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Challenges for the Islands in the era of the Circular Economy

*The local plan for municipal solid waste management –
Aradippou Municipality*

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National Technical University of Athens

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Municipal Solid Waste (MSW) Management

- Collection, transport, treatment / recycling and disposal of Municipal Solid Wastes (MSW), have become a relatively difficult problem to solve for those responsible for their management.
- High transfer costs and low rates of separation at source, are the main reasons for potential planning failures.
- At the same time, legislation sets every year more demanding targets.
- Key objective should be the decentralization of solid waste management (municipality level).



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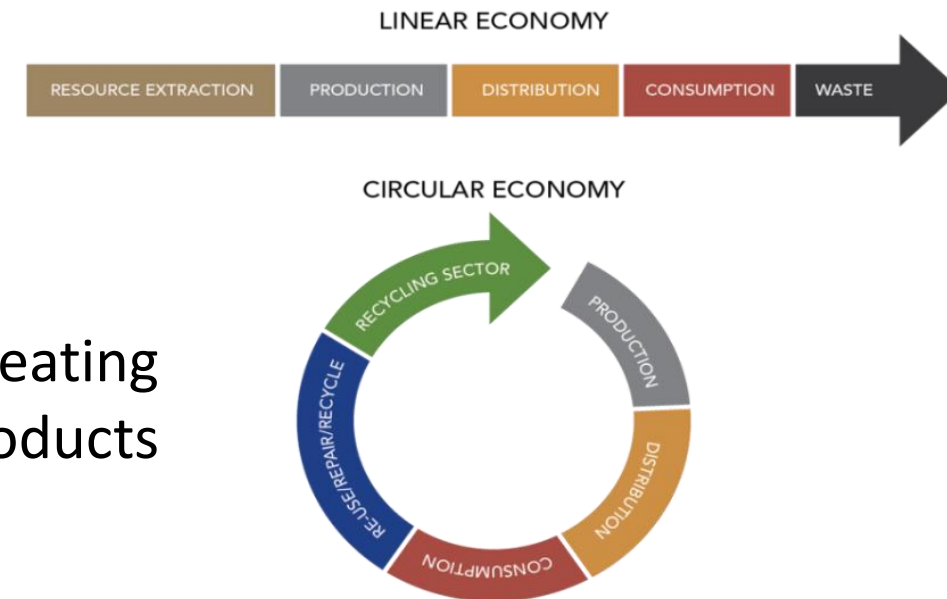
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Circular economy

- The value of products, materials and resources is maintained in the economy as much as possible.
- Waste generation is minimized
- Economy and competitiveness are strengthened by creating new business opportunities and introducing innovative products and services
- Economic, social and environmental benefits

