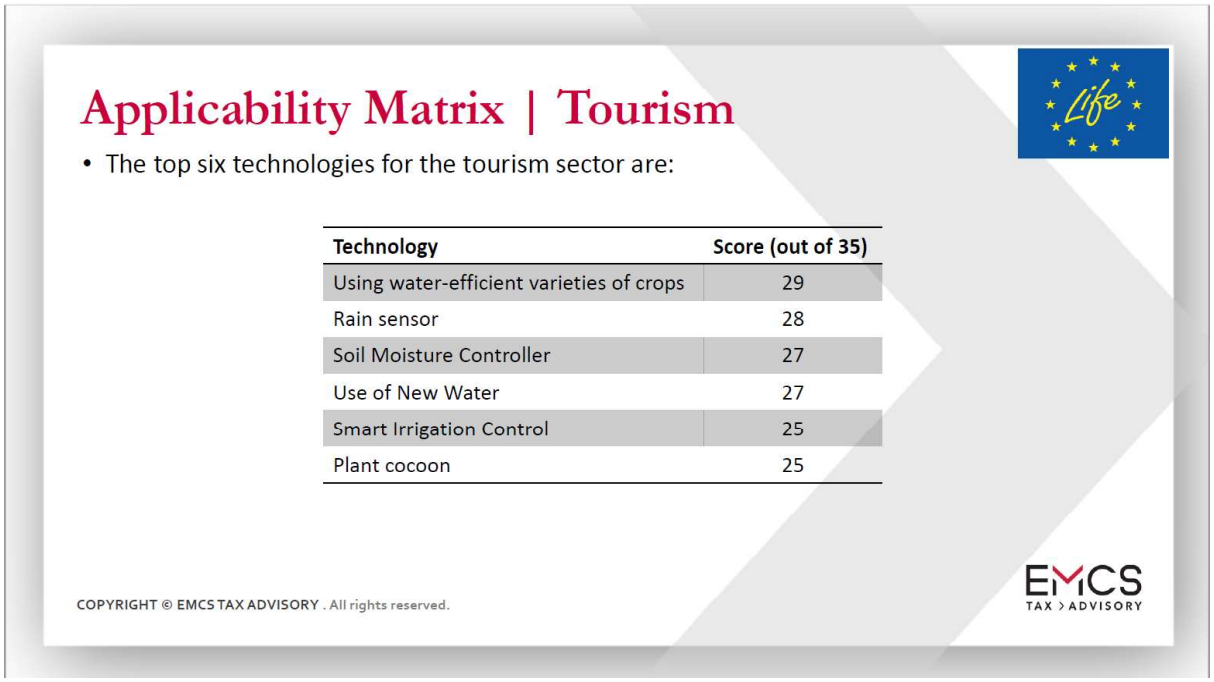
5.2 Conference 1 | Part 2

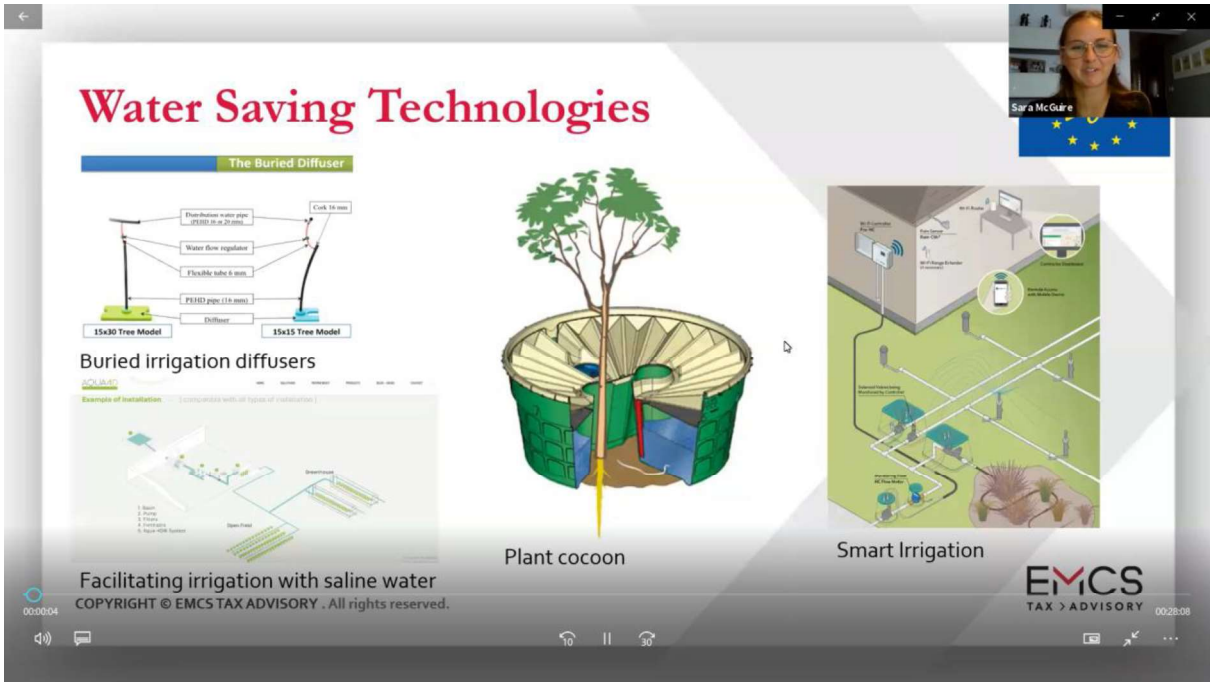


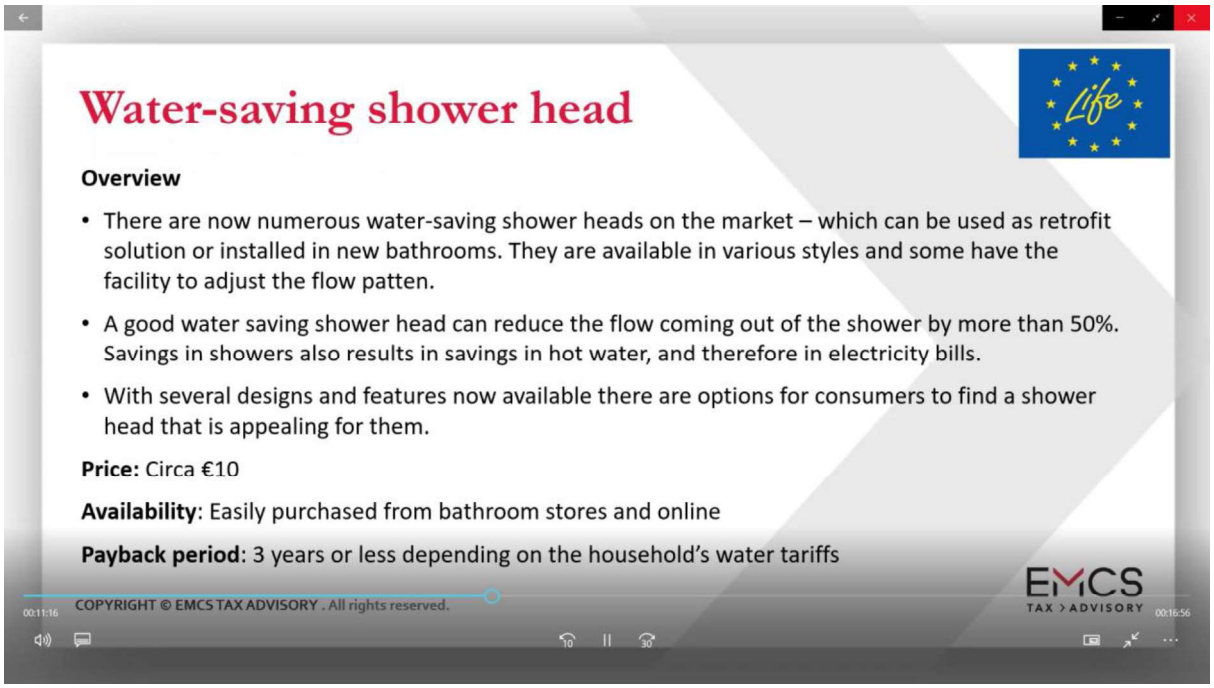
5.3 Conference 2



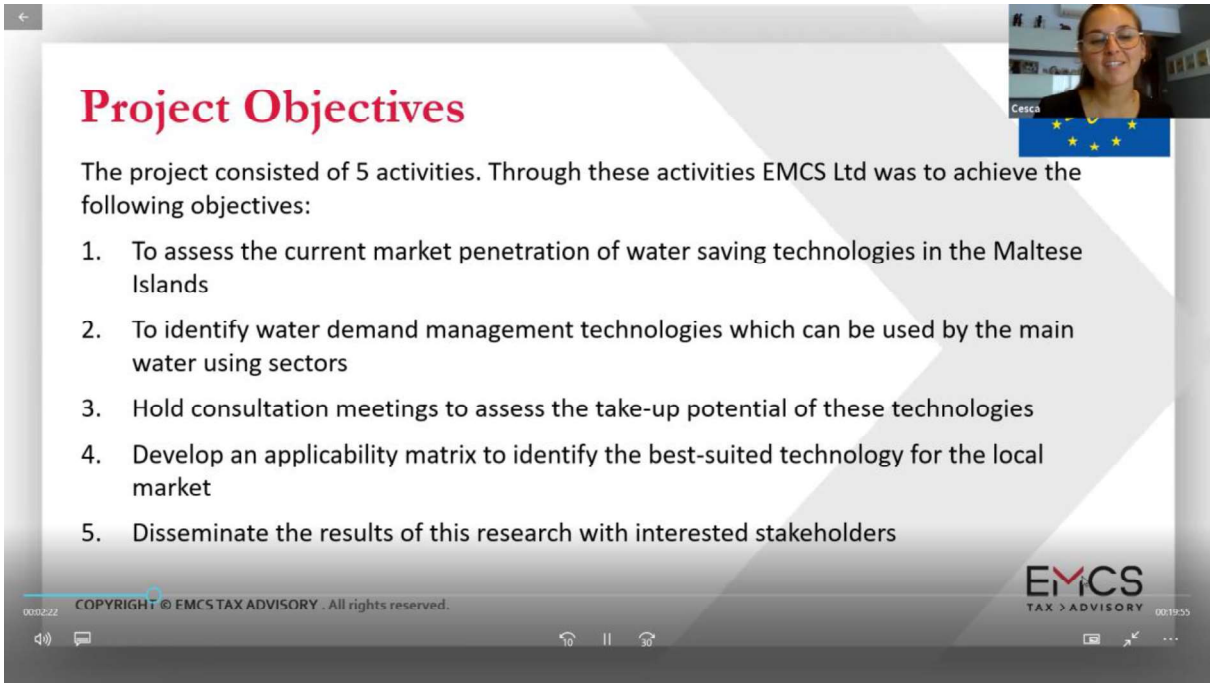
6. Evidence of Conference

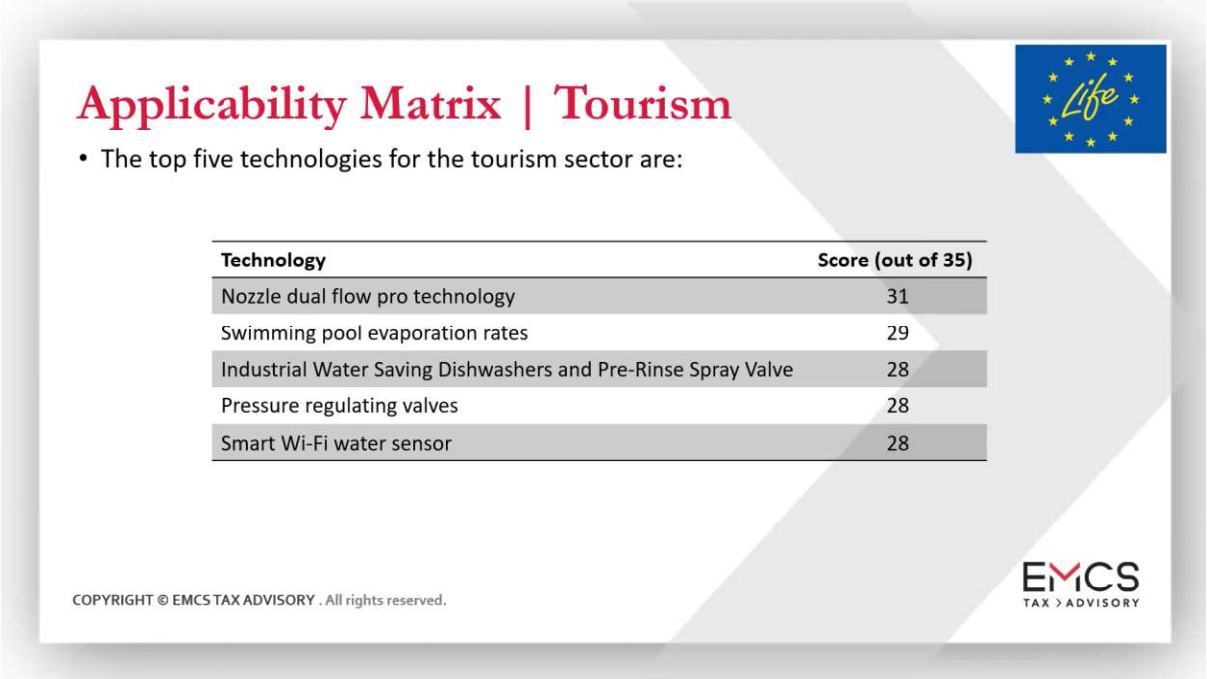
6.1 Conference 1 | Part 1



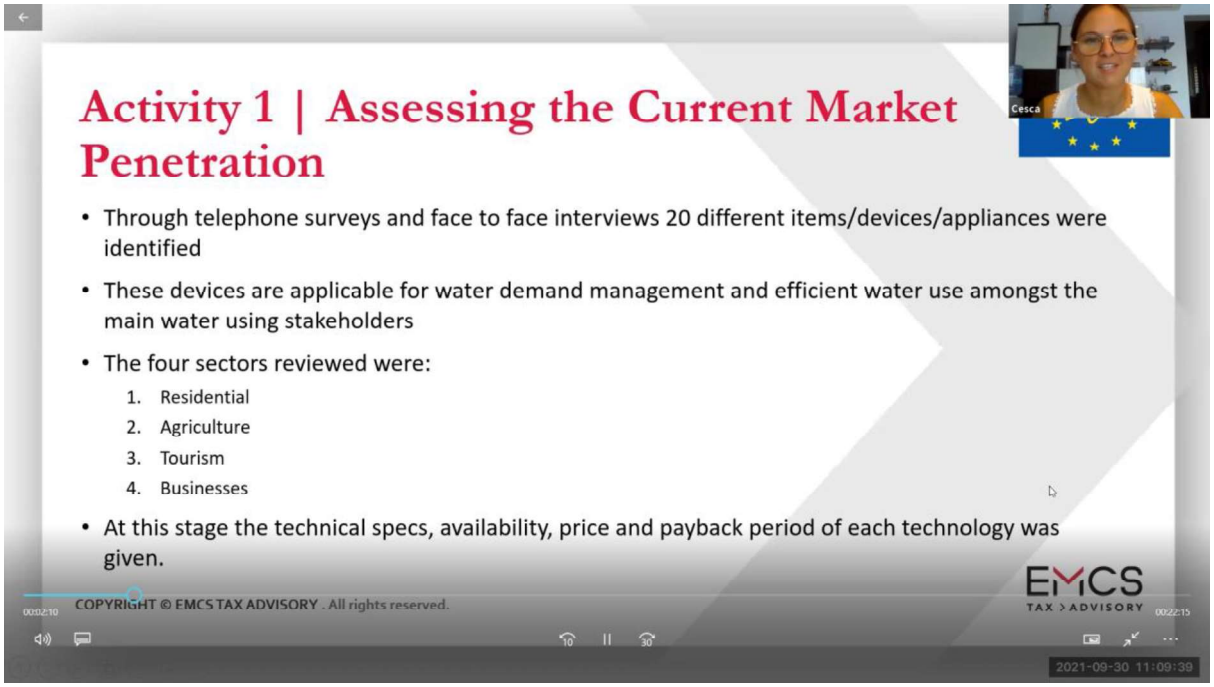


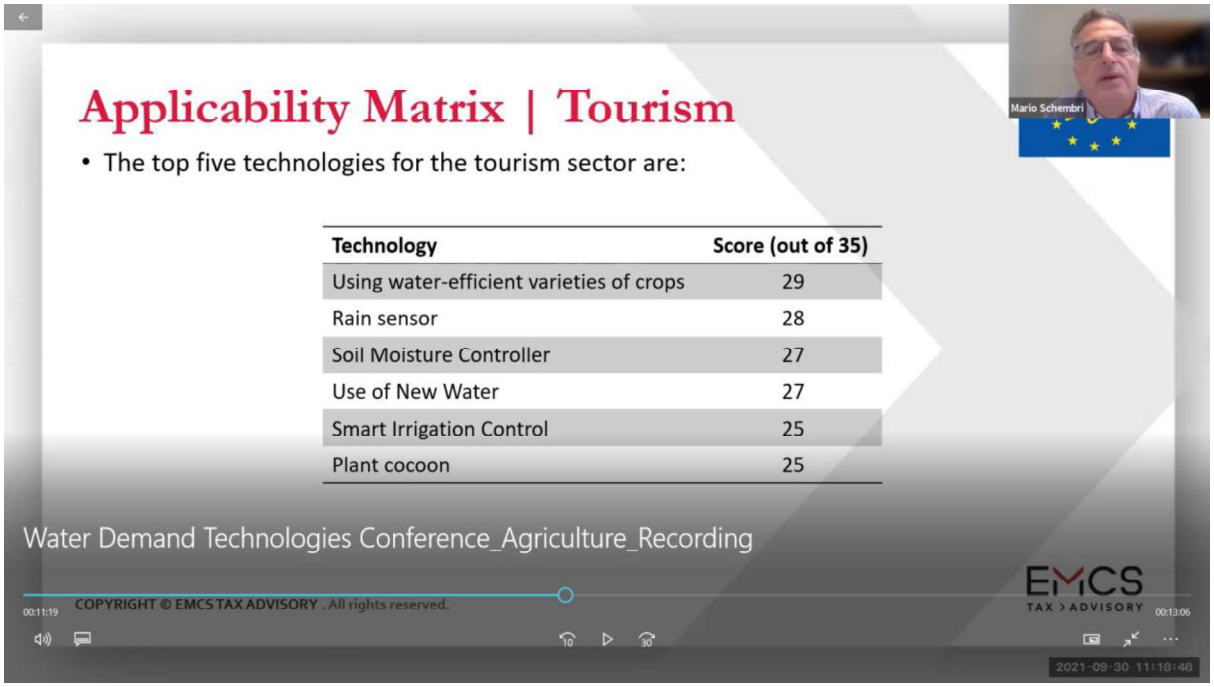
6.2 Conference 1 | Part 2





6.3 Conference 2





Annex 1

Water Demand Technologies Conference 1 | Tourism

Reply | Reply All | Forward | ...

