The untapped potential

BIC-ZWE report, Update 2024

The status of bio-waste management in Europe: The distance to target and the need to improve separation of bio-waste

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CIC . Italian Composting and Biogas Association

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BIC/ZWE Report

- EU policy drivers for bio-waste
- Results for EU27 (+ UK, NO)
  - Current capture levels
  - Comparison to potential
- A few best practices
- Country fact-sheets

https://zerowasteeurope.eu/library/bio-waste-generation-in-the-eu-current-capture-levels-and-future-potential-second-edition/

Why a focus on bio-waste?

- Fundamental to meet the EU material recovery targets (65% “preparation for recycling and reuse” by 2035)
- At the crossroads of various env policies (waste, CAP, climate change…)
- Obligation for separate collection (art. 22 WFD)

The key role of organics (*food waste*!)

- QUANTITATIVE: fundamental to achieve highest material recovery rates
- OPERATIONAL: minimising food scraps in residual waste makes it possible to cut collection rounds
  - cost-optimisation
  - further driving effect for increased separation of dry recyclables, too)

Biowaste strategies in EU Countries

- Mandatory separate collection
  - Germany (2015)
  - Netherlands (1995)
  - Italy (2021)
  - Catalonia (Spain)
  - …many more aligning (art 22 WFD)
- Targets
  - Recycling targets
  - Biowaste targets (Sweden)

Where may food waste be found

	Food waste in mass %	
	(Gusia, 2012)	(Hübsch and Adlwarth, 2017)
Residual waste	37	33
Biobin	42	34
Home composting	9	9
Feeding	4	6
Sewerage	8	14
Others		3

Adopted unit generation rates
(kgs.person.year)

Food waste generation:

EU Fusions project, adapted with national specific literature if available

Table 1: Estimates of food waste in EU-28 in 2012 from this quantification study; includes food and inedible parts associated with food.

Sector	Food waste (million tonnes) with 95% CI*	Food waste (kg per person) with 95% CI*
Primary production	9.1 ± 1.5	18 ± 3
Processing	16.9± 12.7	33 ± 25
Wholesale and retail	4.6 ± 1.2	9 ± 2
Food service	10.5 ± 1.5	21 ± 3
Households	46.5 ±4.4	92 ± 9
Total food waste	**87.6 ± 13.7**	**173 ± 27**

**Confidence interval*

EU 28	**116.7**	Estonia	111.8	Latvia	107.4	Romania	127.7
Austria	118.5	Finland	102.0	Lithuania	121.4	Slovakia	84.4
Belgium	105.7	France	122.3	Luxembourg	118.3	Slovenia	108.4
Bulgaria	80.2	Germany	94.4	Malta	113.3	Spain	144.0
Croatia	84.4	Greece	142.7	Netherlands	111.8	Sweden	105.7
Cyprus	79.8	Hungary	110.0	Norway	78.8	United Kingdom	118.1
Czech Rep	93.7	Ireland	118.2	Poland	112.0		
Denmark	103.5	Italy	127.7	Portugal	127.2		

Garden waste

- Assumption - garden waste varies with:
  - housing type
  - climatic conditions
- Potential captures:
  - Not targeting highest captures for garden waste: *where there's garden waste, there's a garden where households may try home composting*.
  - Also some food waste may be handled through home composting, although a large quantity requires separate collection, above all in urban areas

	Northern / continental climate	Mediterranean climate
Cities	40	10
Towns and suburbs	160	50
Rural	200	100

Theoretical Potential

Food waste and Biowaste

		FOOD WASTE GENERATION (THEORETICAL POTENTIAL)		BIO-WASTE GENERATION (THEORETICAL POTENTIAL)
	POPULATION, JAN 2022 (EUROSTAT)	ADOPTED UNIT VALUE Kgs/person/year	TONNAGE	BIO-WASTE (tonnes)
EU 27	**446.820.419**	**116.7**	**52.157.348**	**98.226.506**
EU 27+	**519.841.689**	**115.5**	**60.034.680,8**	**113.738.053**
AUSTRIA	8.978.929	118.5	1.064.228	2.304.038
BELGIUM	11.617.623	105.7	1.227.983	2.781.491
BULGARIA	6.838.937	80.2	548.449	2.304.038
CROATIA	3.862.305	84.4	326.088	867.429
CYPRUS	904.705	79.8	72.200	107.140
CZECHIA	10.516.707	93.7	985.878	2.441.390
DENMARK	5.873.420	103.5	607.899	1.280.818
ESTONIA	1.331.796	111.8	148.933	283.231
FINLAND	5.548.241	102.0	565.992	1.258.190
FRANCE	67.957.053	122.3	8.313.315	16.204.488
GERMANY	83.237.124	94.4	7.834.000	18.291.912
GREECE	10.459.782	142.7	1.492.849	2.003.391
HUNGARY	9.689.010	110.0	1.065.908	2.362.685
IRELAND	5.060.004	118.2	598.032	1.190.052

Current captures: data sources

- Eurostat Waste Database not fully suitable
  - No distinction between food and garden waste
  - Sometimes MBT accounted as biowaste
- Detailed investigation on national statistic official data
- If no specific national dataset for food waste / garden waste:
  - 20% food waste in biowaste for countries with commingled scheme
  - Specific data wherever available

	REFERENCE YEAR	SOURCE (NAME + LINK)
DENMARK	2022	Ministry of Environment, waste data
FRANCE	2021	National Statistic Institute
IRELAND	2021	Environmental Protection Agency
ITALY	2022	Environmental Protection Agency
MALTA	2022	National Statistics Office
UK	2022	Waste Offices from England, Scotland, Wales, Northern Ireland

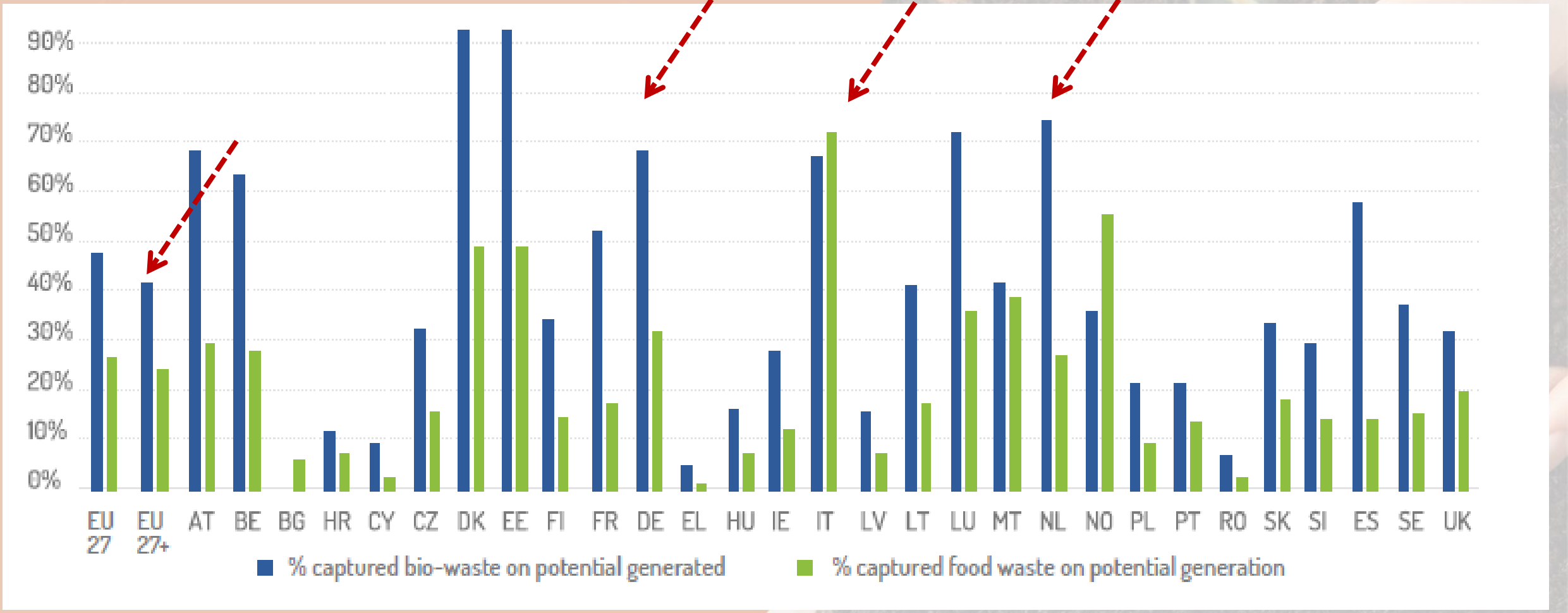
Food waste and bio-waste: potential generation vs. current capture - 2020
(EU 28+)

	Estimated generation		Current capture level		Captured
	t/y	*Kg per capita*	*t/y*	*Kg per capita*	*%*
Bio-waste	**113,816,770**	222	36,675,887	71	32%
Food waste	**59,938,718**	117	9,520,091	19	16%

Food waste and bio-waste: potential generation vs. current capture - 2024
(EU 27+)

	Estimated generation		Current capture level		Captured
	t/y	*Kg per capita*	*t/y*	*Kg per capita*	*%*
Bio-waste	**113,738,053**	219	51,036,874	98	45%
Food waste	**60,034,681**	116	15,112,788	29	25%

The "*distance to target*"



- Current captures compared to «operational potential» (i.e. 85% of theoretical potential)
- Still some 36 Mt/year of food scraps might be captured in EU27+
  - ✓ (some 31 Mt in EU27)
- Potentially equivalent to:
  - ✓ Some 10-15 Mt of compost
  - ✓ Some 3-7 Bn m^3 biogas
  - ✓ 2-4 Bn m^3 biomethane

