OPEN UNIVERSITY OF CYPRUS
www.ouc.ac.cy

Measuring Environmental Performance in Local Level in the framework of the targets set on Waste Framework Directive

Loizia Pantelista, Vassilis Inglezakis, Antonis A. Zorpas

Open University of Cyprus
Faculty of Pure and Applied Science, Environmental Conservation and Management
Lab of Chemical Engineering and Engineering Sustainability
Elected Member of OUC Senate
Email : pantelitsa-loizia@hotmail.com

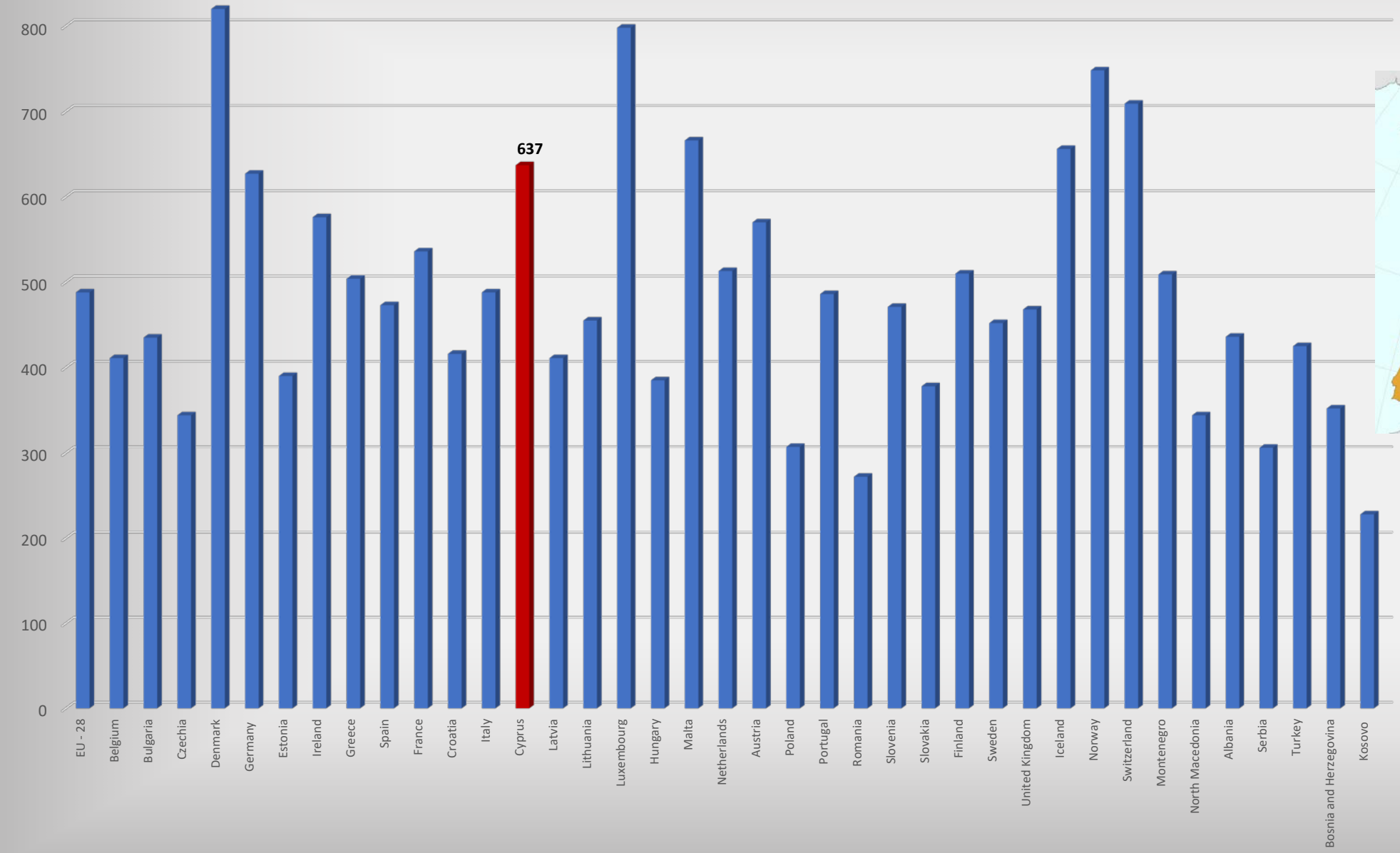

165
ΡΙΧΝΕΤΕ ΕΔΩ
HOTLINE
ΣΥΛΛΟΓΗ ΡΟΥΧΙΣΜΟΥ
CLOTHING COLLECTION

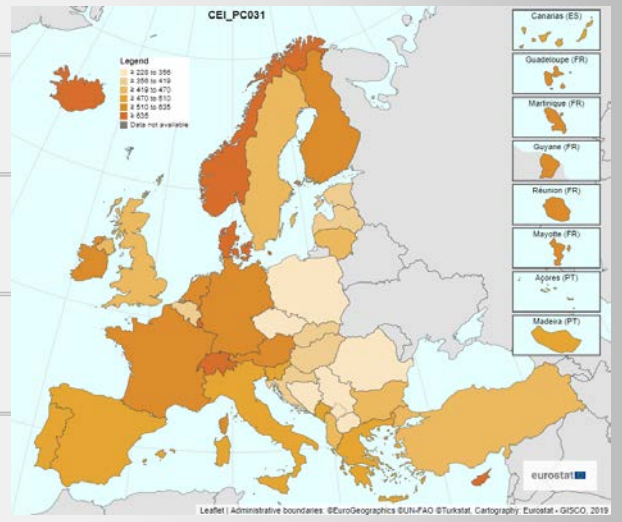

ΑΝΑΚΥΚΛΩΣΗ
MONO / ONLY
PMD
ανακύκλωση
μόνο χαρτί
paper only
YES
NO
green dot


ΑΠΟΦΑΣΙΣΕ
72 39 00
ΑΠΑΛΑΚΑΛΩ,
ΟΧΙ ΣΚΟΥΠΙΔ
ΑΜΕΣΑ
ΑΜΕΣΑ

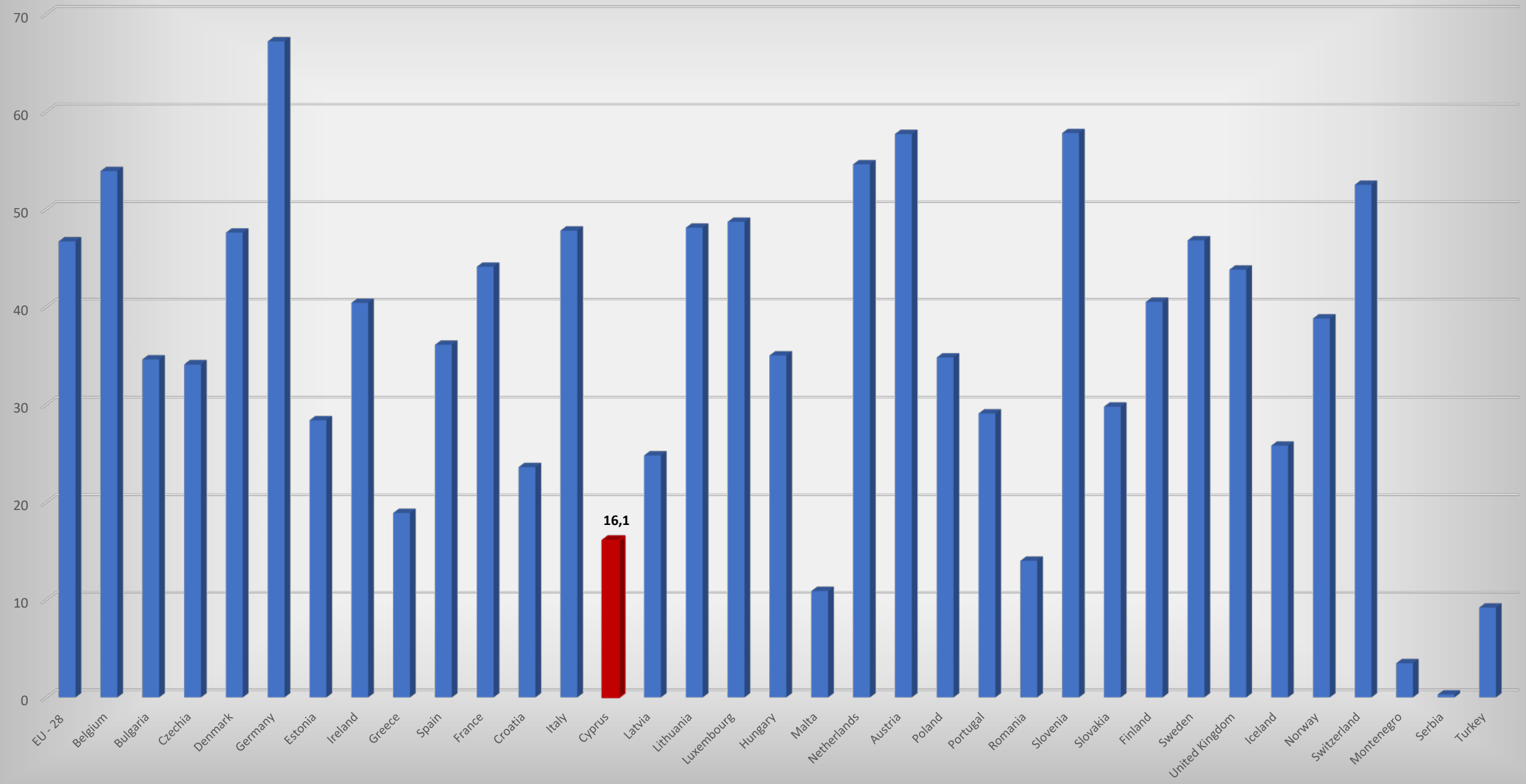
OPEN UNIVERSITY OF CYPRUS
www.ouc.ac.cy

Quantity of municipal waste generated per capita 2017 in Europe by country