FC Francesca Camenzuli
To Mario Darmanin

Thu 30/09/2021 13:44

Dear Mr Darmanin,

We are aware you could not attend our conference held on the 28th September regarding Water Saving Technologies.

You can download the recording and slides for this event through this link: https://we.tl/t-oHzNwKqLzO

Should you have any questions, please do not hesitate to ask.

Kind regards,
Cesca

Francesca Camenzuli

Lead Associate - Advisory Services
T +356 2777 2581 M +356 7902 0527

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Water Demand Technologies Conference 1 | Tourism

Reply | Reply All | Forward | ...

FC Francesca Camenzuli
To Etienne Magri

Thu 30/09/2021 13:44

Dear Mr Magri,

We are aware you could not attend our conference held on the 28th September regarding Water Saving Technologies.

You can download the recording and slides for this event through this link: https://we.tl/t-oHzNwKqLzO

Should you have any questions, please do not hesitate to ask.

Kind regards,
Cesca

Francesca Camenzuli

Lead Associate - Advisory Services
T +356 2777 2581 M +356 7902 0527

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Water Demand Technologies Conference 1 | Tourism

Reply | Reply All | Forward | ...

FC Francesca Camenzuli
To nsammut@dbhotelsresorts.com

Thu 30/09/2021 13:45

Dear Mr Sammut,

We are aware you could not attend our conference held on the 28th September regarding Water Saving Technologies.

You can download the recording and slides for this event through this link: https://we.tl/t-oHzNwKqLzO

Should you have any questions, please do not hesitate to ask.

Kind regards,
Cesca

Francesca Camenzuli

Lead Associate - Advisory Services
T +356 2777 2581 M +356 7902 0527

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Reply | Reply All | Forward | ...

FC Francesca Camenzuli
To ben@longbowmalta.com

Thu 30/09/2021 13:46

Dear Mr Farrugia,

We are aware you could not attend our conference held on the 30th September regarding Water Saving Technologies.

You can download the recording and slides for this event through this link: https://we.tl/t-EPO9CXUctW

Should you have any questions, please do not hesitate to ask.