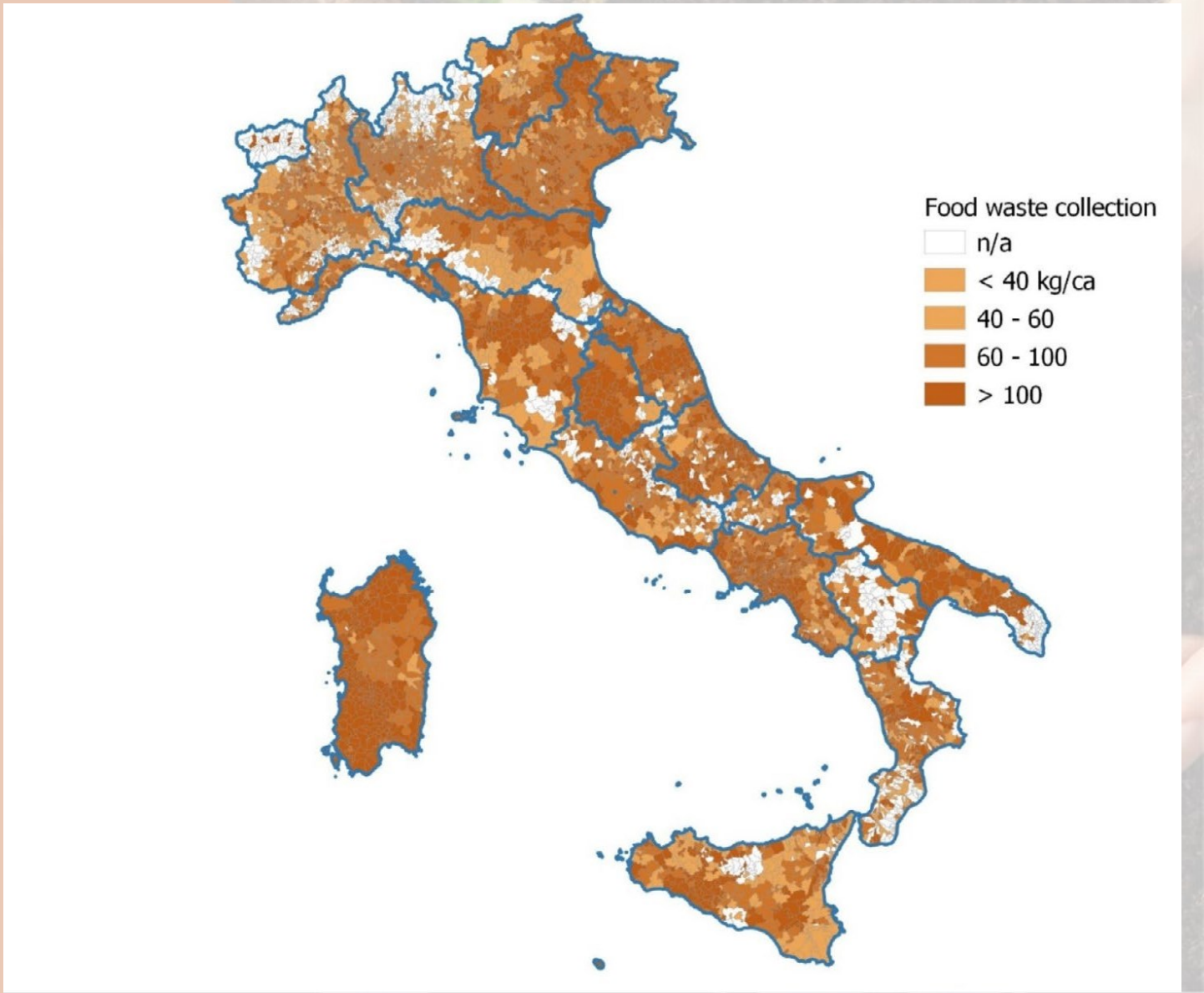
	THEORETICAL FOOD WASTE GENERATION PER CAPITA	THEORETICAL POTENTIAL (TONNES) (See Table 8)	POTENTIAL CAPTURE WITH OPTIMISED COLLECTION SCHEMES (operational potential, 85% of theoretical potential), tonnes	CURRENT CAPTURE (TONNES)	SHORTFALL (TONNES)
EU 27	**116.7**	**52.157.348**	**44.333.745**	**13.578.084**	**30.755.661**
EU 27+	**115.5**	**60.034.680,8**	**51.029.479**	**15.112.788**	**35.916.691**
AUSTRIA	118.5	1.064.228	904.593	312.467	592.127
BELGIUM	105.7	1.227.983	1.043.785	353.176	690.610
BULGARIA	80.2	548.449	466.181	-	466.181
CROATIA	84.4	326.088	277.175	18.539	258.636
CYPRUS	79.8	72.200	61.370	1.990	59.379
CZECHIA	93.7	985.878	837.996	153.544	684.453
DENMARK	103.5	607.899	516.714	296.325	220.390
ESTONIA	111.8	148.933	126.593	3.995	122.598
FINLAND	102.0	565.992	481.093	85.443	395.650
FRANCE	122.3	8.313.315	7.066.318	1.413.507	5.652.811
GERMANY	94.4	7.834.000	6.658.900	2.480.466	4.178.434
GREECE	142.7	1.492.849	1.268.922	16.736	1.252.186
HUNGARY	110.0	1.065.908	906.022	75.574	830.448

	THEORETICAL POTENTIAL generation kg/capita	*THEORETICAL POTENTIAL generation t/year*	*POTENTIAL CAPTURE - OPTIMISED SCHEMES (operational potential, 85% of theoretical potential)*	*CURRENT CAPTURE (T)*	***STILL TO BE COLLECTED***
EU 27+	116.7	60.034.680	51.029.479	15.112.788	**35.916.691**

NETHERLANDS	111.8	1.967.362	1.672.258	541.793	1.130.465
NORWAY	78.8	427.511	363.385	238.712	124.673
POLAND	112.0	4.216.206	3.583.775	391.604	3.192.171
PORTUGAL	127.2	1.317.010	1.119.458	178.055	941.403
ROMANIA	127.7	2.431.546	2.066.814	57.127	2.009.687
SLOVAKIA	84.4	458.844	390.017	85.868	304.149
SLOVENIA	108.4	228.368	194.113	32.872	161.241
SPAIN	144.0	6.830.337	5.805.786	996.091	4.809.695
SWEDEN	105.7	1.104.841	939.115	171.418	767.697
UK	118.1	7.985.764	6.787.900	1.564.608	5.223.292

What is needed for this to happen

- Disseminating best practices
- Keeping confident
  - It may be done in all conditions
- Regulatory drivers
  - Supplementing the obligation with legally binding targets
- Rely on **frontrunners**



Biowaste collection methods Comparisons from Catalonia

Biowaste Separate collection in Catalonia – Quantity & quality

Door to Door

Model	Kg bioR/year	gbioR/day
Road containers (RC)	42	114,5
Mixt (RC & DtD)	68,5	188
Door to Door (DtD)	112	306
AVERAGE	47	128

Source: ARC Data 2020

Road containers

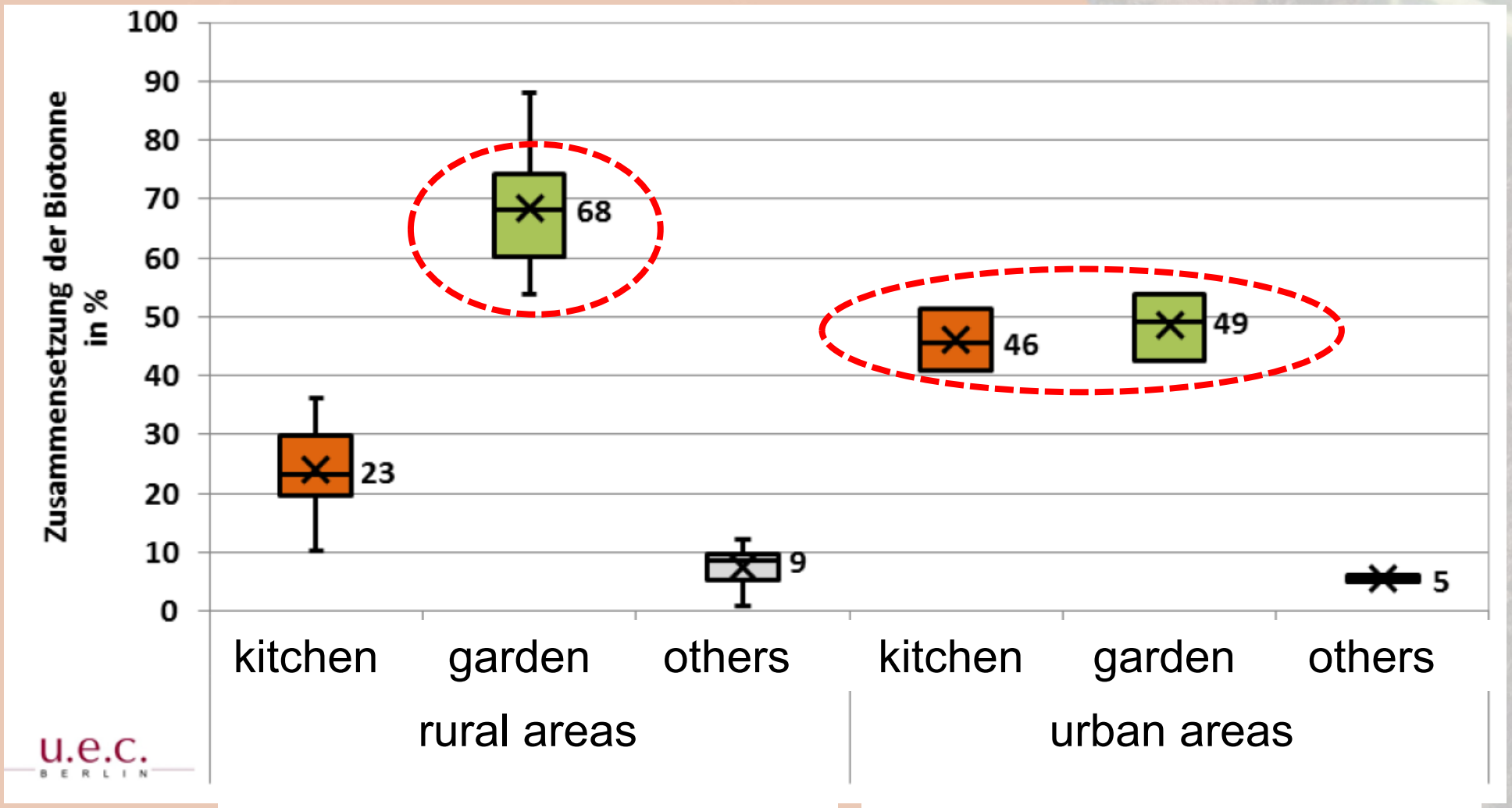
Model	% impurities
Road containers (RC)	13,48 %
Door to Door (DtD)	4,68 %
AVERAGE	12%