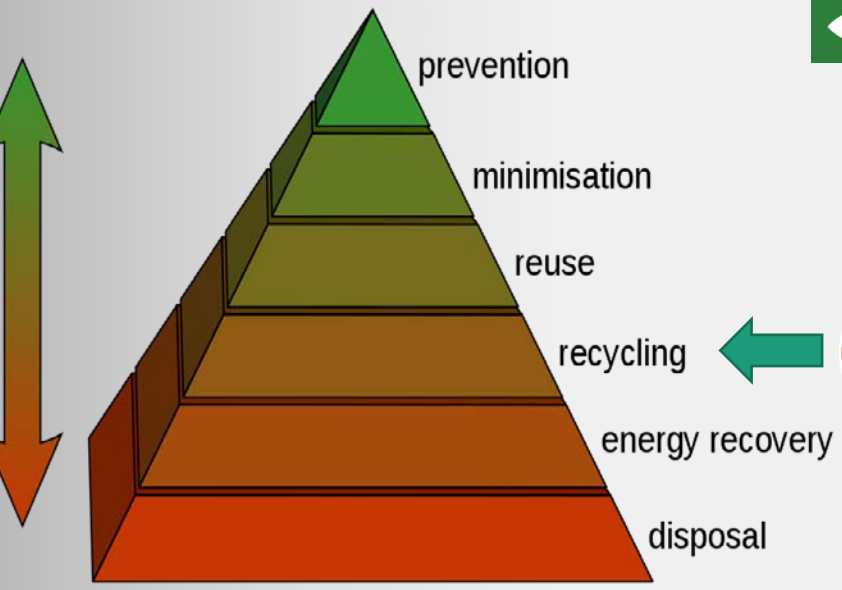




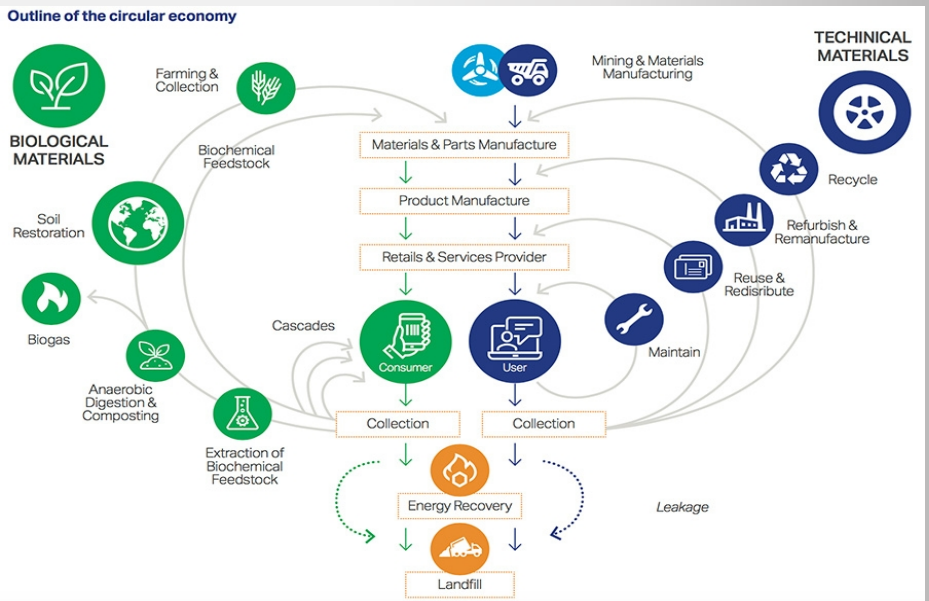
Recycling rate % in Europe by country 2017



OPEN UNIVERSITY OF CYPRUS
www.ouc.ac.cy



Waste strategy in local communities



- Legislative approach end of waste criteria
- Eco design products
- Products with external life -Critical minerals
- A common EU target for recycling 65% of municipal waste by 2035;
- A common EU target for recycling 70% of packaging waste by 2030;
- There are also recycling targets for specific packaging material
- andfill target to reduce landfill to maximum of 10% of municipal waste by 2035
- Separate collection obligations are strengthened and extended to hazardous household waste (by end 2022), bio-waste (by end 2023), textiles (by end 2025)
- Member States to take specific measures to tackle food waste and marine litter

OPEN UNIVERSITY OF CYPRUS
www.ouc.ac.cy

