Optimisation of local waste management systems by promoting waste sorting at source and rationalising waste collection routes

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8th International Conference on Sustainable Solid Waste Management

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Pilot area

Northern Greece, Central Macedonia

- Municipality of Thermi

- Municipality of Kalamaria

Study carried out by

- ANATOLIKI SA-Development Agency of Eastern Thessaloniki's Local Authorities
- Aristotle University of Thessaloniki-Laboratory of Heat Transfer and Environmental Engineering

Aim

- Transformation to resilient cities

- Promotion of circular economy model

- Waste management cost reduction

- Harmonisation with EU Waste Management framework

- Update of waste collection routes

- Accurate data regarding waste generation and composition

Methodology

Phase1

- Recording of current situation on waste temporary storage network (number of waste bins, pavement recesses)
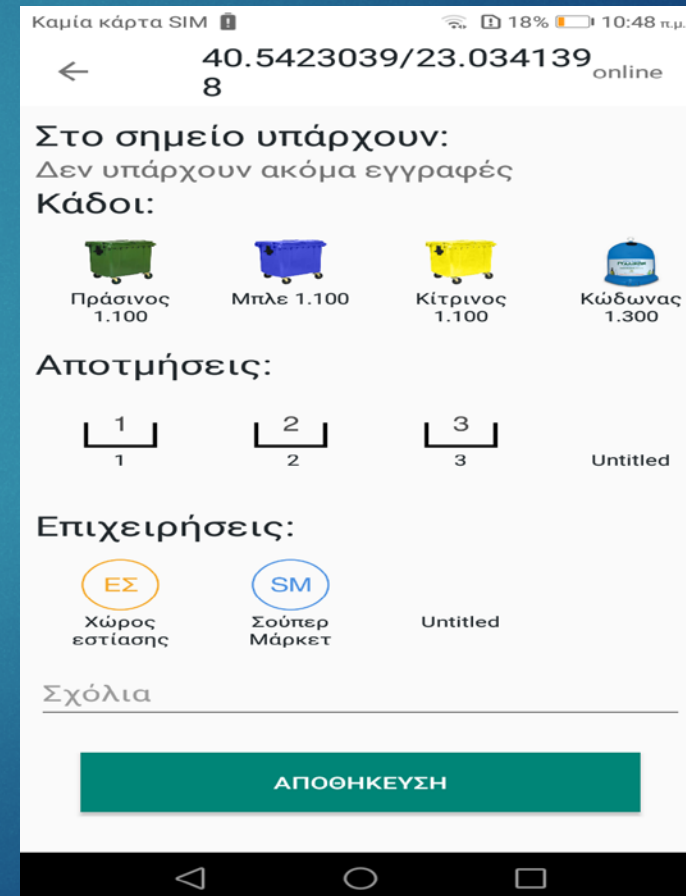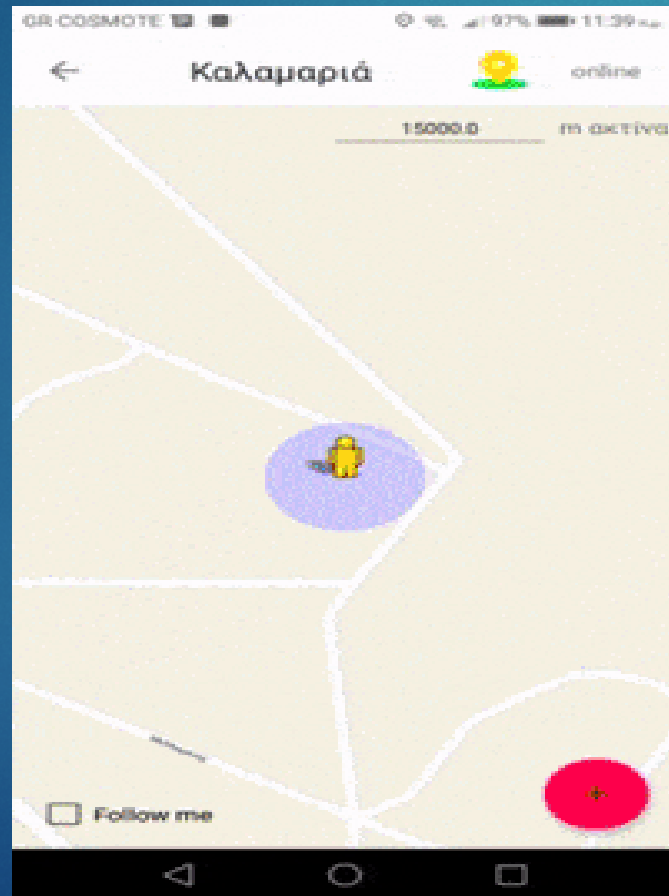
Means
Geographic Information Systems and cartographic software/ Android application