Kind regards,
Cesca

Francesca Camenzuli

Lead Associate - Advisory Services
T +356 2777 2581 M +356 7902 0527

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FC Francesca Camenzuli
To info@mrddf.org

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Thu 30/09/2021 13:47

Dear Mr Restall,

We are aware you could not attend our conference held on the 30th September regarding Water Saving Technologies.

You can download the recording and slides for this event through this link: https://we.tl/t-EPO9CXUctW

Should you have any questions, please do not hesitate to ask.

Kind regards,
Cesca

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Lead Associate - Advisory Services
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FC Francesca Camenzuli
To Rita Vella

Reply | Reply All | Forward | ...

Thu 30/09/2021 13:47

Dear Ms Vella,

We are aware you could not attend our conference held on the 30th September regarding Water Saving Technologies.

You can download the recording and slides for this event through this link: https://we.tl/t-EPO9CXUctW

Should you have any questions, please do not hesitate to ask.

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Cesca

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Lead Associate - Advisory Services
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FC Francesca Camenzuli
To Christian Magro

Reply | Reply All | Forward | ...
Thu 30/09/2021 13:47

Dear Mr Magro,

We are aware you could not attend our conference held on the 28th September regarding Water Saving Technologies.

You can download the recording and slides for this event through this link: https://we.tl/t-Yvq362kqPg

Should you have any questions, please do not hesitate to ask.

Kind regards,
Cesca

Francesca Camenzuli

Lead Associate - Advisory Services
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Water Demand Technologies Conference 1 | Residential and Small Businesses

FC Francesca Camenzuli
To Chris Bonello

Reply | Reply All | Forward | ...
Thu 30/09/2021 13:47

Dear Mr Bonello

We are aware you could not attend our conference held on the 28th September regarding Water Saving Technologies.

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Water Demand Technologies Conference 1 | Residential and Small Businesses

FC Francesca Camenzuli
To Michael Schembri

Reply | Reply All | Forward | ...

Thu 30/09/2021 13:48

Dear Mr Schembri,

We are aware you could not attend our conference held on the 28th September regarding Water Saving Technologies.

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Lead Associate - Advisory Services
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FC Francesca Camenzuli
To Etienne Magri

Reply | Reply All | Forward | ...

Thu 30/09/2021 13:48

Dear Mr Magri,

We are aware you could not attend our conference held on the 28th September regarding Water Saving Technologies.

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FC Francesca Camenzuli
To Dunstan Hamilton

Reply | Reply All | Forward | ...

Fri 01/10/2021 09:23

Dear Mr Hamilton,

We are aware you could not attend our conference held on the 30th September regarding Water Saving Technologies.

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Should you have any questions, please do not hesitate to ask.

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FC Francesca Camenzuli
To Dominic Borg

Reply | Reply All | Forward | ...

Fri 01/10/2021 09:23

Dear Mr Borg,

We are aware you could not attend our conference held on the 30th September regarding Water Saving Technologies.

You can download the recording and slides for this event through this link: https://we.tl/t-EPO9CXUctW

Should you have any questions, please do not hesitate to ask.

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Cesca

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FC Francesca Camenzuli
To samcremona1950@gmail.com

Reply | Reply All | Forward | ...
Fri 01/10/2021 09:23

Dear Sam,

We are aware you could not attend our conference held on the 30th September regarding Water Saving Technologies.

You can download the recording and slides for this event through this link: https://we.tl/t-EPO9CXUctW

Should you have any questions, please do not hesitate to ask.

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Cesca

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FC Francesca Camenzuli
To Marietta Caruana

Reply | Reply All | Forward | ...
Fri 01/10/2021 09:24

Dear Ms Caruana,

We are aware you could not attend our conference held on the 30th September regarding Water Saving Technologies.

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Should you have any questions, please do not hesitate to ask.

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FC Francesca Camenzuli
To gcamilleri234@yahoo.com

Reply | Reply All | Forward | ...

Fri 01/10/2021 09:24

Dear Mr Camilleri,

We are aware you could not attend our conference held on the 30th September regarding Water Saving Technologies.

You can download the recording and slides for this event through this link: https://we.tl/t-EPO9CXUctW

Should you have any questions, please do not hesitate to ask.

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Francesca Camenzuli

Lead Associate - Advisory Services

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