WASTE FRAMEWORK DIRECTIVE 2008/98/EC

Objectives:

- Separate collection for recyclables (paper, glass, plastic, metal)
- by 2020, the preparing for re-use and the recycling of waste materials such as at least paper, metal, plastic and glass from households and possibly from other origins as far as these waste streams are similar to waste from households, shall be increased to a minimum of overall 50 % by weight;
- by 2020, the preparing for re-use, recycling and other material recovery, including backfilling operations using waste to substitute other materials, of non-hazardous construction and demolition waste excluding naturally occurring material defined in category 17 05 04 in the list of waste shall be increased to a minimum of 70 % by weight.

OPEN UNIVERSITY OF CYPRUS
www.ouc.ac.cy

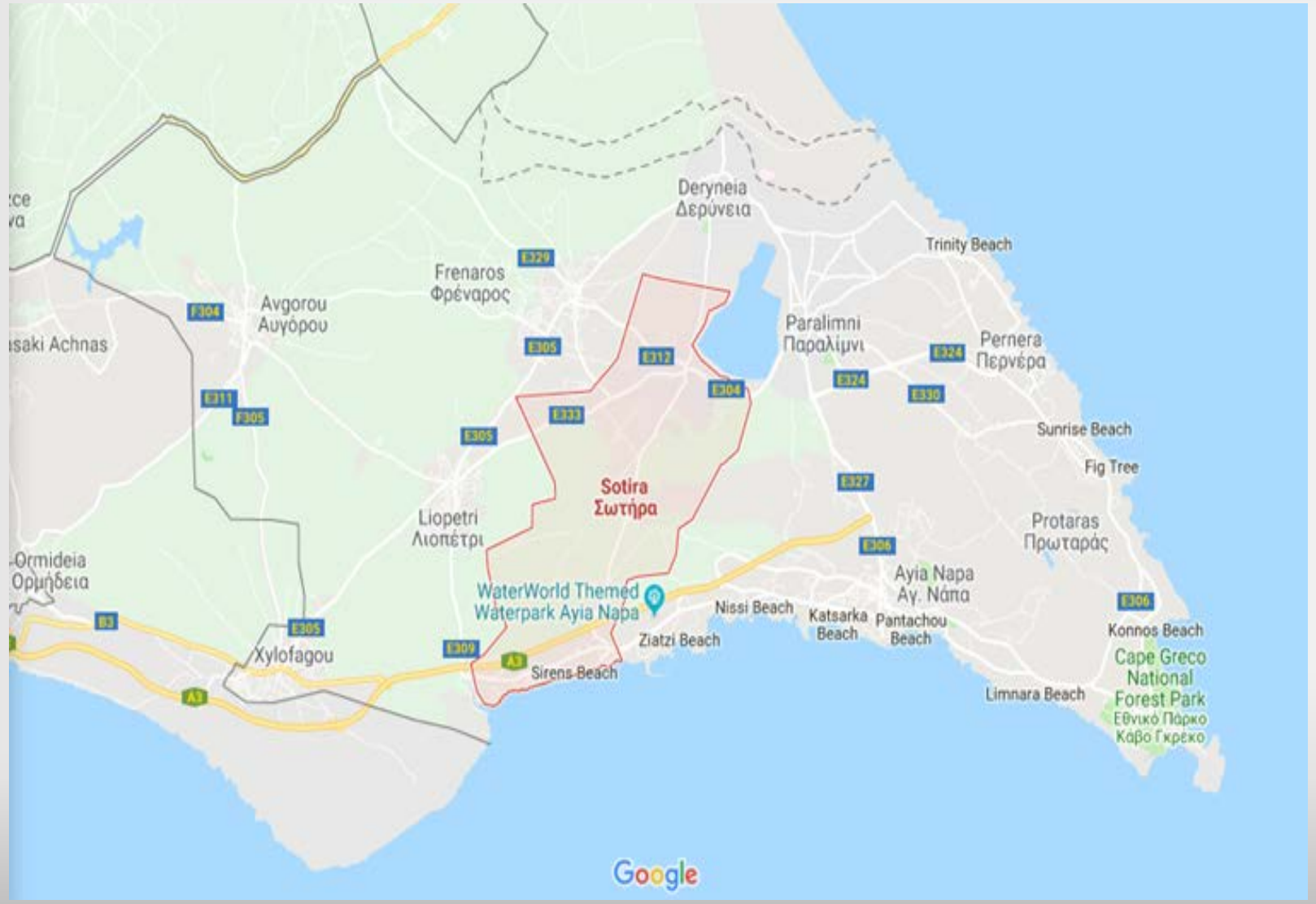
Directive (EU) 2018/851 amending Directive 2008/98/EC on waste

