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Innovation, Impacts and Future Direction of Sustainable Universities: The Case of the University of Minho - Portugal (Braga-Guimarães)

Bandeira, Miguel Sopas M.^{1}, Lobão, Ricardo J.A.S.²*

¹ Reitoria, Universidade do Minho, Pró-reitor para a Sustentabilidade e Gestão dos Campi, Largo do Paço, 4704-553 Braga, Portugal

² USGCI, Universidade do Minho, Diretor de Serviços da Gestão dos Campi e Infraestruturas, Rua da Universidade 4710-057 Braga, Portugal

*corresponding author: bandeira@reitoria.uminho.pt

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Abstract. Human wellbeing is closely linked to the health of the environment. Around the world, 24% of deaths can be traced back to avoidable environmental factors, according to the World Health Organization. People need clean air to breathe, fresh water to drink, and places to live that are free of toxic substances and hazards. As we begin to experience the long-term consequences of exponential industrial growth and energy use, we must act to reverse these effects and prevent further damage, ensuring we have healthy places to live for generations to come. Objectives of this work are to show the implementation in our University of methods of water and waste management, since early 2017.

Keyword:

Sustainability, Water management, Waste management.

1. Introduction

Objectives of the work are to show the implementation in UMinho of methods of water and waste management. Since early 2017 UMinho is consistently trying to reduce water consumption and trying better approaches to waste management.

The correct characterization of the main types of waste produced in the campuses and in UMinho's buildings is what enables the definition of the stages of sorting, collection,

storage, transportation and sending the waste to its final destination. It is worth noting that the person that produces the waste is responsible for its proper sorting and package, hence the need to take the necessary measures to ensure the exact classification of the waste.

In water management the irrigation of green spaces is achieved through a process of natural infiltration, resulting from the capture of water, by underground sources that are in the perimeter of the UMinho campuses, serving exclusively to cover the water needs of the green spaces, through the process of natural infiltration, returning to the natural environment the water captured.

2. Water management

In terms of results of UMinho policies it is interesting to observe that since 2017 effective savings with the implementation of groundwater and rainwater abstraction systems allowing a management of green spaces more consistent with the environmental goals proposed by the European Union. Likewise, the implementation of consumption reduction policies in campus facilities has allowed a constant reduction in per capita consumption, as can be seen in Figure 2. [1]

One of the main problems in this matter focuses mainly on aspects related to the management of buried supply infrastructure, which, due to the age and technology used when it was implemented, still allows substantial losses, namely through leaks (estimated at about 30%). In this sense, a more assertive action is envisaged in the replacement of buried water distribution pipes, so that it is possible to drastically reduce the losses verified to 15%. Fundamentally, the positive variations in consumption observed in the graphs are due to these occurrences and which contribute decisively to a lower variation in water consumption in the periods identified (Figure 1).

The resolution of these problems is a systematic approach to that defined in the Water Framework Directive (WFD) defined by the European Union [2].

2.1. Evolution of water consumption

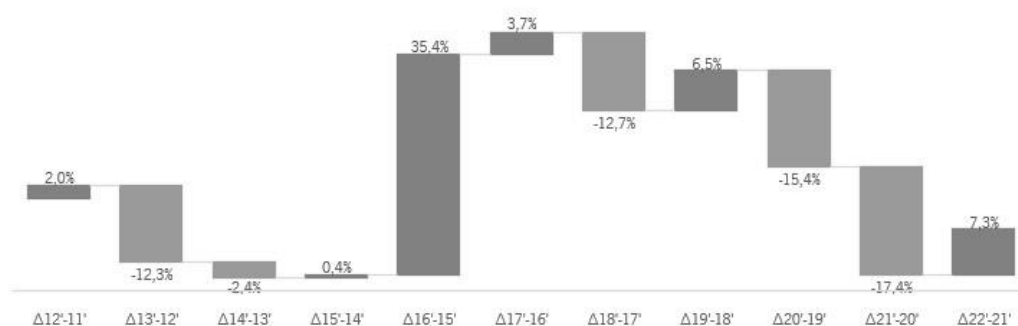


Figure 1. Water Consumption Evolution (*per Comparison*)