1.805 samples/year Characterisation annual campaign

Collection models for organics

- Garden waste only
- Biowaste («commingled»: garden + food waste)
  - VGF/GFT (NL, Flanders - no meat/fish)
  - *Bioabfall* (Central Europe - includes meat/fish, commingled with garden waste)
- Dedicated collection: “bespoke” kitchen waste schemes
  - Kitchen waste at the kerb
  - Garden waste with a dedicated collection round (less frequent, seasonal) and/or at Civic Amenity Sites

“commingled” collection - Germany composition of biowaste bins



Dedicated schemes for food scraps (kitchen waste): cheap, open lorries

Large cities?

- Milan, Lubiana, Copenhagen, Bristol, Barcelona…
- Milan (pop. 1,4M and 800k commuters) capturing 87,5% of organics
- Around 10% (and less) organics in residual waste

Key takeaways

- Food waste a “largely untapped potential”
- Many drivers, including art. 22 of WFD, boosting interest (and activities)
  - Schemes already diffused, **also in densely populated areas**
- Collection of biowaste widespread
  - mainly propelled, so far, by **garden waste**
  - **food waste** potential still to be largely harnessed (art. 22 new WFD)
- Room for improvement!
  - Also in those areas with a long established tradition (e.g. Central Europe)
  - **User friendliness** of the system seems to be key to highest performances
  - Opportunities coming mainly from **design** (collection rounds) and **tools**

- Time to **update and supplement the regulatory drivers**

Thanks for your attention

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24 April 2025

Manon Jourdan, Zero Waste Europe, LIFE BIOBEST Consortium

LIFE BIOBEST Policy recommendations for effective bio-waste management in the EU

Unlocking successful bio-waste management in Europe: key enablers and progress one year after the EU bio-waste separate collection mandate

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LIFE BIOBEST Project

LIFE BIOBEST Consortium

Fundació ENT

ECN (European Compost Network)

ACR+ (Association of cities and Regions)

CIC (Italian Composting and Biogas Association)

ZWE (Zero Waste Europe)

LIFE BIOBEST

Guiding the mainstreaming of best bio-waste recycling practices in Europe

2,5-year project, start date 1/1/23

CALL LIFE 2021-PREP-NATURA, NATURE AND BIODIVERSITY

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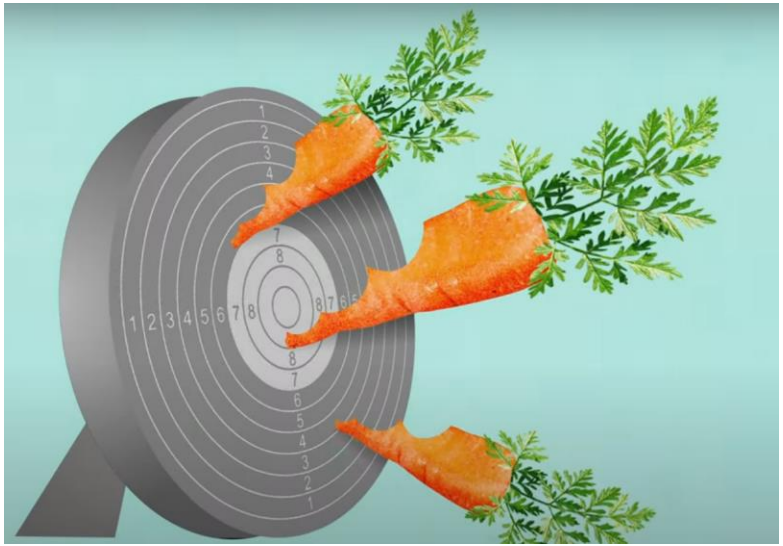
LIFE Preparatory Projects - Projects addressing ad hoc Legislative and Policy Priorities (PLP)

Preparing the basis for EU guidance and standardization on closing the gap in the biological cycle to enrich soils with high quality compost from collected organic waste in support of nature and biodiversity

Policy recommendations



Underlying questions

- How can we boost **high-performing bio-waste collection models** that achieve both high capture rates and minimal physical impurities?
- How to **stimulate public and private demand** for compost and digestate?
- How to ensure **effective monitoring and enforcement** of bio-waste regulations?

5 policy actions to transform bio-waste management

More concretely

- How can we boost **high-performing bio-waste collection models** that achieve both high capture rates and minimal physical impurities?
    - **Establish legally binding targets**
        - for the amount of bio-waste found in residual waste *(e.g 25 kg/cap./year by 2030)*
        - for the quality of bio-waste entering the recycling process with a control value on accepted physical impurities *(e.g 5%)*
        - to reduce residual waste generation *(e.g 120 kg/cap./year by 2030)*

More concretely

- **Supplementary mechanisms to increase the cost-competitivity of bio-waste management**
  - Discourage landfilling and incineration with key economic instruments
  - Avoid any funding of lower tiers in the waste hierarchy
  - Encourage PAYT/SAYT
  - Require full cost coverage of waste management charges
  - Full integration of waste incineration in EU ETS from 2028

More concretely

- How to **stimulate public and private demand** for compost and digestate?
    - **Reinforce synergies between environmental, agricultural and product policies to develop reliable/new markets for compost and digestate**
        - High quality compost and digestate should be recognised as recycled organic soil improver and fertiliser in:
            - EU Soil Monitoring Law
            - CAP, CFCR (carbon farming practice)
            - CEA (= promote a market for secondary raw material)

More concretely

- **Subsidy system & Quality assurance**
  - Establish national/regional subsidy system for farmers using high quality compost (e.g via Rural Development plans)
  - EU wide QAS for compost and digestate to ensure the highest product quality

More concretely

- How to ensure **effective monitoring and enforcement** of bio-waste regulations?
  - **Introduce a legal obligation (& a method/frequency) of compositional analysis of residual waste**
  - **Expand/strengthen reporting requirements for local authorities & treatment sites:**
    - monitoring of impurities
    - Inclusion of a set of KPIs on collection, recycling, enabling legislation
    - collect/report data annually
  - **Ensure data transferability to regional/national institutions**

Thank you!

Manon Jourdan, ZWE

Implementation Officer

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Explore the LIFE BIOBEST project online

Keep up with all the developments at lifebiobest.eu

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24 April 2025

Gemma Nohales, ENT Foundation, LIFE BIOBEST Consortium

Successful economic instruments and governance models for efficient municipal bio-waste management

Unlocking successful bio-waste management in Europe: key enablers and progress one year after the EU bio-waste separate collection mandate

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European Circular Economy Stakeholder Platform

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Economic & fiscal instruments

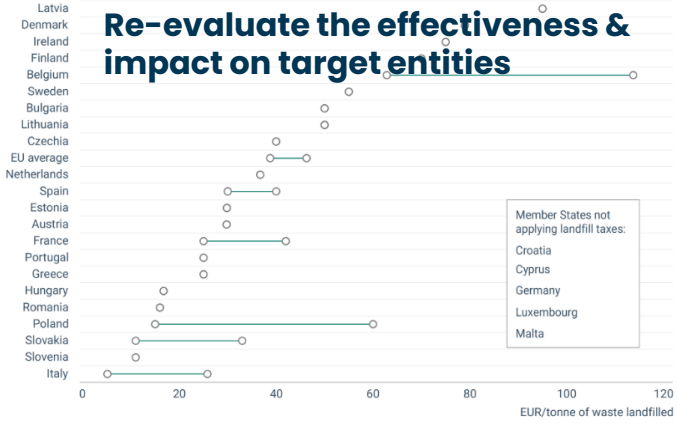
Why complementary instruments?