In order to comply with the objectives of this Directive, and move to a European circular economy with a high level of resource efficiency, Member States shall take the necessary measures designed to achieve the following targets:

- by 2025, the preparing for re-use and the recycling of municipal waste shall be increased to a minimum of 55 % by weight
- by 2030, the preparing for re-use and the recycling of municipal waste shall be increased to a minimum of 60 % by weight
- by 2035, the preparing for re-use and the recycling of municipal waste shall be increased to a minimum of 65 % by weight.

OPEN UNIVERSITY OF CYPRUS
www.ouc.ac.cy

Study Area– Sotira Municipality

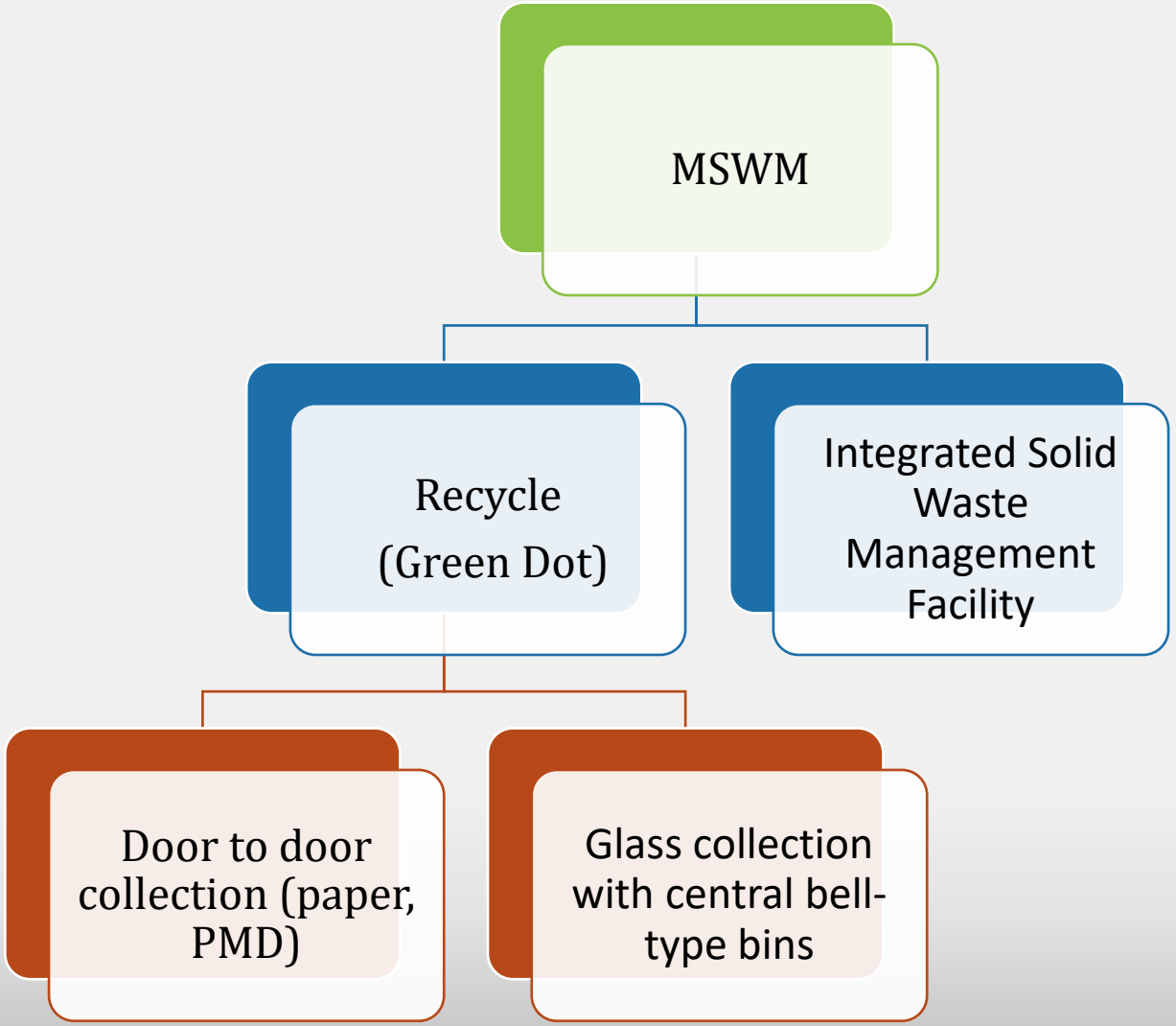


Population: 5474 residents

Households: 1900

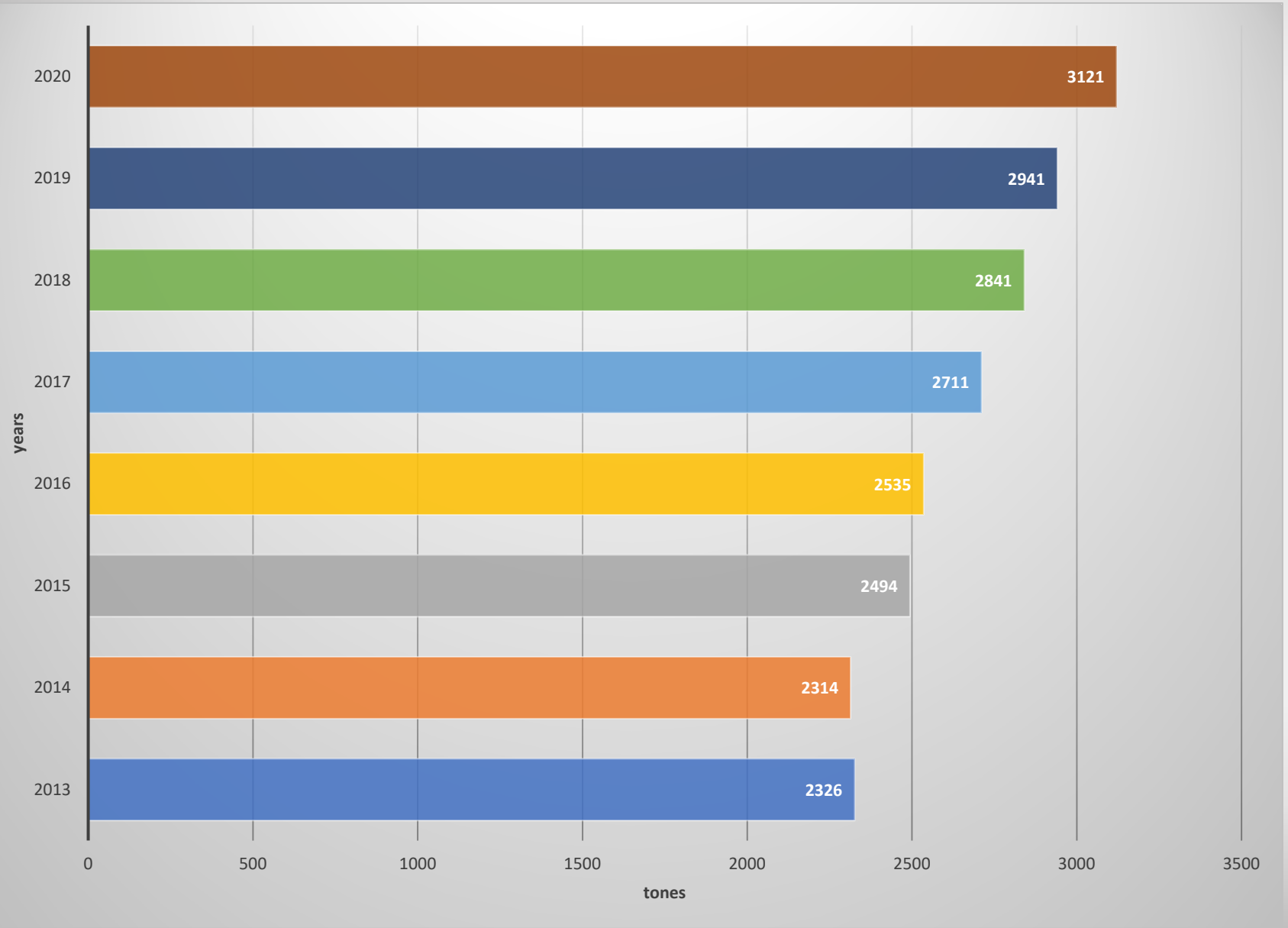
OPEN UNIVERSITY OF CYPRUS
www.ouc.ac.cy

Study Area– Sotira Municipality
State of the art in MSWM



OPEN UNIVERSITY OF CYPRUS
www.ouc.ac.cy

Integrated Solid Waste Management Facility



Quantities of waste collected and transported for treatment at the landfill site (2013-2020) amounted to 21 283 t, costing more than 1 383 800 €.

OPEN UNIVERSITY OF CYPRUS
www.ouc.ac.cy

Paper, PMD, Glass recycling
GREEN DOT CYPRUS

OPEN UNIVERSITY OF CYPRUS
www.ouc.ac.cy

Methodology

Waste Compositional Analysis

Standard ASTM D5231 92/2008

SWOT ANALYSIS

Identification of Environmental Performance Indicators (economic, environmental, social)

OPEN UNIVERSITY OF CYPRUS
www.ouc.ac.cy

WASTE COMPOSITIONAL ANALYSIS

Standard ASTM D5231 92/2008

Daily quantitative and qualitative analysis in specific streets of Sotira Municipality

(sampling period: 3 periods between October – December).