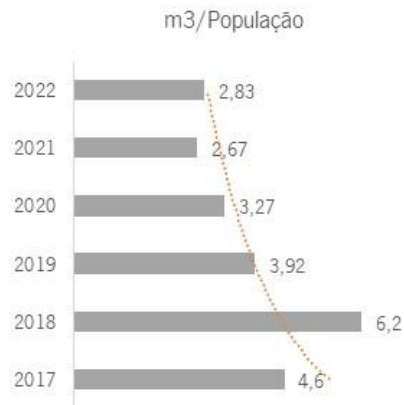


Figure 2. Water Consumption Evolution per Capita

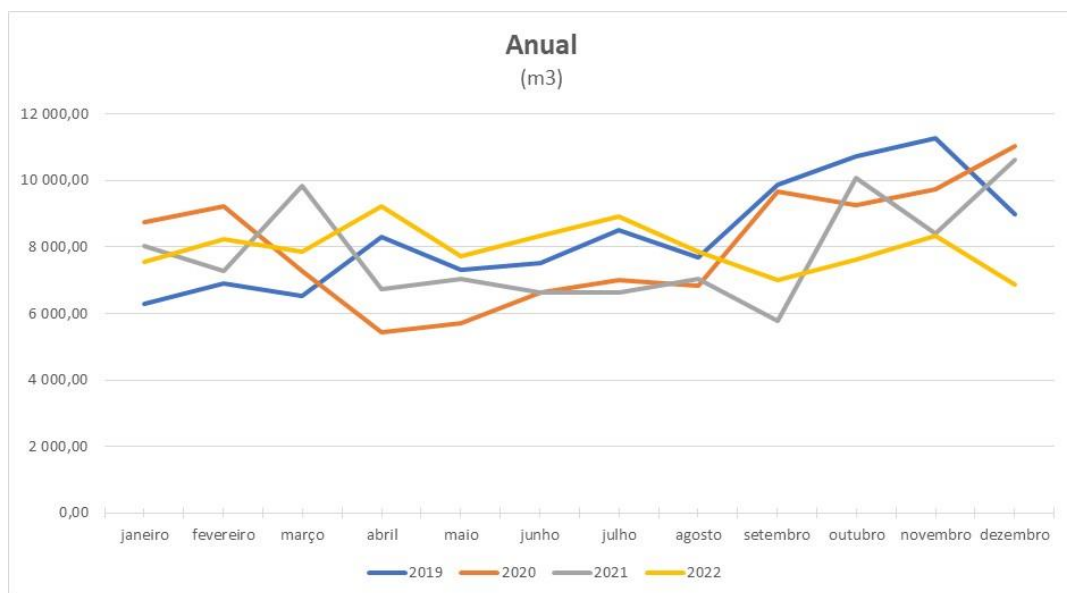


Figure 3. Water Consumption Evolution per Month

Table 1. Water Consumption

	2017	2018	Δ	2019	Δ	2020	Δ	2021	Δ	2022	Δ
Gualtar (m3)	45236	45808	1,3%	54891	19,8%	49971	-9,0%	34807	-30,3%	32193	-7,5%
Azurém (m3)	46117,11	33950	-26,4%	30057	-11,5%	21869	-27,2%	24503	12,0%	31462	28,4%
Total (m3)	91353,11	79758	-12,7%	84948	6,5%	71840	-15,4%	59310	-17,4%	63655	7,3%
Faturação(€)	187 078,00 €	281 342,17 €	50,4%	370 500,00 €	31,7%	242 605,00 €	-34,5%	117 660,00 €	-51,5%	221 174,17 €	7,8%
Tabela: Consumo de água								205 160,00 €	-15,4%		
	2017	2018	Δ	2019	Δ	2020	Δ	2021	Δ	2022	Δ
m3	91353,11	79758	-12,7%	84948	6,5%	71840	-15,4%	59310	-17,4%	63655	7,3%
ABrutaConstruida	284815,95	284815,95	0,0%	284815,95	0,0%	284815,95	0,0%	284815,95	0,0%	284815,95	0,0%
População	19987	12774	-36,1%	21664	69,6%	21999	1,5%	22180	0,8%	22516	1,5%
funcionário	1707	1707	0,0%	2324	36,1%	2367	1,9%	2415	2,0%	2462	1,9%
m3/População	4,6	6,2	36,6%	3,92	-37,2%	3,27	-16,7%	2,67	-18,1%	2,83	5,7%
m3/ Area	0,32	0,28	-12,7%	0,30	6,5%	0,25	-15,4%	0,21	-17,4%	0,22	7,3%
m3/ funcionário	4,82	4,21	-12,7%	3,29	-21,8%	2,73	-17,0%	2,21	-19,1%	2,33	5,3%
alunos	18280	18365	0,5%	19340	5,3%	19632	1,5%	19765	0,7%	20054	1,5%
Proporção funcionario/ p	9%	13%	56,5%	11%	-19,7%	11%	0,3%	11%	1,2%	11%	0,4%
m3/ aluno	4,57	3,76	-17,7%	3,92	4,2%	3,27	-16,7%	2,67	-18,1%	2,83	5,7%
Redução	Δ12'-11'	Δ13'-12'	Δ14'-13'	Δ15'-14'	Δ16'-15'	Δ17'-16'	Δ18'-17'	Δ19'-18'	Δ20'-19'	Δ21'-20'	Δ22'-21'
Total (m3)	2,0%	-12,3%	-2,4%	0,4%	35,4%	3,7%	-12,7%	6,5%	-15,4%	-17,4%	7,3%

3. Waste management

UMinho has, since 2017, established a consistent policy in waste management, through the promotion of environmentally responsible behaviors, as well as a series of measures aimed at its implementation within the context of campus use.