Results
- Exact geographical position of waste bin/recesses
- Market areas (paper generation)
- Restaurants (organic waste generation)
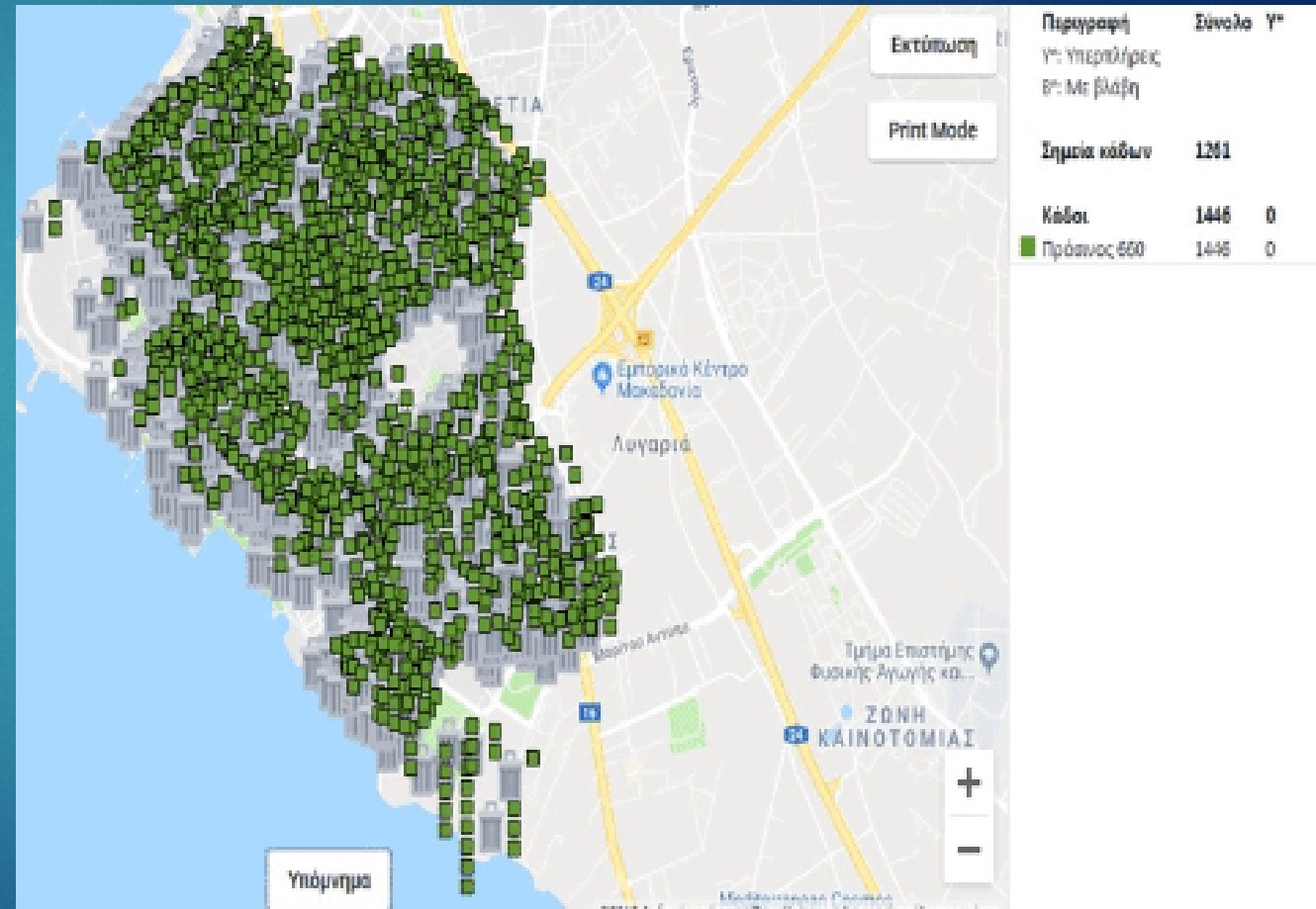
Methodology