- Period A: 10/10 – 27/10, 1190 bin bags / 5826kg
- Period B : 30/10 – 15/11, 1120 bin bags / 5174kg
- Period C : 22/11 – 11/12, 1010 bin bags ς / 4352kg (fasting period)

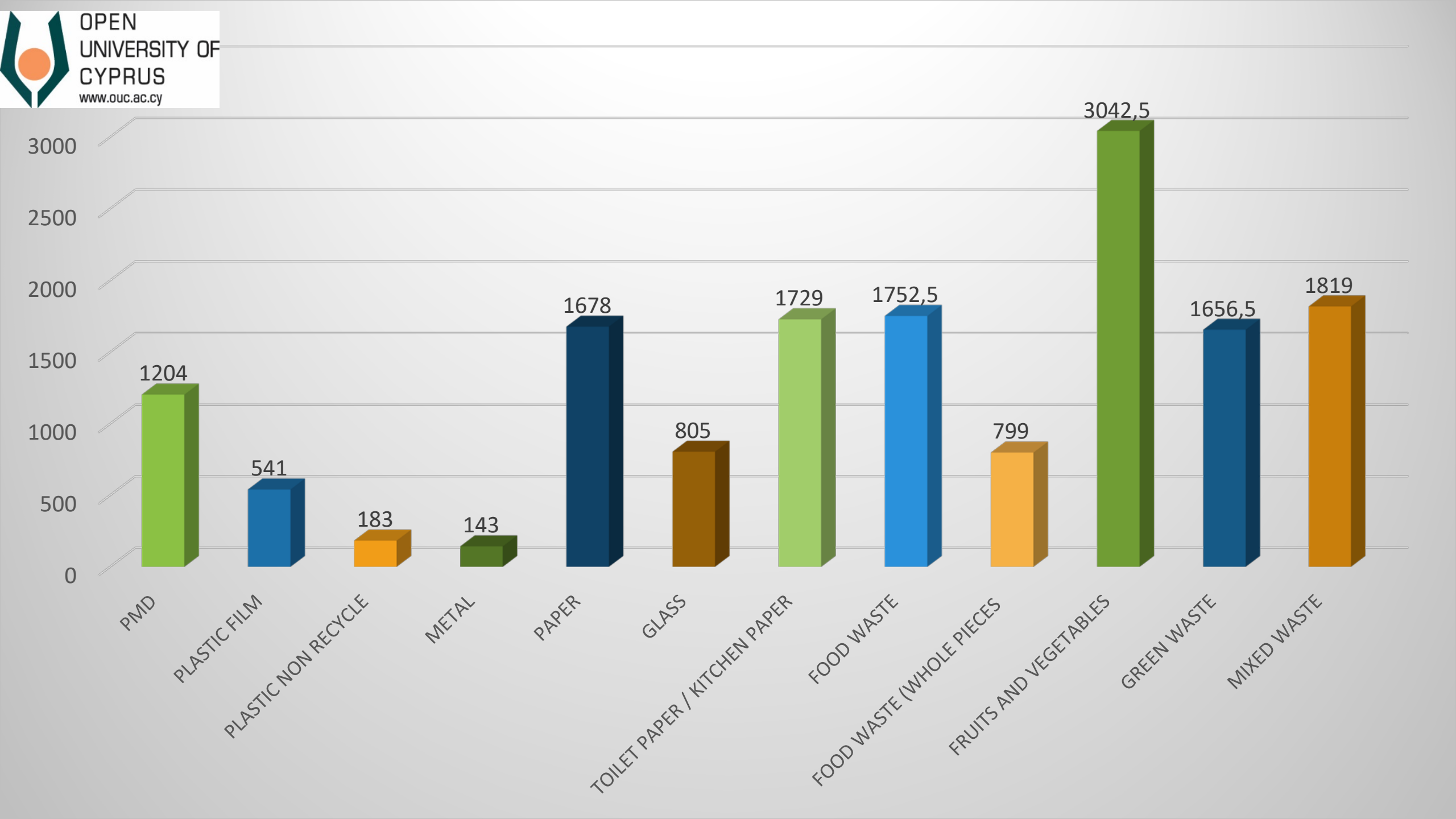
Total collected waste for 3 periods:
15352 kg / 3320 bin bags