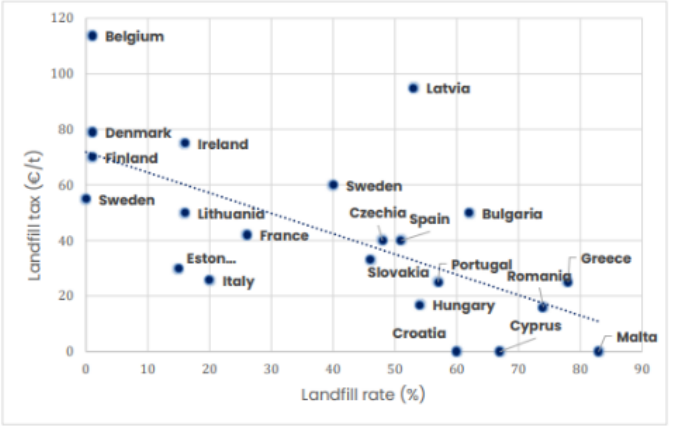
- Combination of instruments is key and economic instruments are crucial to incentivize stakeholders.
- Bio-waste is the backbone of the municipal waste management and the most important fraction in weight. It is a cross-cutting topic.
- New mandate seems not effective to promote implementations or improvements. Penalties will arrive late, may not be effective.
- Bio-waste is **not cost competitive**. Residual waste is still cheaper and with no pre-treatment before landfilling in some regions**. No coverage by EPR**.
- Adoption of low performance collection schemes.
- Quality must be improved too (especially for kitchen waste)–crucial parameter for circularity, monitoring is needed-.

Economic & fiscal instruments

Discourage landfilling and incineration and rebalance economic viability of bio-waste by effective economic/fiscal instruments

- **Higher landfill and incinerator gate fees** including **externalities**
- **Strategic and efficient disposal taxes** for incinerators and landfills (e.g. increased tax fees, tax modulation and evolution in time). Take advantage of an instrument already applied in many MS.

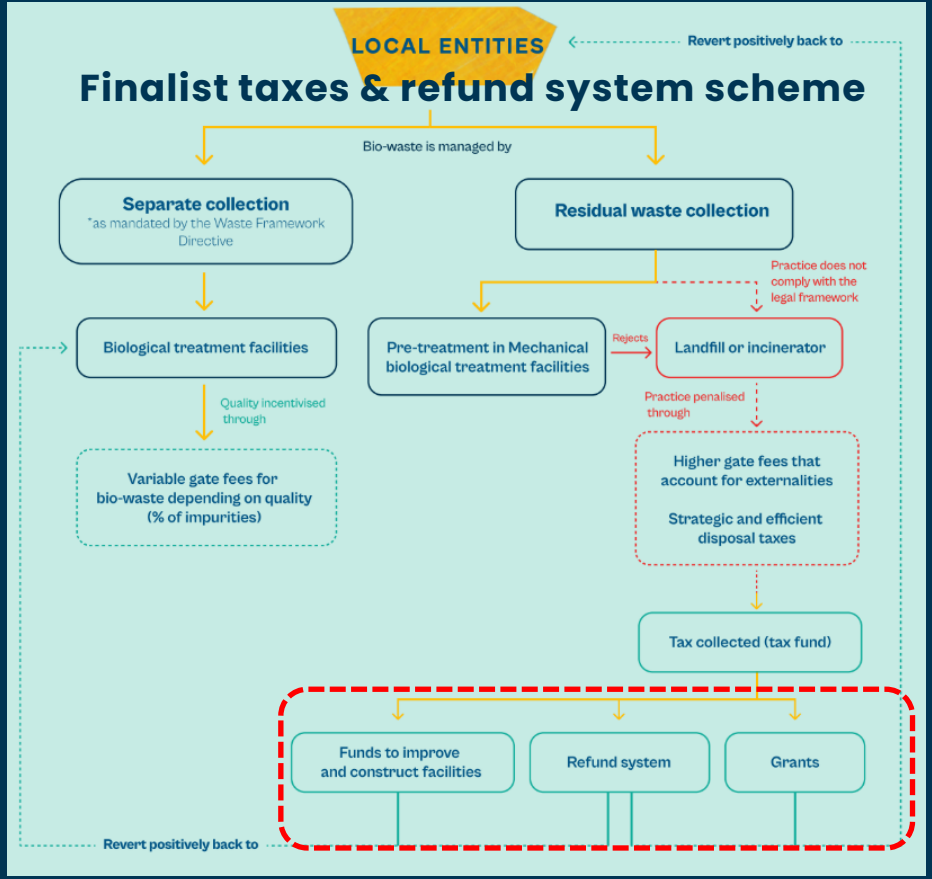




Economic & fiscal instruments

Compensate and cover management and implementation costs of bio-waste

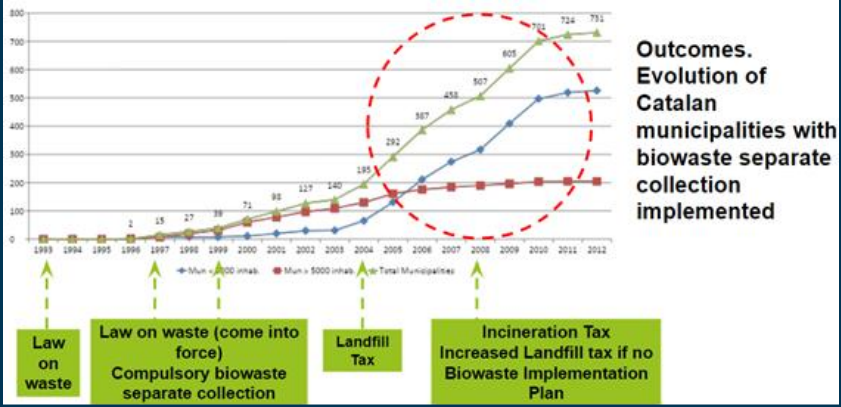
- Bio-waste is **not supported by EPR**, other alternative instruments are needed
- **Finalist taxes to reinvest landfill/incineration tax** revenues:
  - **Refund systems**, based on premium/penalty principle (considering quantity/quality refund concepts)
  - **Grants** to implement/improve bio-waste collection
  - **Funds to construct** or improve biological treatment facilities



Economic & fiscal instruments: real application

Catalonia – disposal tax refund system (quantity & quality of bio-waste collected)

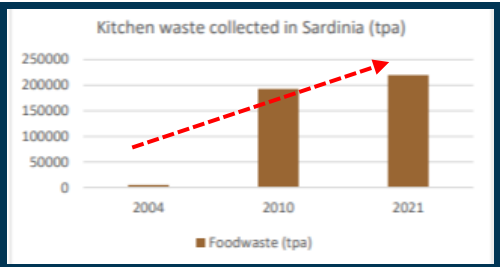
Increase in local entities with bio-waste collection service & network of public facilities



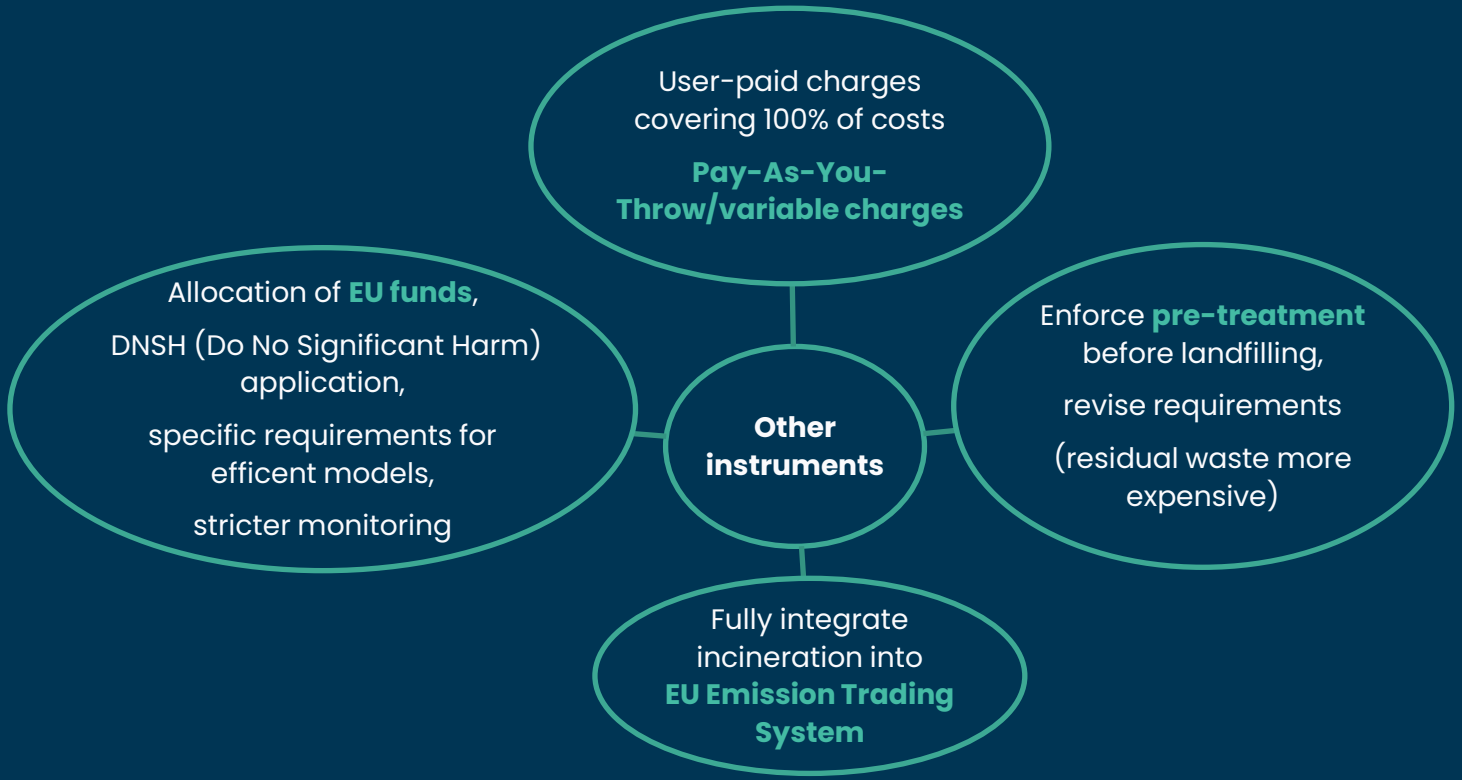
Sardinia -penalty/premium system (high threshold % separate collection rate & PAYT application)