Phase1

Methodology

Phase1

Web GIS platform

Waste storage network
- Mixed waste
- Organic waste
- Glass
- Packaging waste
- Paper
- Pavement recesses

https://anatolikirecycling.firebaseapp.com/

Methodology

Phase 2

- Qualitative analysis of three waste streams – mixed and packaging waste and residues in two different periods (winter and summer time)

Means
- Experienced staff
- Fully equipped and authorized sorting area
- Representative samples of waste bins

(7,5 t and 5,7 t of waste from Kalamaria and Thermi respectively)
- Calibrated weighing instruments
- 22-month period 2018-2019

Methodology

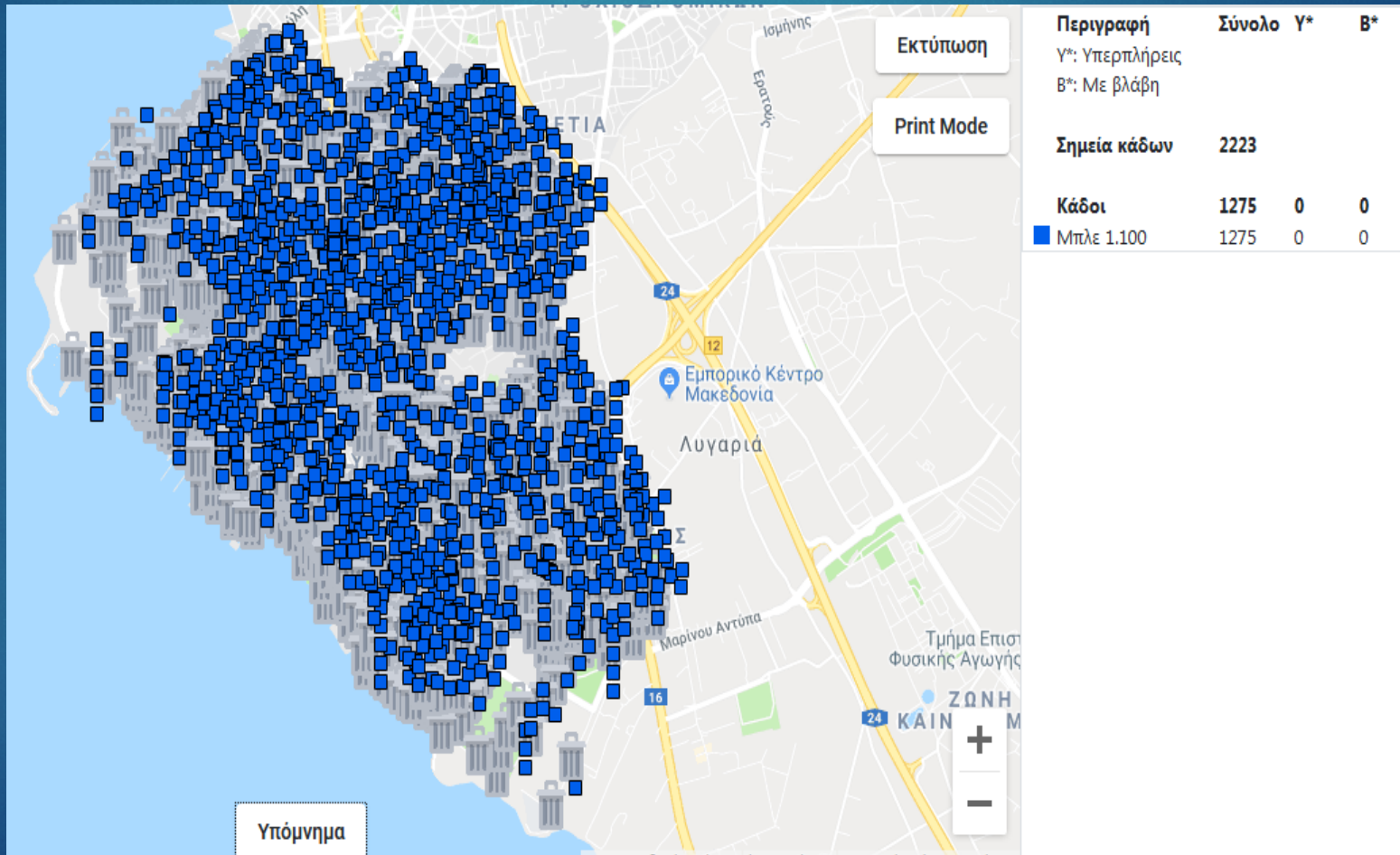Phase 2

Methodology

Phase 3

- Optimisation of waste management systems

Means
- Population growth: $P_k = P_0(1 + r/100)^k$
- Economic development: National Statistical Authority study
- Daily waste generation rate: W=p* WGR
- Waste bins fullness: $\sigma = \dfrac{[Volume/(Number\ of\ Bins\ /\ waste\ collection\ route\ )]}{Bin\ capacity}$

- Waste bins needed: $\Sigma XK = n \times V_k \times \sigma \Rightarrow n = \dfrac{\Sigma XK}{V_k \times \sigma}$

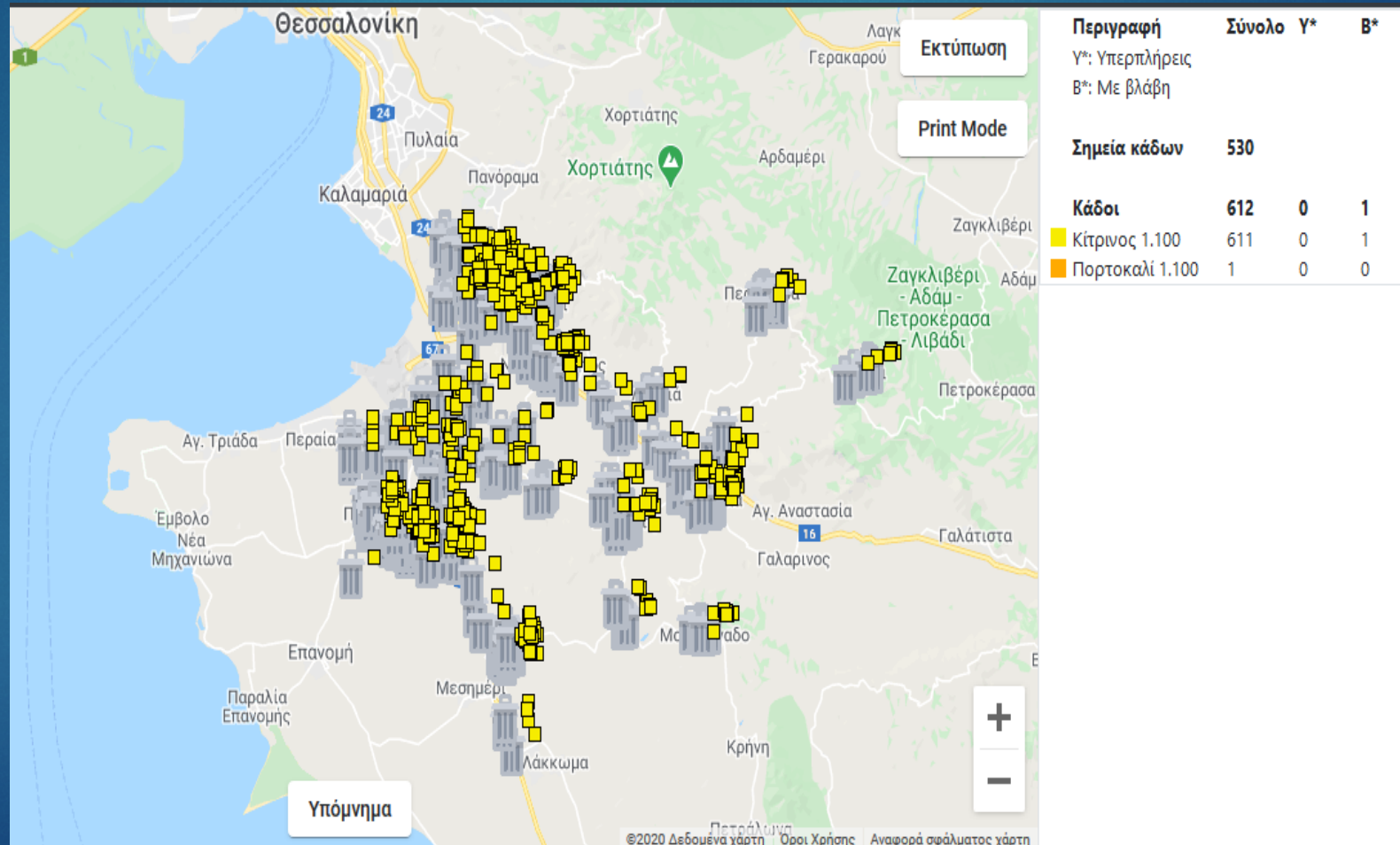- Waste collection route time: $T_r = t_1 + (n_b \times t_p / 60) + t_2 + t_3$