OPEN UNIVERSITY OF CYPRUS
www.ouc.ac.cy

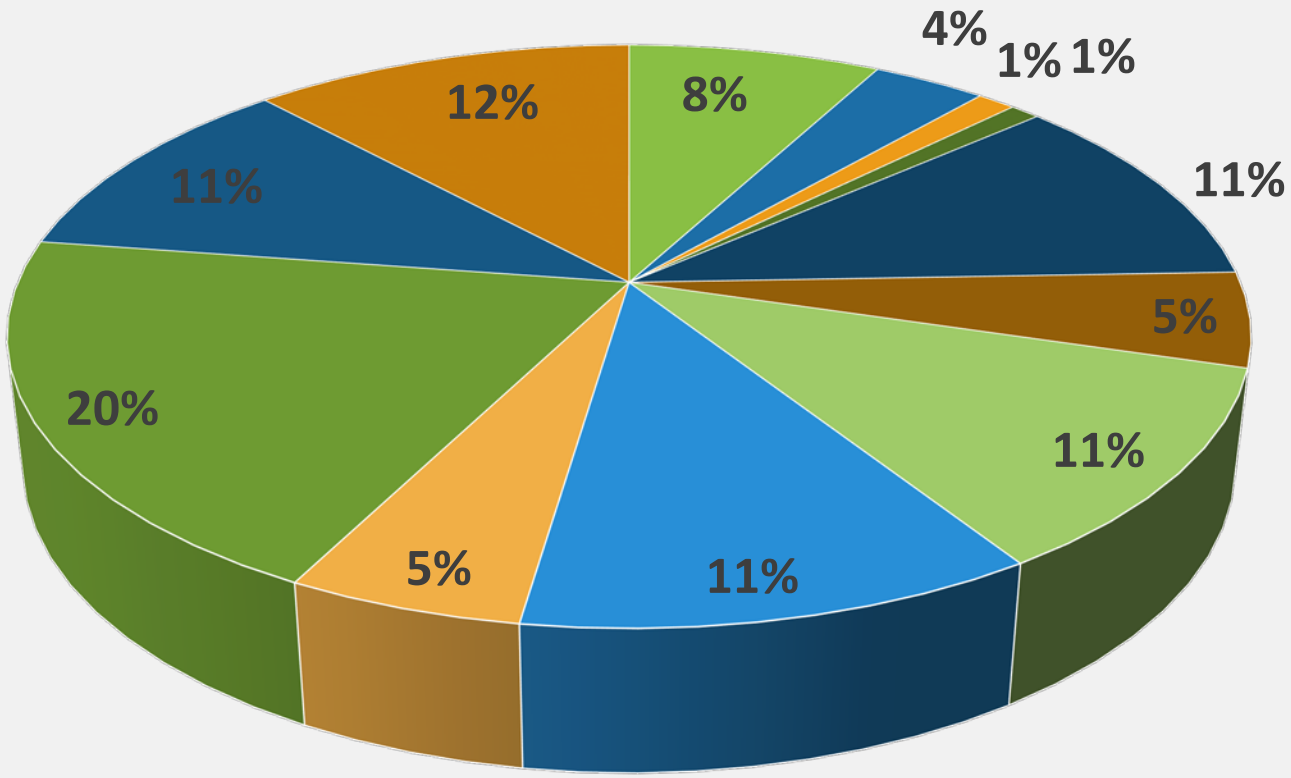
WASTE COMPOSITIONAL ANALYSIS RESULTS

CATEGORIES	PERIOD A	PERIOD B	PERIOD C	TOTAL
	%	%	%	%
PMD	5.77	10.18	7.85	7.8
PLASTIC FILM	2.91	4.42	3.29	3.5
PLASTIC NON RECYCLE	1.36	1.44	0.68	1.2
METAL	0.54	1.19	1.15	0.9
PAPER	9.29	11.49	12.46	10.9
GLASS	4.57	4.34	7.21	5.2
SANITARY	11.03	11.21	11.64	11.3
FOOD WASTE	8.01	14.20	12.67	11.4
FOOD WASTE (WHOLE PIECES)	4.74	6.82	3.91	5.2
FRUITS AND VEGETABLES	18.30	19.24	**22.54**	19.8
GREEN WASTE	19.14	6.97	4.16	10.8
TOTAL	14.36	8.51	12.45	11.8

OPEN UNIVERSITY OF CYPRUS
www.ouc.ac.cy



OPEN UNIVERSITY OF CYPRUS
www.ouc.ac.cy



WASTE MANAGEMENT PLAN PROPOSED

The analysis of the waste composition made in 2018 highlighted the major problem of the MSWM for Sotira Municipality

- 24 % for recycling (glass, paper, PMD)
- 36.4 % food waste
- 10.8 % green waste

ends up in the landfill, increasing both the environmental impact of the Municipality and its financial burden for collection and transportation.

OPEN UNIVERSITY OF CYPRUS
www.ouc.ac.cy

WASTE MANAGEMENT PLAN PROPOSED

1.	Development of a Prevention Action Plan for waste streams e.g. organic, paper, plastic bottles and bags, bulky.
2.	Home Composting
3.	Green Point (waste collection point)
4.	Pay as you Throw System
5.	**Development of awareness programs**

OPEN UNIVERSITY OF CYPRUS
www.ouc.ac.cy

STRENGTHS (S)

- Reduce the volume of waste end up in landfills
- Cost saving (transport costs, entry fees to landfills)
- Practices that have already been successfully implemented and have positive results
- The implementation of both recycling and composting is easy to process and requires no specialized knowledge
- The implementation of home composting is feasible due to the fact that a large number of houses have a yard
- Production of soil improvers that can be used in municipal parks and private gardens in place of chemical fertilizers
- Application of door to door collection results in very high purity of collected recyclable materials.
- Utilization of inter-municipal collaborations with the aim of separately collecting the stream of food waste and disposing it in common power plants
- There is a good level of education to adopt the actions
- Staff / employees willing to engage in the environmental management program of the Municipality

WEAKNESS (W)

- Deficiency in permanent staff (in number and specialization)
- Insufficient financial resources
- Lack of staff / volunteers for environmental awareness raising actions for the public
- Incorrect implementation of actions such as home composting can create problems such as causing odors and attracting insects and rodents
- The quality of the soil conditioner produced is based on the "quality" of incoming MSW
- The implementation of the PAYT requires specialized equipment with the consequent requirement of financial resources from the MunicipalityΟι Δημότες χρειάζονται συνεχή ενημέρωση και έλεγχο για την εφαρμογή των δράσεων
- The failure to implement an integrated management plan and the appropriate infrastructure for all waste streams results in the creation of small uncontrolled landfills within the Municipality
- Non-social acceptance of the implementation of the project (reactions either due to interests or ignorance)
- The introduction of many different actions at the same time can confuse the citizens

OPEN UNIVERSITY OF CYPRUS
www.ouc.ac.cy

OPPORTUNITIES (O)

- New job positions
- Saving Landfill Fee
- Exploiting financial opportunities
- Settlement of the competencies of the Municipalities so that they can implement the whole range of actions of the local management plans
- Compliance with environmental legislation
- Changing culture and creating environmental consciousness for the inhabitants of the Municipality
- Reduction of Fee Charges / Rewarding Municipalities engaged in Good Waste Management Programs / Economic Benefit
- Increasing the Environmental Performance of the Municipality

THREATS (T)

- Difficulty in finding a suitable piece of waste collection point to be created and licensed by state authorities
- The delay in the creation of the waste collection point will result in the non-diversion of specific waste streams leading to the landfill sites
- Political considerations which may jeopardize the implementation of the plan
- Reduced funding from the Government
- Possible lack of willingness of residents to cooperate in the management plan (e.g. implementation of domestic composting)
- No incentives
- The implementation of PAYT can lead to uncontrolled disposal of waste in empty fields and foreign property
- Fines / charges from failure to meet legal requirements for diversion of specific waste streams
- Future economic crisis may burden the system
- Increasing visitors / tourists can also lead to a dramatic increase in waste generated