Increase in separate collection rate, high-capture of bio-waste with good quality

RESULTS	
Residual waste reduction after introducing bio-waste collection	46% (between years 2004/2010)
MSW separate collection rate	• Increase to 20% in year 2006 following the penalty/premium mechanism • In year 2021 about 75% of all MSW
MSW production per capita	437 kg/inhab./yr (2021)
Residual waste collection per capita	106 kg/inhab./yr (2021)
Bio-waste collection per capita	• KW: 138 kg/inhab./yr (2021) • GW: 73 kg/inhab./yr (2021)
Impurities in bio-waste	3.3% in KW (2017) Data are assessed regularly on a large set of municipalities



Economic & fiscal instruments



LIFE BIOBEST Outputs

LIFE BIOBEST Outputs

Guidelines

- D3.1 Guideline on separate collection
- D3.2 Guideline on governance and economic incentives
- D3.3 Guideline on quality compost and digestate
- D3.4 Factsheets on the analysis of best practices in communication and engagement from various countries
- Summary of the guidelines WP3 Set of guidelines
- D5.3 Proposal for quality standards for bio-waste entering biological recycling facilities
- D5.4 **Comprehensive guidance for the EU + VIDEO**

Tools

- D2.3 Assessment matrix of best practices
- LIFE BIOBEST D5.1 Decision Support Trees
- D7.1 Decision Support Web Tool

Other

- D2.1 Improved and homogenised datasets
- D2.2 Statistical analysis identifying best practices
- D5.2 Policy brief including regulatory barriers

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Thank you!

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Supporting municipal bio-waste separation through quantitative targets and support to municipalities

Webinar on Biowaste Management

ARC+

24/04/2025

Nico Vanaken

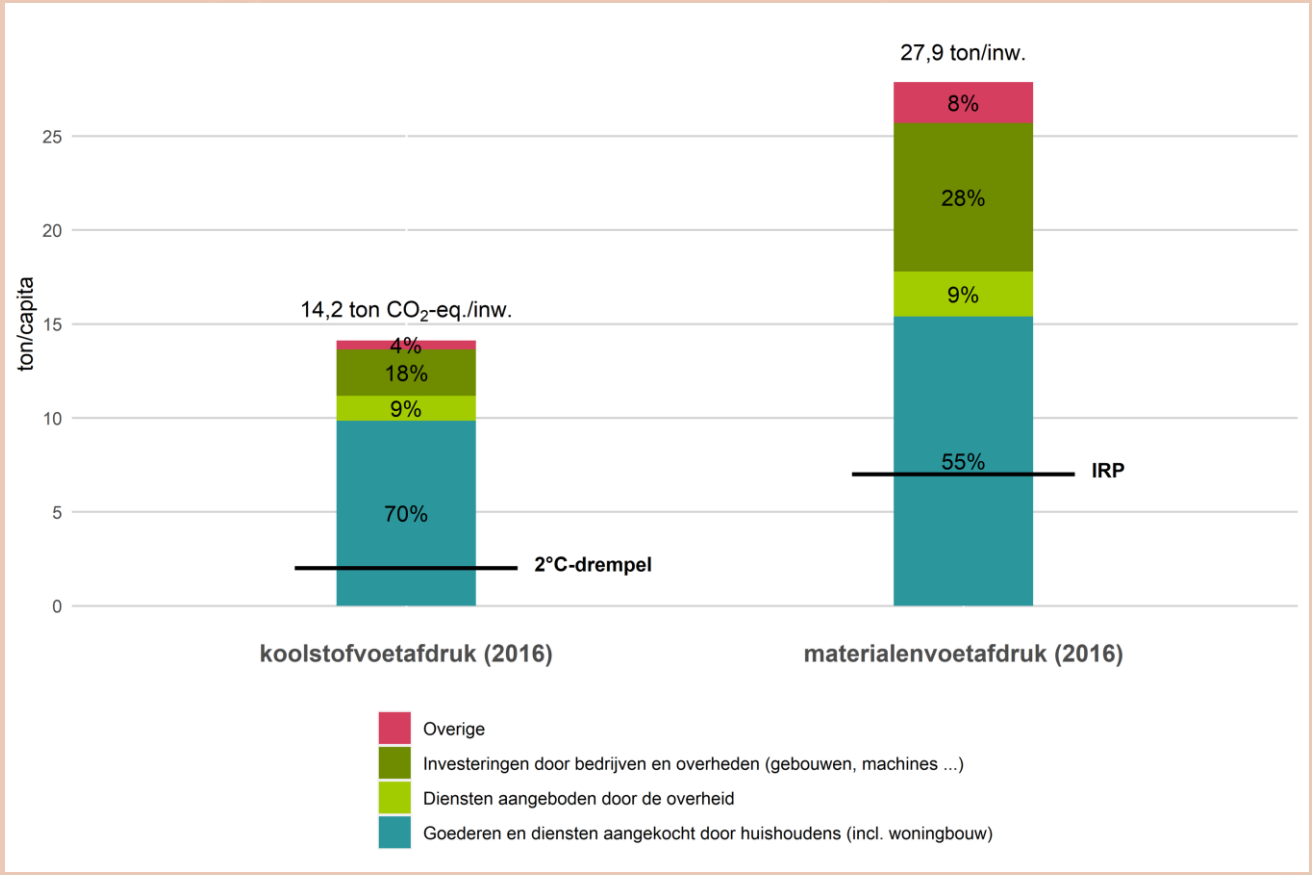
Policy advisor

OVAM

Content

- Snapshot of the Flemish region
- Residual household waste targets and biowaste collection
- Role of PAYT schemes and government support
- Benchmarking municipalities

Snapshot of the Flemish region

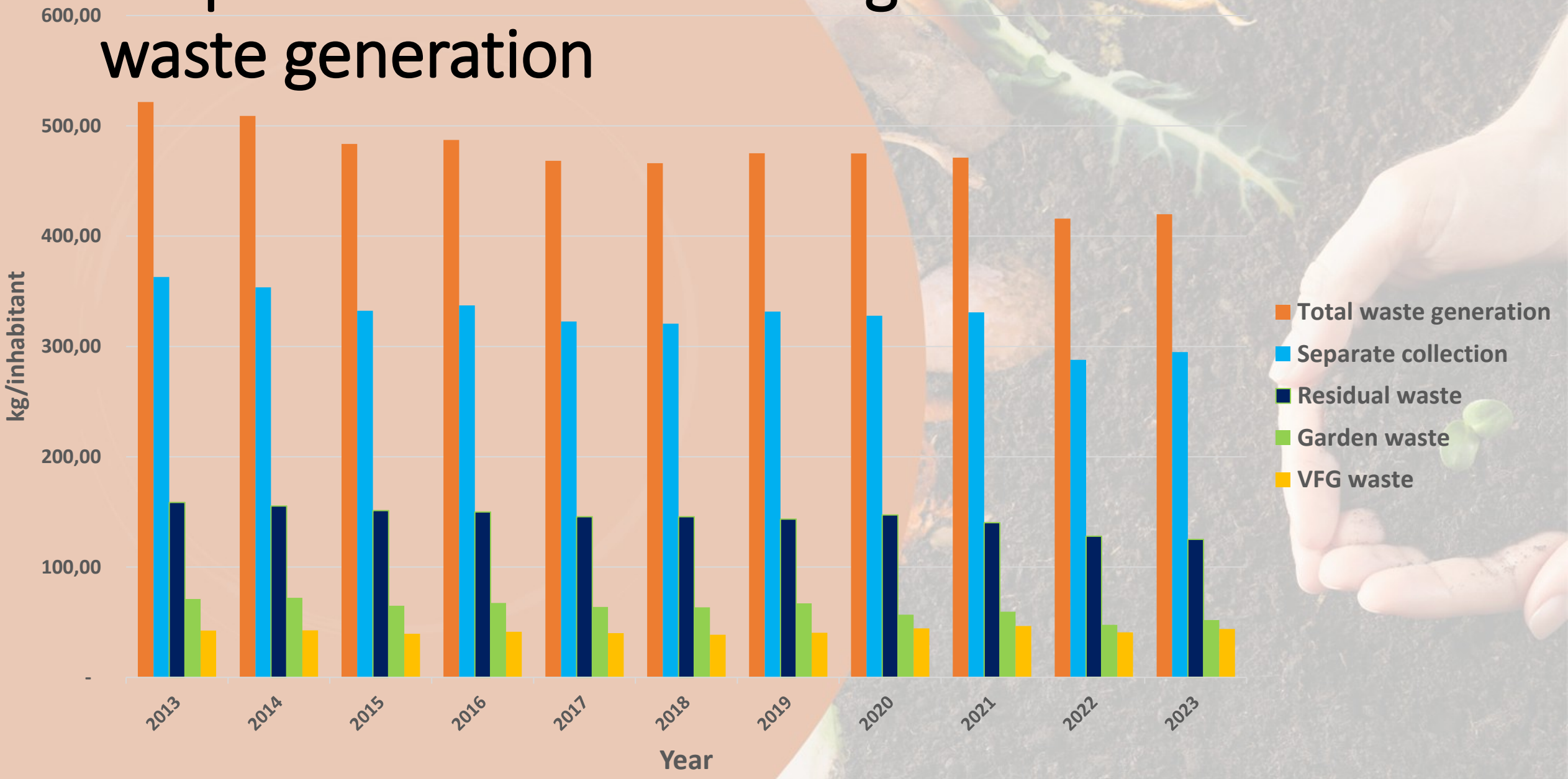


Population: 6,65 mio
(12% growth between 2000 and 2021)