In this regard, several waste selection and collection systems have been implemented in the various campus facilities so that they can be easily segregated and sent to specific treatment sites by local or municipal waste management companies.

3.1 Ethical sourcing of food and supplies

Improving interaction with partners by sharing information and knowledge, particularly with regard to communication with suppliers, subcontractors and competent authorities is fundamental for good results. That is why UMinho has a code that refers to all activities undertaken at the University, as indicated in its statutes, and concerns the entire academic community, which is composed of teaching staff, research staff, non-academic staff and the students in the 1st, 2nd and 3rd study cycles leading to the degrees of bachelor, master or doctor, respectively, as well as the students of other programs or training courses conducted at the Institution or in collaboration with it [3].

3.2 Waste characterization and management

The correct characterization of the main types of waste produced in the campuses and in UMinho's buildings is what enables the definition of the stages of sorting, collection, storage, transportation and sending the waste to its final destination. It is worth noting that the person that produces the waste is responsible for its proper sorting and package, hence the need to take the necessary measures to ensure the exact classification of the waste.

Environmental sustainability practices implemented at the UMinho activities are the reflex of the institution's commitment to minimize environmental impacts and improving the well-being of the academic community. Consequently, it is promoted the implementation of procedures that improve environmental performance, mainly with regard to the waste management.

Each person with contract with the institution has access to the platform where the Health, Safety and Environment (management system is available for further research and awareness. In the platform, the user can easily access the internal policy as well the different levels of action and legal framework. FAQ's frequently asked questions are also available to read and learn more about the UMinho procedures regarding HSE [4].

In Table 1 we can observe waste produced per unity/school and the deviation from previous year.

Table 2. Waste Management

	2017	2018	Δ	2019	Δ	2020	Δ	2021	Δ	2022	Δ
Peso total de resíduos	93	73	-22%	87	19%	43	-50%	173	301%	67	-61%
Resíduos Perigosos	28	25	-10%	60	138%	25	-58%	26,02	6%	31,93	23%
Escola de Engenharia	9	5	-41%	15	192%	4,20	-72%	4,90	17%	9,95	103%
Escola de Ciências	11	8	-26%	17	102%	6,51	-61%	4,90	-25%	6,34	29%
Escola de Medicina	6	6	-1%	10	69%	6,17	-39%	7,13	15%	8,43	18%
Escola de Enfermagem	0		-100%								
i 3B's		5		14	202%	6,15	-99%	6,95	391%	4,25	-39%
QUALTAR/ AZURÉM/ Serviços/ Geral	2	1	-34%	4	185%	0,14	-68%	0,70	7%	0,91	30%
ibs				1		1,35		1,44		2,05	43%
Escola de Psicologia										0,002	
Resíduos não Perigosos	65	47	-27%	26	-44%	19	-29%	147	691%	35	-76%
Escola de Engenharia	0	12	817485%	14	21%	5,04	-65%	12,20	142%	10,07	-17%
Escola de Ciências	0	1	847%	2	229%	0,03	-99%		-100%	0,20	
i 3B's		0								0,04	
QUALTAR/ AZURÉM/ Serviços/ Geral	65	34	-47%	9	-73%	13,44	44%	134,30	899%	24,54	-82%
Escola de Medicina	0	0				0,00				0,00	
ibs						0,02			-100%	0,00	
Escola de Psicologia										0,00	
Resíduos Valorizados	72	52	-28%	45	-13%	42	-7,5%	55	31,7%	47	-14,5%

Tabela 16: Tipologia de Resíduos

71%

3.3 Good practices - plastic usage and waste reduction

The elimination of plastics in food units is one of the issues identified in the Sustainability Plan of the SASUM Social Action Services of UMinho and for which a set of measures have been defined:

- Plastic cups, fruit bowls and cutlery have been replaced for more durable and recycle materials;
- Studies are running to select biodegradable materials and reusable solutions;
- With regard to vending machines, personal glasses or cups are the best solutions to get a coffee, reducing massively the amount of plastic Single use plastic products elimination;

The Social Action Services of the University of Minho (as responsible for all the cafeterias and food stations) has implemented a program for the elimination of straws and drink stirrers from all SASUM food units, as well as the replacement of plastic cups with paper coffee carton cups, along with the decrease of purchasing these products in order to promote the use of reusable cups and follow the European Commission rules to reduce marine litter. [5]

Evidences of waste management



Figure 4. Waste Containers

4. Concluding remarks

Water management is a constant concern at UMinho taking into account that we are in a country severely affected by climate change and particularly with extreme drought. This is undoubtedly an essential issue in the definition of standards of quality of life of populations that we must necessarily project already in the short term.

There's still a long way to go. However, this path is clear and needs everyone's contribution so that the management of both water and waste is the best possible, in order to contribute decisively to the achievement of the goals of carbon neutrality defined by the European Union.

We must improve the relationship with the whole chain of waste collection, separation and processing so that it is possible for a more concrete definition of the circular economy in this area.

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