SWOT correlated matrix table

		S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10
THREATS	10			√						√	√										
	9		√			√							√				√				
	8		√					√	√				√	√				√	√		√
	7																	√		√	
	6			√	√	√			√	√	√									√	
	5			√	√	√		√		√				√	√	√		√	√	√	√
	4			√								√	√				√		√		
	3			√					√		√									√	
	2			√									√						√		
	1																		√		
OPPORTUNITIES	10								√		√		√								
	9			√						√	√										
	8	√		√	√			√	√	√	√							√			
	7		√			√	√		√	√										√	
	6			√	√	√				√								√		√	√
	5					√		√			√										
	4		√	√															√		
	3												√				√				
	2	√	√						√												
	1			√								√		√				√			
		1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10
		STRENGTHS										WEAKNESSES									

- Opportunities with the related strengths (O-S),
- Opportunities per weaknesses (O-W),
- Threats with the related associate strengths (T-S) and
- Threats with the related weaknesses (T-W)

2 connections among O-W,
30 connections among O-S
24 connections among T-S
25 connections among T-W

OPEN UNIVERSITY OF CYPRUS
www.ouc.ac.cy

Environmental performance indicators (ECONOMIC, SOCIAL, ENVIRONMENT)

The assessment of Environmental Performance will be achieved through the use of indicators that will cover the three pillars of Sustainability:

Economic (implementation cost, resources saving)

Social (culture change)

Environmental (waste volume)

OPEN UNIVERSITY OF CYPRUS
www.ouc.ac.cy

TARGETS AND TIMELINE

ACTION	TARGET	TIMELINE		INDICATORS		
				ENVIRONMENTAL	ECONOMIC	SOCIAL
RECYCLE		2025	2030	Quantity of waste end up in landfill (t/y)	Cost saving from the reduction of waste end up in landfills (€ / y)	Percentage of participation in the program (households / y)
	Increase recycling rate from door to door collection	5%	5%	Reduction of CO2 emissions (t / y)		
HOME COMPOSTING		2025	2030	Quantity of waste end up in landfill (t/y)	Cost saving from the reduction of waste end up in landfills (€ / y)	Percentage of participation in the program (households / y)
	Implementation of home composting in all houses that have the required space	30% of houses	50% of houses	Reduction of CO2 emissions (t / y)		Percentage of required change of behavior of residents (1: High 2: Moderate 3: Low)
GREEN POINT (WASTE COLLECTION POINT)	development and licensing of a collection point	By 2020, all actions should be completed and fully operational by covering the entire population of the Municipality		Quantity of waste end up in landfill (t/y)	Cost saving from the reduction of waste end up in landfills (€ / y)	Percentage of required change of behavior of residents (1: High 2: Moderate 3: Low)
				Reduction of CO2 emissions (t / y)	Implementation cost(€)	

ΔΡΑΣΗ ΣΤΟΧΟΣ ΧΡΟΝΟΔΙΑΓΡΑΜΜΑ ΔΕΙΚΤΕΣ ΑΞΙΟΛΟΓΗΣΗΣ ΔΡΑΣΗΣ

ACTION	TARGET	TIMELINE	INDICATORS		
			ENVIRONMENTAL	ECONOMIC	SOCIAL
PAY AS YOU THROW	Implementation of the action	By 2021, the implementation of the system should be applied at a pilot level and, depending on the results, the Municipality should proceed to its full implementation.	Quantity of waste end up in landfill (t/y)	Cost saving from the reduction of waste end up in landfills (€ / y) Percentage of required change of behavior of residents (1: High 2: Moderate 3: Low) Implementation cost(€)	Percentage of required change of behavior of residents (1: High 2: Moderate 3: Low)
AWARENESS ACTIVITIES	Implementation of information and awareness actions in target groups	Before 2021, an integrated information program on all proposed actions to be implemented will be developed	Quantity of waste end up in landfill (t/y)	Implementation cost(€)	Population Participation Rate in Actions (1: High 2: Moderate 3: Low)

OPEN UNIVERSITY OF CYPRUS
www.ouc.ac.cy

CONCLUSION - PROPOSALS

- The implementation of home composting will prevent the flow of organic / green from the landfills and will also contribute to the creation of compost which will be useful for agricultural activities.

- For the food waste management, the Municipality should initially inform the catering establishments as they proceed to a separate collection and then, in cooperation with the neighboring Municipalities, to be sent to licensed plants for energy generation.

- The implementation of the PAYT will be the additional action that will contribute to the reduction of the produced MSWs and will give the Municipality an incentive / opportunity to consider their total contribution to the production of waste.

- The municipality should aim not only at informing but also at raising awareness by developing integrated programs in all the groups with an emphasis mainly on the school community.

The Management Plan should be sustainable and take into account the Framework Directive, the three pillars of sustainability - economic, social, environmental - and also adopt the concept of cyclical economy according to which waste can be converted into resources and come back to the consumer chain.

Publications

- Zorpas, A. A., Lasaridi, K., Voukkali, I., **Loizia, P**., Chroni, C., 2015. Household waste compositional analysis variation from insular communities in the framework of waste prevention strategy plans. *Waste Management*. 38, 3-11.

- Zorpas, A.A., Lasaridi, K., Pociovalisteanu, D.M., **Loizia, P.,** 2018. Monitoring and evaluation of prevention activities regarding household organics waste from insular communities. *Journal of Cleaner Production*.172, 3567 – 3577.

- **Loizia, P.,** Voukkali, I., Zopras, A.A., Pedreno, C.N., Chatziparaskeva, G., Inglezakis, V., Vardopoulos, I., Doula, M. 2021. Measuring the level of environmental performance in insular areas, through key performed indicators, in the framework of waste strategy development. *Science of the Total Environment.* 753, 141974.

OPEN UNIVERSITY OF CYPRUS
www.ouc.ac.cy

Thank you for your attention!!!

Pantelitsa Loizia
Chemical Engineer – Environmental Engineer
pantelitsa-loizia@hotmail.com