Population density: 488 inh/km²

High material and carbon footprint, mainly outside Flanders

Snapshot of the Flemish region – household waste generation



Residual household waste targets - approach

‘dot on the horizon’

Fixed in household waste management plans

Target on municipal level => accountability on municipal level

Evolution approach of fixing targets municipal level:

1 target for all municipalities w/ correction factors

→

Target per municipality or 16 clusters of similar municipalities

→

Main cluster + separate clusters for large cities and coastal municipalities

+

Target on Flemish level

Residual household waste targets - approach

Residual household waste generation 2023: **125 kg/inh**

Target on Flemish level 2030: **100 kg/inh**

Subtargets for:

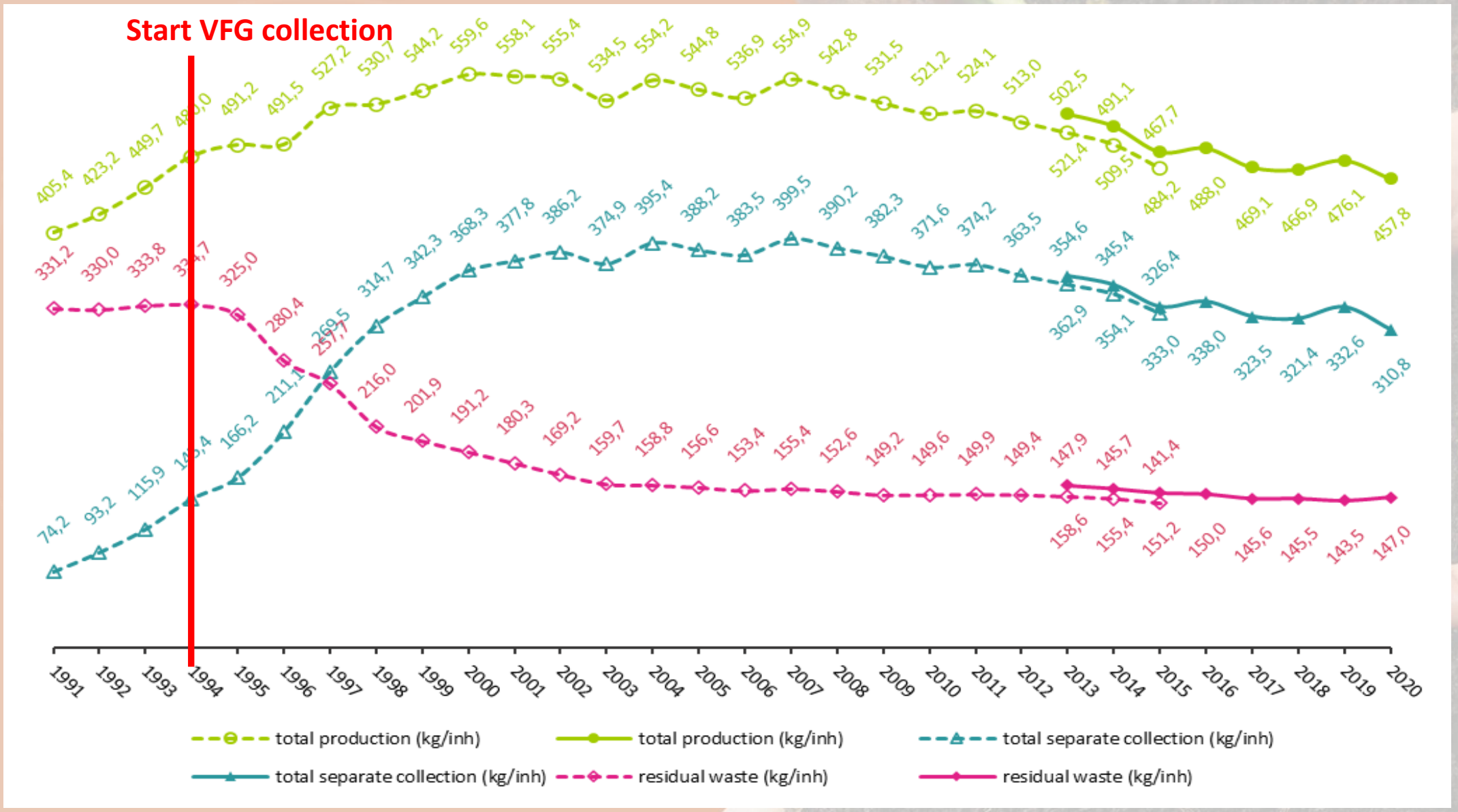
- Prevention and reuse
- Recycling (EU targets WFD)

Tailoring the efforts on municipal/intermunicipal level

Several instruments supporting achievement of the target

Coupling residual waste targets with Flemish Energy and Climate Plan

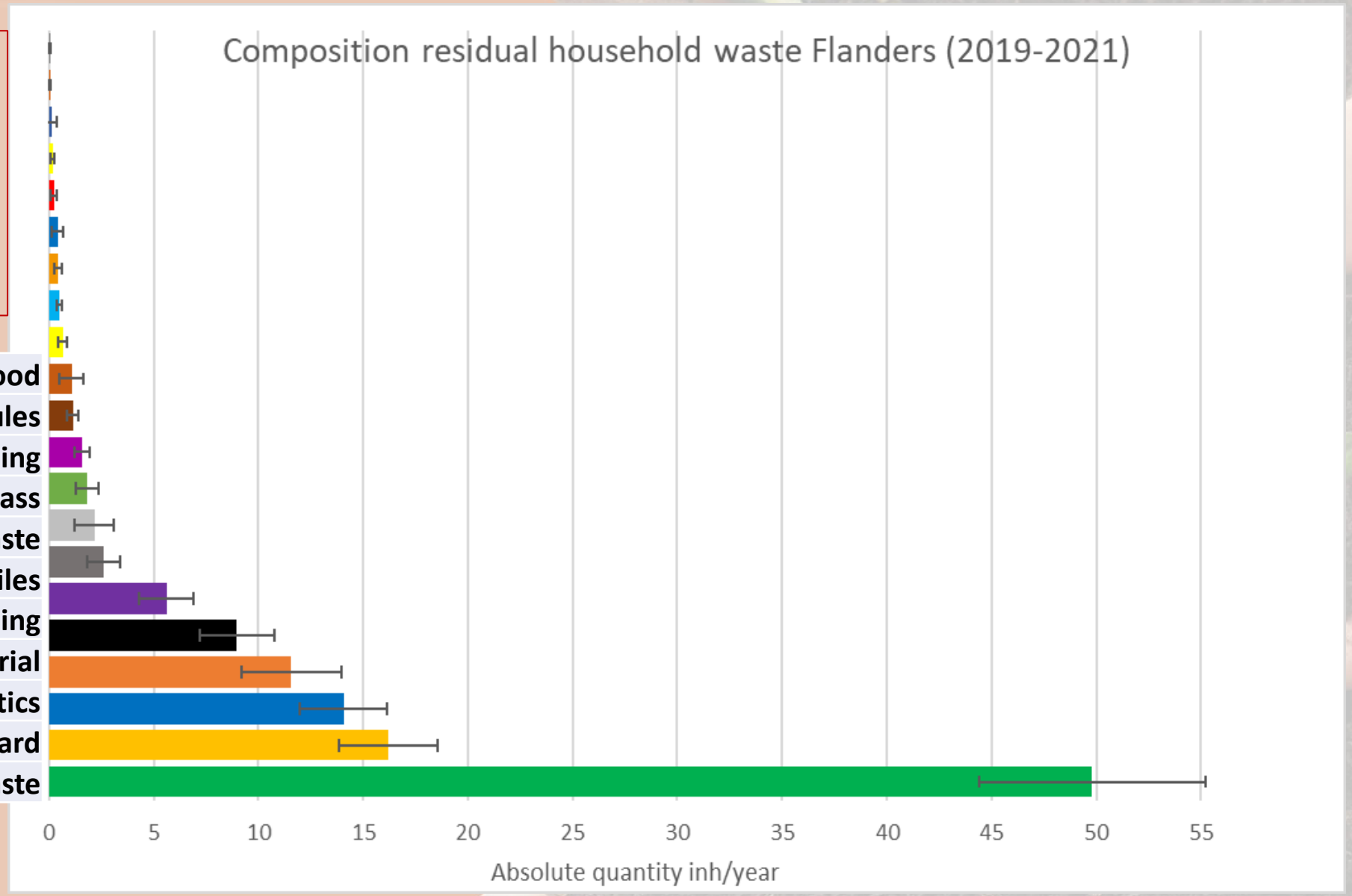
Effect of separate collection on residual waste generation



Effect of biowaste collection on residual waste generation

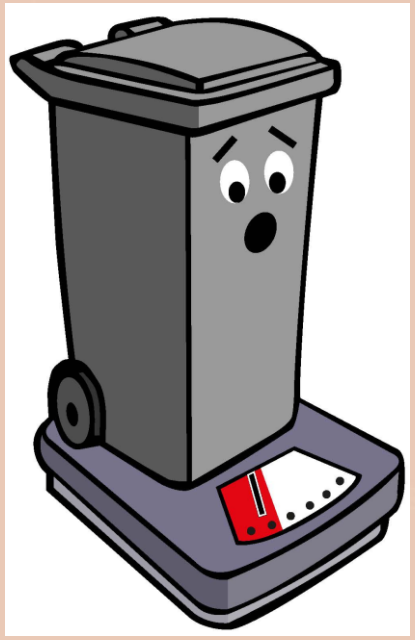
Total amount of residual waste is reduced, but biowaste is still main recyclable fraction in residual waste

22% of the biowaste in residual waste are food losses !