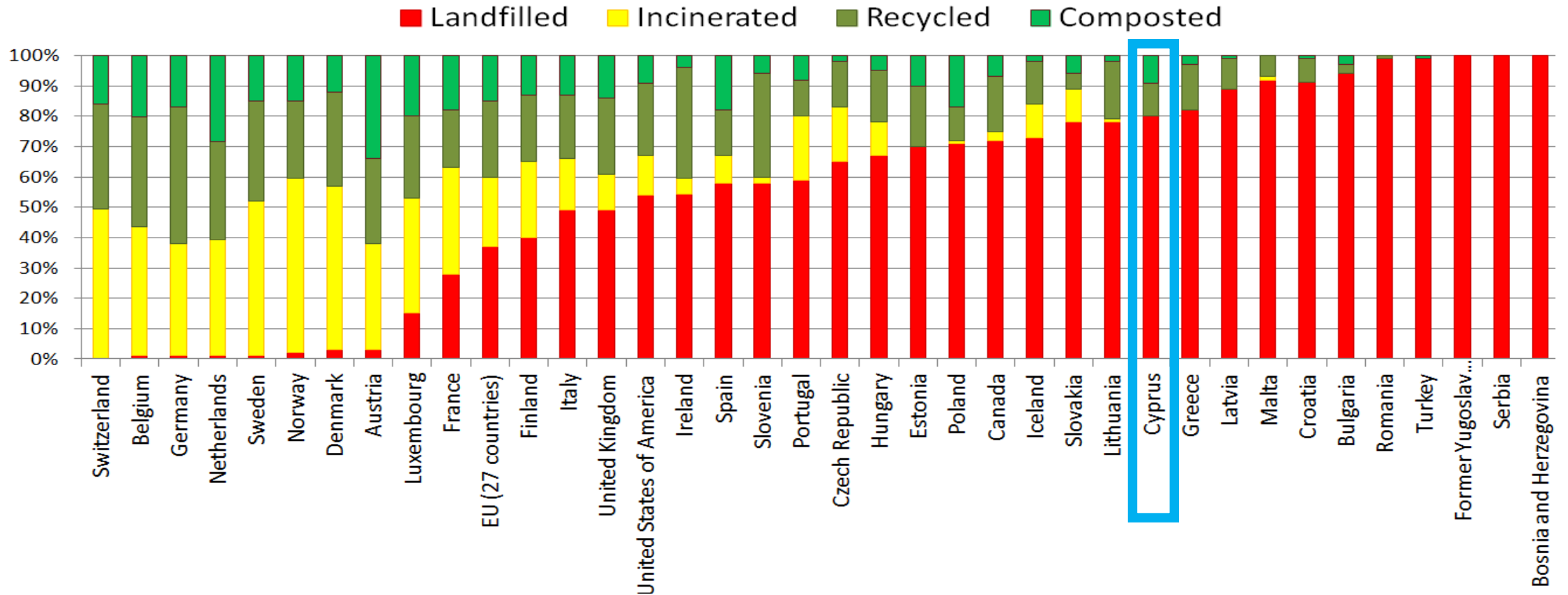




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Local Waste Management Plans (LWMP)

The basic contents are:

- Presentation of the legislation in force and the objectives deriving from it.
- Recording and evaluation of the existing situation for waste generation and management
- Quantification of source-separation and recycling targets.
- Development of various source-separation and recycling schemes.
- Establish a general budget for the implementation of the plan.
- Procedures for the approval & monitoring of the plan.

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Objectives and Obligations

•The objectives and obligations that have been set by the National Plan for waste management must be taken on board fully by all Municipalities

- Prevention of waste production
- Source separation & recycling **40% of MSW** by 2021 and 50% by 2027
- Source separation & recycling **15% of Biowaste** by 2021
- Source separation & recycling **50% of recyclable waste** by 2020
- Maximum amount of biodegradable waste that can be sent for landfilling is **95.000 tones**

THE WASTE HIERARCHY





Municipal Solid Waste generation

- Population of Aradippou Municipality = **22.500**
- Production of municipality solid waste (2017) = **8.899,77 t**
- Average annual production per resident = **400 kg/year – resident**