Results

Phase 1

Results

Phase 1

Results

Phase 2 – Thermi Municipality

Waste	Average (%) summer	Average (%) winter	Average (%)
Organic	90,25%	80,42%	85,33%
Paper/carton	1,63%	4,07%	2,85%
Plastic	2,16%	8,19%	5,18%
Metals	0,23%	1,68%	0,95%
Glass	0,00%	2,30%	1,15%
Other	5,73%	3,34%	4,53%

Results
Phase 2 – Kalamaria Municipality

Waste	Average (%) summer	Average (%) winter	Average (%)
Organic	88,38%	80,23%	84,31%
Paper/carton	1,34%	4,41%	2,88%
Plastic	2,32%	7,13%	4,73%
Metals	0,56%	1,42%	0,99%
Glass	0,19%	1,91%	1,05%
Other	7,44%	4,89%	6,17%

Results

Phase 2 – Recyclable waste management unit (residues)
* common for the municipalities of Thermi and Kalamaria

Waste streams in residues	Winter (%)	Summer (%)	Average (%)
Organic	27,70	17,67	22,69
Paper	2,79	2,49	2,64
Plastic	4,37	3,90	4,14
Glass	0,15	0,13	0,14
Aluminum	0,32	0,28	0,3
Metals	0,07%	0,07	0,07
Other*	64,60	75,46	70,02
TOTAL	100	100	100

Results

Phase 3 – Required waste bins for Thermi municipality

Waste stream	Number of bins 2020	Number of bins 2023
Mixed waste	2.200	1.947
Organics	400	1.482
Paper/cardboard	402	621
Plastics/metals	397	528
Mixed recyclables	500	-
TOTAL	3.899	4.578

Results

Phase 3 – Required waste bins for Kalamaria municipality

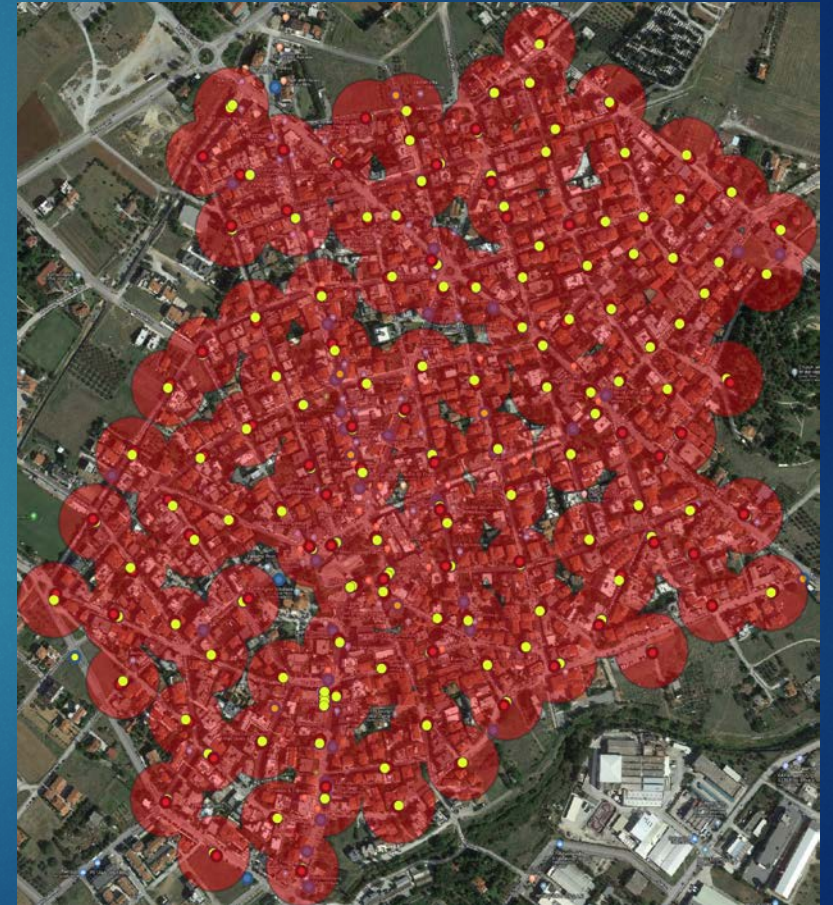| Waste stream	Number of bins 2020	Number of bins 2023
Mixed waste	2.280	2.046
Organics	400	1.832
Paper/cardboard	140	642
Plastics/metals	-	618
Mixed recyclables	1.150	-
TOTAL	4.588	5.138