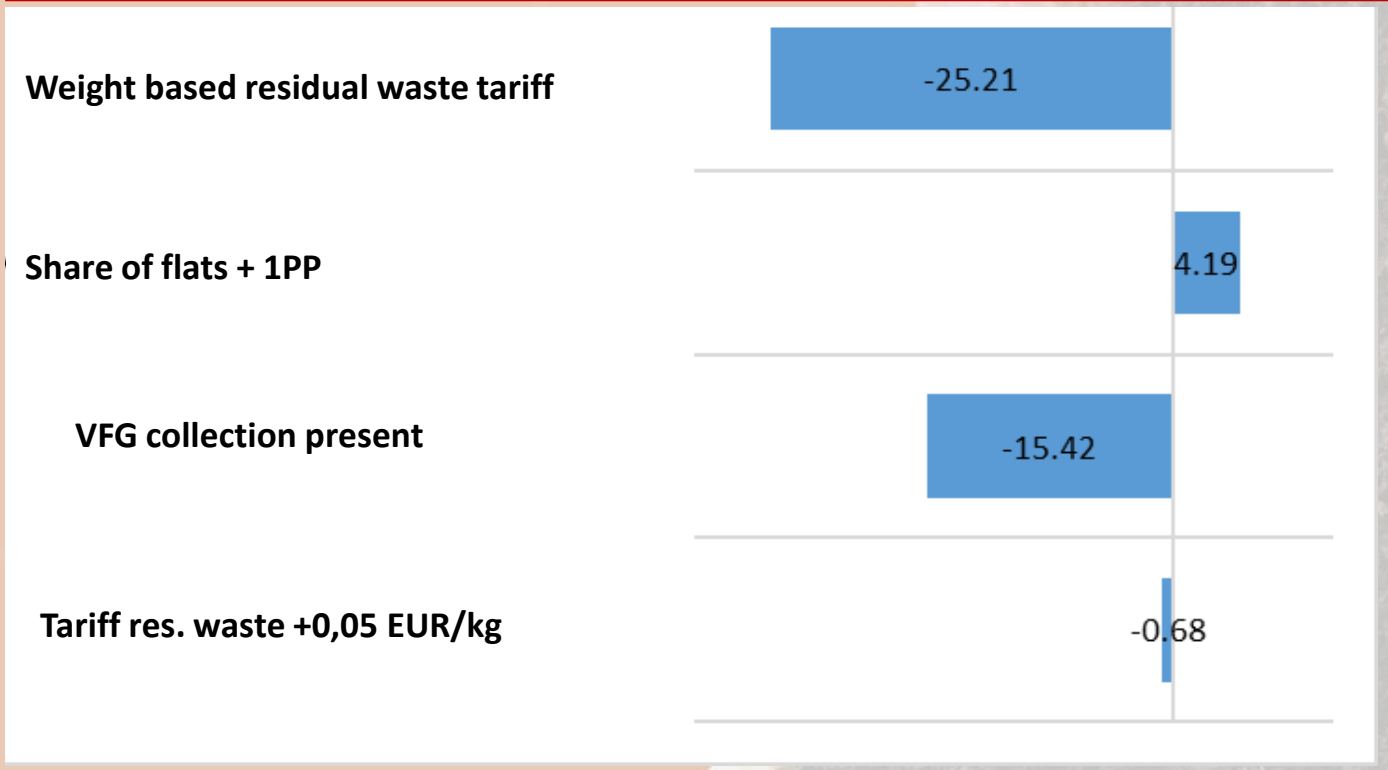


Effects of PAYT systems on residual and biowaste collection

Econometric analysis of tarification systems of residual waste and biowaste – main variables influencing sorting behaviour



Elasticities in general – changes in kg residual waste/capita



Effects of PAYT systems on residual and biowaste collection

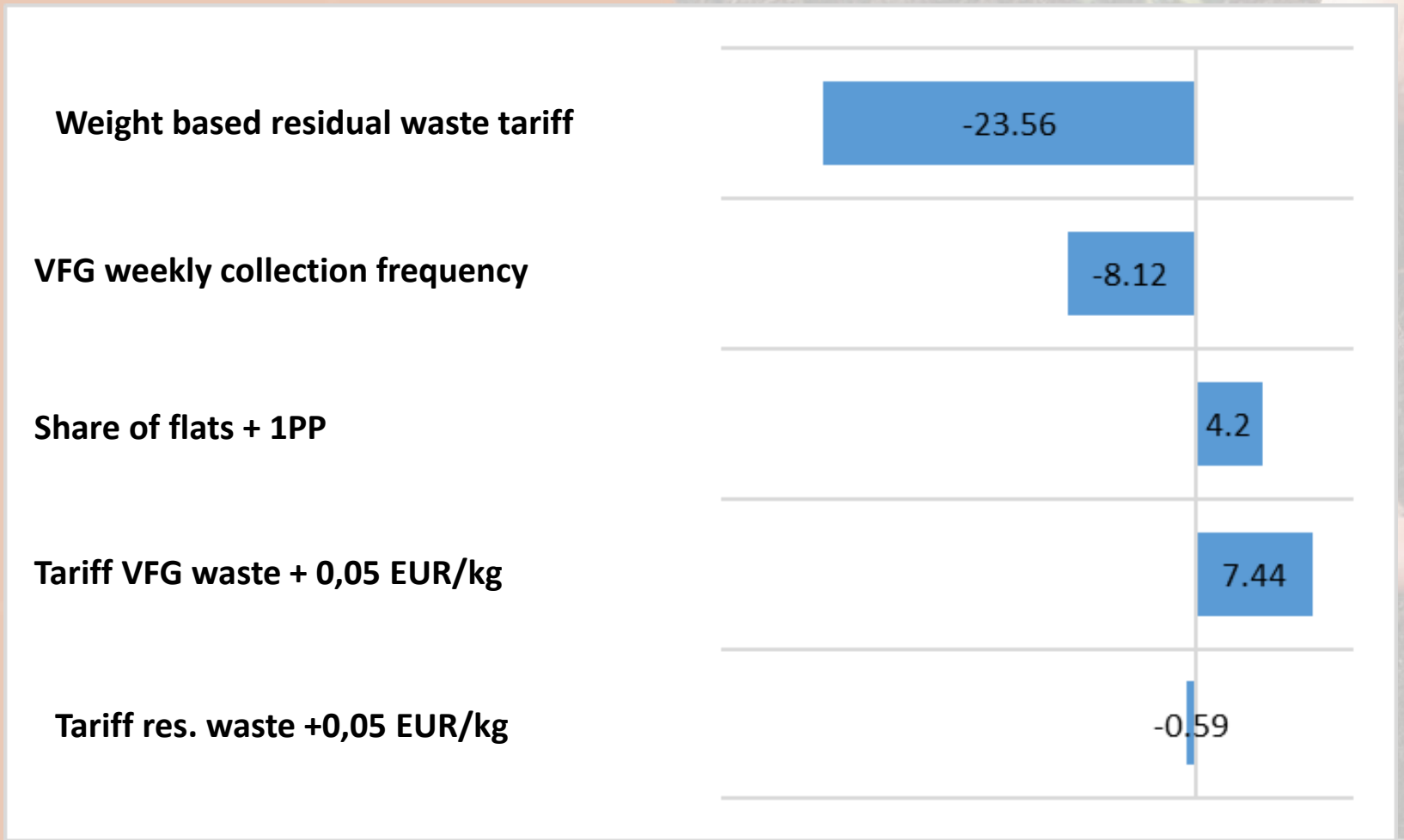
Elasticities in VFG collection regions – changes in kg residual waste/capita