Municipal Solid Waste composition

- 38% Biowaste
- 40% Recyclable waste
- 22% Other waste

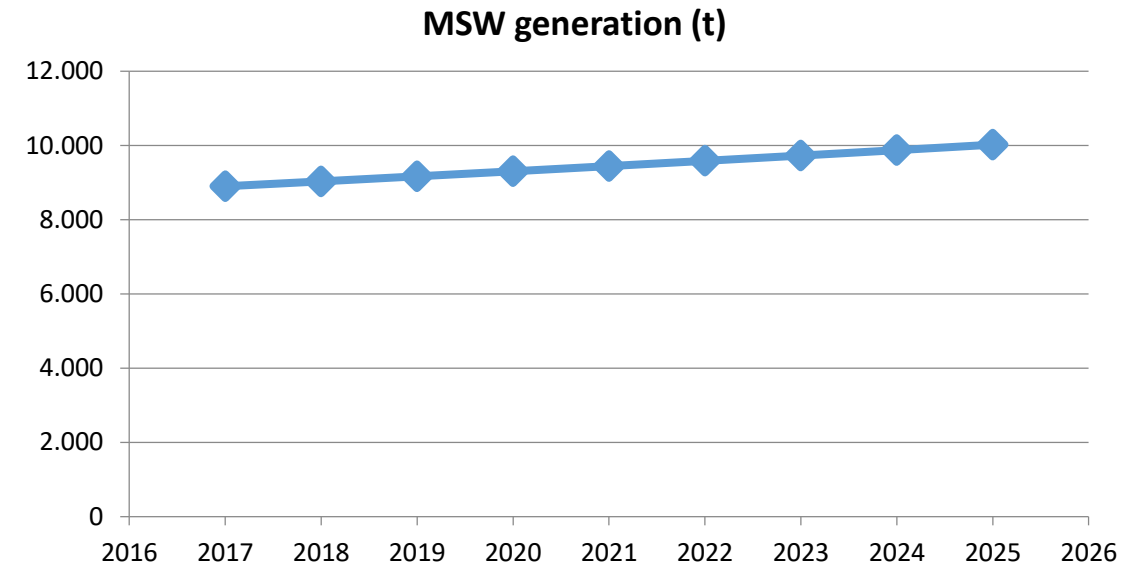




Future development of MSW generation

- 1,5% increase in MSW production is considered

Year	MSW generation, t
2019	9.169
2020	9.306
2021	9.446
2022	9.588
2023	9.731
2024	9.877
2025	10.026





MSW generation

Year	Total MSW, t	Biowaste, t		Recycling waste, t		Mixed MSW, t
		<i>~38% of MSW</i>	Total <i>(~39% of MSW)</i>	Packaging <i>(~25% of MSW)</i>	Other <i>(~14% of MSW)</i>	
2017	8.900	3.382	3.489	<i>2.242</i>	<i>1.247</i>	2.029
2018	9.033	3.433	3.541	<i>2.275</i>	<i>1.266</i>	2.060
2019	9.169	3.484	3.594	<i>2.310</i>	<i>1.285</i>	2.090
2020	9.306	3.536	3.648	<i>2.344</i>	<i>1.304</i>	2.122
2021	9.446	3.589	3.703	<i>2.379</i>	<i>1.323</i>	2.154
2022	9.588	3.643	3.758	<i>2.415</i>	<i>1.343</i>	2.186
2023	9.731	3.698	3.815	<i>2.451</i>	<i>1.363</i>	2.219
2024	9.877	3.753	3.872	<i>2.488</i>	<i>1.384</i>	2.252
2025	10.026	3.810	3.930	<i>2.525</i>	<i>1.405</i>	2.286





Current waste management structure

•Mixed waste

- Municipal cleaning services & private constructor responsible for the collection
- Transferred to the Integrated Solid Waste Management (IWMF/OEDA) of Kochi



•Recyclable waste

- The collective waste management system (Green Dot Cyprus) responsible for the collection and management since 2009
- Collection to bins or door-to-door



•Bulky and Green waste

- Transferred to the Green Points in Larnaca-Famagusta by citizens
- If it is not possible, municipal cleaning services are responsible for the transfer to IWMF/OEDA





Waste management cost

- Total expense for waste management (2017): **1.266.000€**
- Total MSW generation: **8.900 t**
- Annual cost per resident: **56 €/year – resident** or **142 €/t**

• It should be underlined that at the end of 2018, the operation of the Green Point in Larnaca-Famagusta started, funded by government.

Expenditure category	Expense (€)
Payroll	323.304
Contractor cost	92.004
Repair & maintenance (vehicles)	62.208
Other collection costs	47.520
Other department's costs	193.081
Reductions & deletions of waste	16.316
OEDA Kochi	284.215
Management costs	47.955
Other costs	4.633
Green Point costs	188.531
TOTAL	1.265.767





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Evaluation of the current waste management

- ✓ The overall assessment of the current situation is positive
- ✓ Collection frequency at regular intervals
- ✓ The citizens follow the Municipality's program with slightest deviations
- ✓ The annual production per resident of MSW is one of the lowest in Cyprus
- ✓ The percentage of recyclable waste derived from separation at source is relatively low (about 18% of the total recyclable waste). It should be increased as soon as possible in view of the new legislation
- ✓ The participation of a private contractor in the mixed waste collection positively affects the final balance

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Quantification of source-separation and recycling targets

Year	Total MSW, t	Generated Biowaste, t <i>~38% of MSW</i>	Biowaste to be separated, t		Recycling waste, t		Mixed MSW t	
			<i>% of generated biowaste</i>	t	<i>~39% of MSW</i>	<i>% of generated recyclables</i>		
2019	9.169	3.484	10%	348	3.541	45%	7.228	
2020	9.306	3.536	12%	424	3.594	50%	7.085	
2021	9.446	3.589	15%	538	3.648	50%	7.084	
2022	9.588	3.643	15%	546	3.703	50%	7.191	
2023	9.731	3.698	15%	555	3.758	50%	7.297	
2024	9.877	3.753	15%	563	3.815	50%	7.407	
2025	10.026	3.810	15%	571	3.872	50%	7.519	
	(100%)		< ----- (25%) ----- >					(75%)





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European experience has shown that segregation at source of biowaste can rise to more than 15%.