Results

Phase 3 – Optimisation of waste storage network
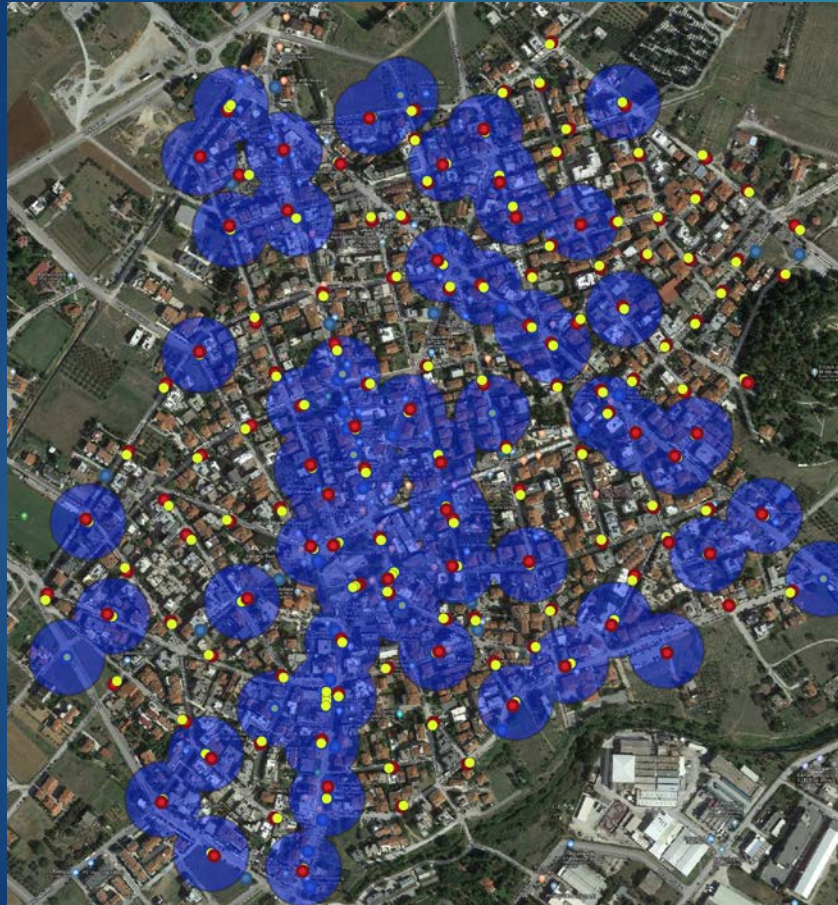
2020

Optimised
dispersion of
waste bins

2023

Results

Phase 3 – Optimisation of waste storage network 2023

Results

Phase 3 – New waster collection zones   2023

Conclusions

- Organic waste represent almost 80% of the total generated waste
- Thermi and Kalamaria are considered pioneers among Greek municipalities in this issue
- This study revealed the need for organic waste separate collection
- the waste bins are proposed to be installed in groups including all the waste streams (mixed, packaging, paper, organic, plastic/metals and glass)

Thank you for your attention!

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