In municipalities with door-to-door systems, the rate of source-separation exceeds 70% and in some cases, it reaches 90%.

Regardless of the recycling that will be achieved in the Green Points, the Municipality of Aradippou is proposed to lead the way and **gradually target to a diversion rate close to 70%.**

The following table shows the new proposed targets.

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Quantification of source-separation and recycling **UPDATED / PROPOSED** targets

Year	Total MSW, t	Generated Biowaste, t		Recycling waste, t		Recycling waste to be separated, t		Mixed MSW
		~38% of MSW	% of generated biowaste	t	~39% of MSW	% of generated recyclables	t	
2019	9.169	3.484	15%	523	3.541	45%	1.593	7.053
2020	9.306	3.536	30%	1.061	3.594	50%	1.797	6.448
2021	9.446	3.589	45%	1.615	3.648	60%	2.189	5.642
2022	9.588	3.643	50%	1.822	3.703	65%	2.407	5.360
2023	9.731	3.698	60%	2.219	3.758	70%	2.631	4.882
2024	9.877	3.753	70%	2.627	3.815	70%	2.671	4.579
2025	10.026	3.810	70%	2.667	3.872	70%	2.710	4.649
	(100%)	< ----- (54%) ----- >						(46%)





Cost – Benefit Analysis

• Three main scenarios for waste diversion

1. Scenario 1: **Business as usual** - low rates of diversion for recyclable waste & zero rates for Biowaste
2. Scenario 2: **Achieve the legislation's rates**
3. Scenario 3: Higher diversion and recycling rates (**70% for Biowaste – 70% for recyclable waste**)

	Total Cost (€)	Cost per tone (€)	Cost per resident (€)	% Reduction
Scenario 1	1.250.880	125	54	-
Scenario 2	1.129.630	113	49	-10%
Scenario 3	995.805	98	43	-22%

The benefit of implementing segregation at source is not only ecological but also financial





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From the previous table we conclude that the benefit of implementing Segregation at Source and Recycling Schemes, is not only environmental but also financial.

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Targeted Actions

- Prevention & Re-use actions
- Separate Biowaste collection & domestic composting
- Reinforcement of source separation for recyclable & other waste
- Pay as You Throw System
- Awareness campaigns
- Monitoring & Control System



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Indicative Plan

- In the Municipality there are about 5.400 detached houses & 180 blocks.
- There are 6.500 households.
- The average size of each household is 3,5 people.

In addition to Biowaste collection, it is proposed that 500 detached houses receive a domestic composter to manage their own waste. Accordingly, also to meet the requirements of the Municipality the necessary bins are as follows:

- Number of 10 – liter bins: 6.500
- Number of domestic composters (detached houses): 500
- Number of 40 – liter bins (detached houses): 4.900
- Number of 120 – 600 liter bins (blocks): 180

10-liter bins	40-liter bins	120-660 liter bins	Composters	50-liter bins	1.100-liter bins
6.500	5.000	180	500	100	100





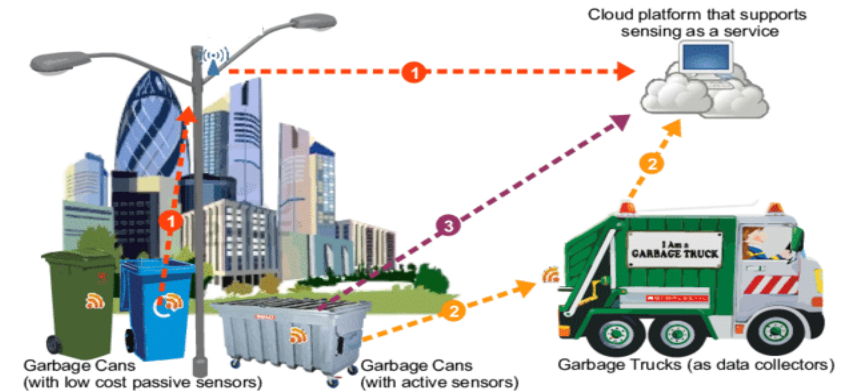
General Budget of Local Plan implementation

- Estimated cost of acquisition of equipment
 - **40€ / resident** (low enough)
 - It may be increased if innovation systems (ICT: Information & communications technology) are implemented in the bins or in the PAYT system

- Future Stages
 - ICT solutions (Information & communications technology) should be examined:
 - ✓ Smart bins
 - ✓ Smart routing of collection vehicles

The above mentioned is also linked with the Smart City concept, which is now a one-way development model.

Type	Number	Cost (€)
Supplementary bins, composters, biodegradable bags	As mentioned before	~ 400.000
Biowaste collection vehicles	2 (minimum)	~ 150.000
Green Points	Through study	~ 200.000
Information actions	Initial cost	~ 100.000
Advisory support services		~ 100.000
TOTAL		~ 950.000





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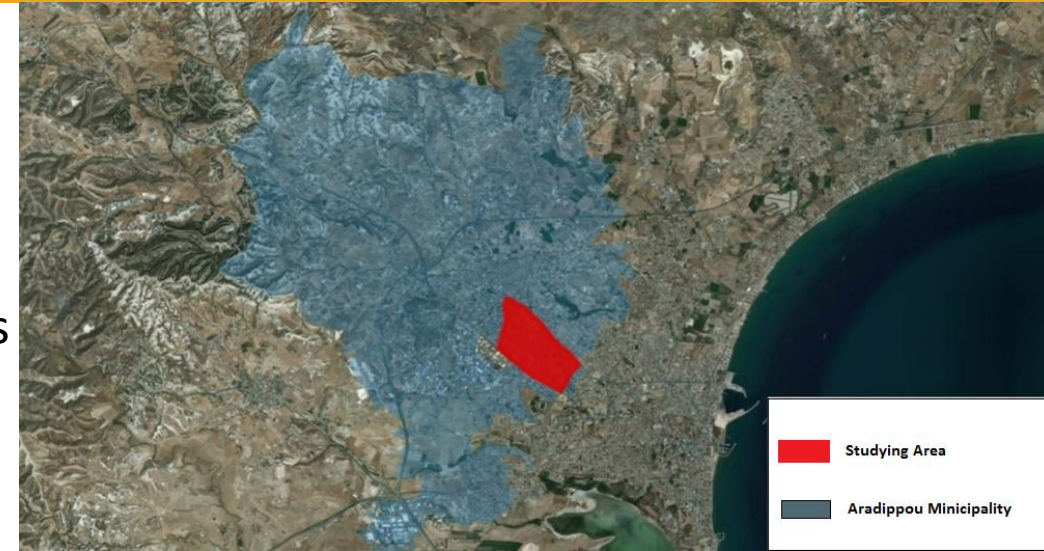
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Pilot implementation program

- Studying Area: part of Agios Fanourios neighborhood
- Current population: **4.500 residents**
- Consists of 32 blocks with 280 households, 1.250 detached houses & various stores



- The design of the source separation system of recyclable materials (reinforcement) and biowaste (onset) will be studied extensively
- Enhance citizens awareness on waste reduction & the separation at source
- Useful conclusions will be drawn from the implementation of pilot program, for the broad application of the Local Plan

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- The food waste will be placed in the kitchen bin, in a biodegradable bag
- When it is filled, it will be transferred to an outer bin

- A 10-liter bin for households (inside the house)
- A set of biodegradable bags
- 40 – 660 liter collection bins (near households/blocks)



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Implementation of the local plan for MSW management in Aradippou Municipality

•Stage A – Design the strategy and consolidation of the pilot system

- Approval of local plan
- Design & Implementation of pilot system
- Public awareness raising and information

•Stage B – Implementation of the local plan throughout the Municipality

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Thank you for your attention



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