High effect of weight based tariff on residual waste/capita

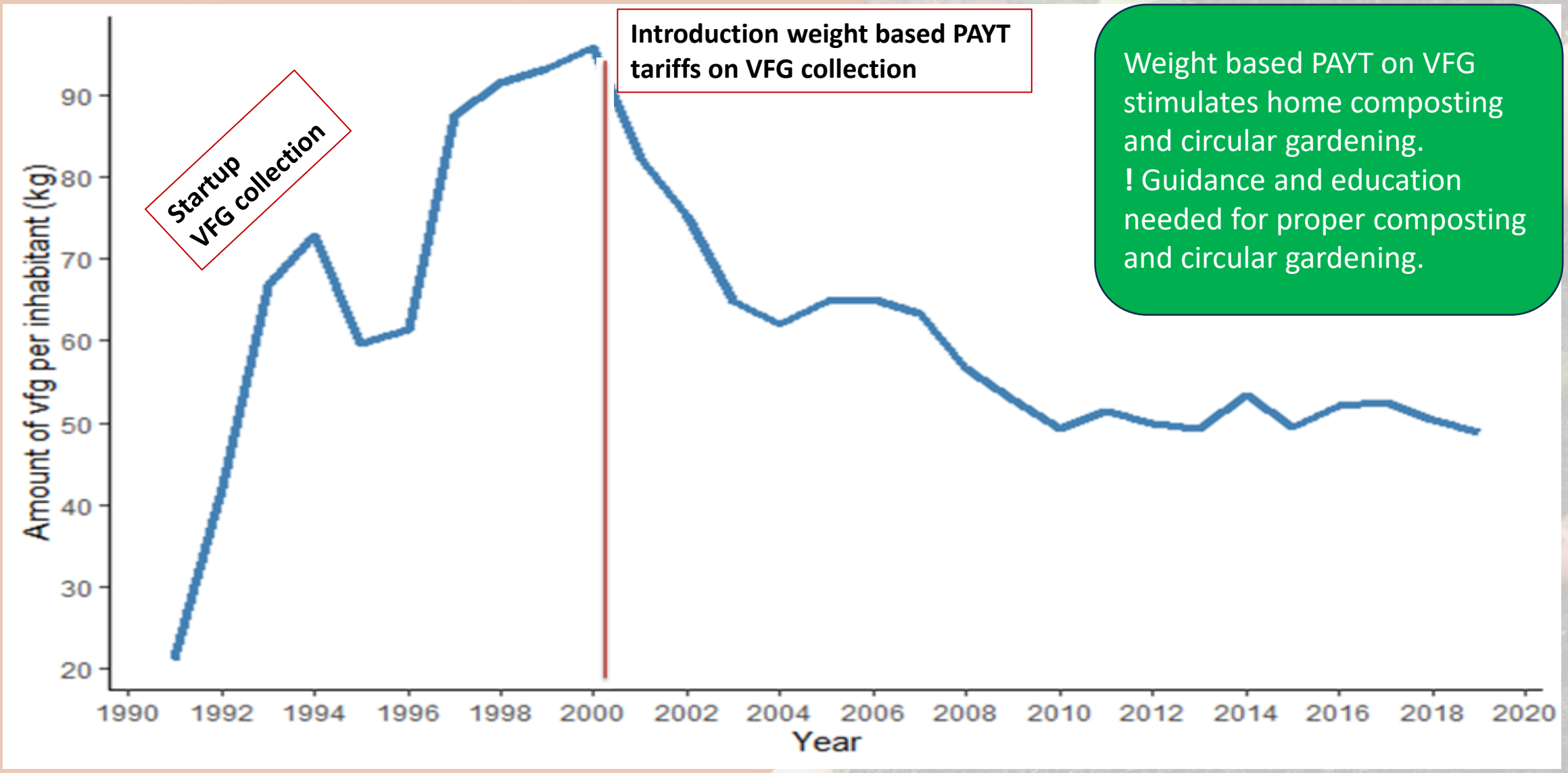
Weekly collection of VFG also important variable

Residual waste tariff variation has limited effect,
more important:
Optimising VFG tariff – delta in relation to residual waste tariff

Erosion effect of pricing policy!



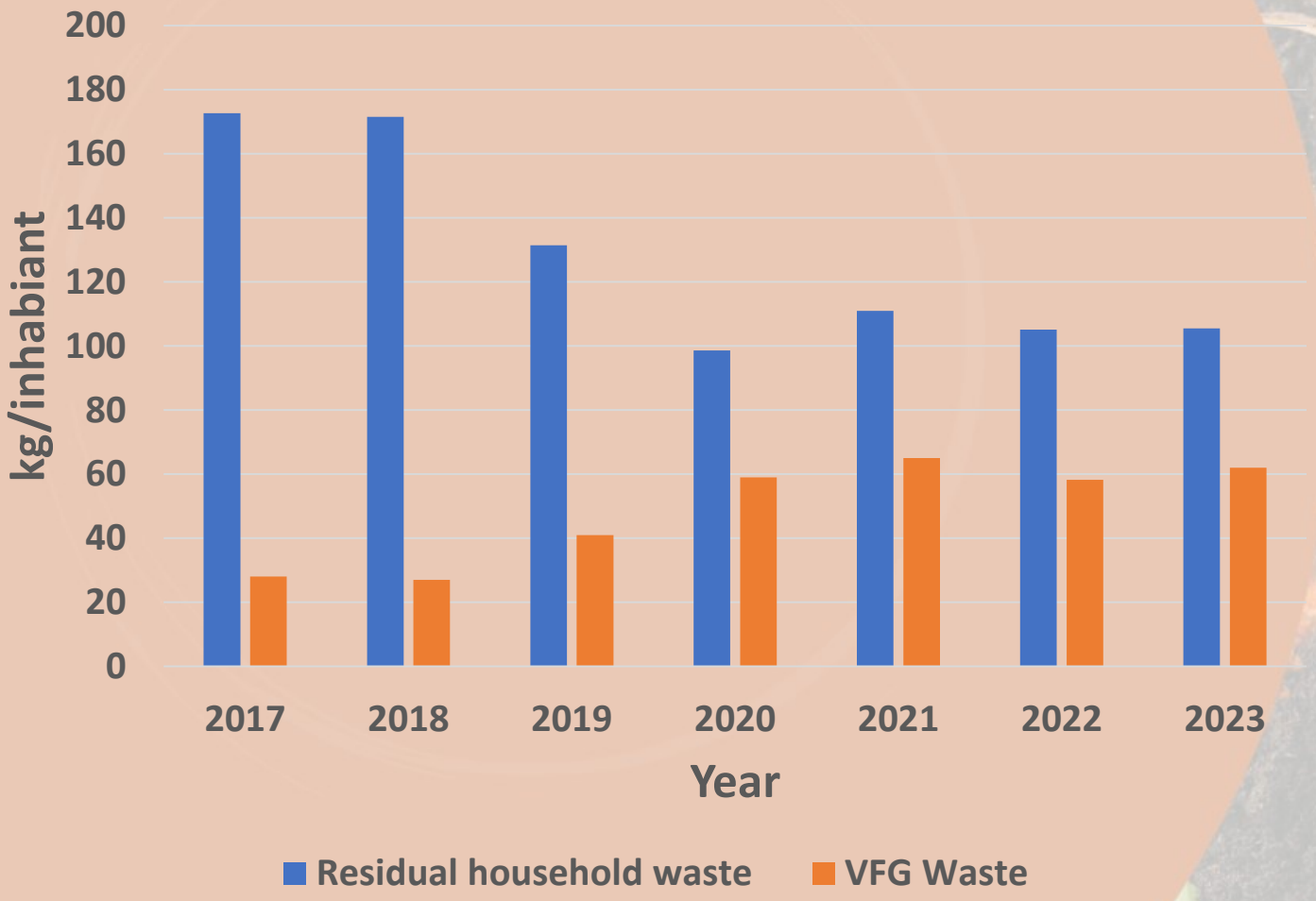
Role of PAYT schemes - case



Weight based PAYT on VFG stimulates home composting and circular gardening.

! Guidance and education needed for proper composting and circular gardening.

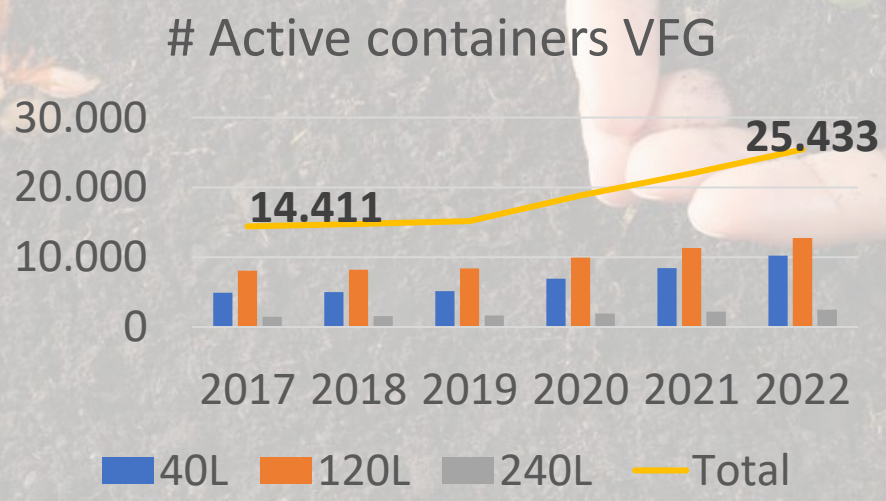
Effect of weight based PAYT on residual waste and biowaste collection – case Sint Niklaas



Sint-Niklaas
79.357 inh, 33.700 households,
952 inh/km²

VFG: volume based PAYT

July 2019: start collection weight based PAYT for residual waste



Benchmarking tool

What?

Tool to compare waste- and soil data and policies between municipalities.

Target group?

Municipalities.

How?

- Fed with data from recurrent reporting obligations waste/soil. Only publicly available data.
- Online platform, accessible for municipalities and intermunicipalities.
- Comparing data and policy indicators w/ other municipalities w/ similar characteristics
- Calculates effect of waste reduction/recycling on the GHG emissions of the municipality

Vergelijkingsgroep

Item toevoegen

-- Selecteer gemeente — Toevoegen
-- Selecteer intercommunale — Toevoegen
-- Selecteer belfius-groep — Toevoegen

Groep gemeenten toevoegen

Intercommunale: -- Selecteer intercommunale
Belfius-groep: -- Selecteer belfius-groep
Aantal inwoners: -- Selecteer categorie
Gemiddeld inkomen: -- Selecteer categorie

☐ Toeristische gemeente
☐ Groot aandeel hoogbouw

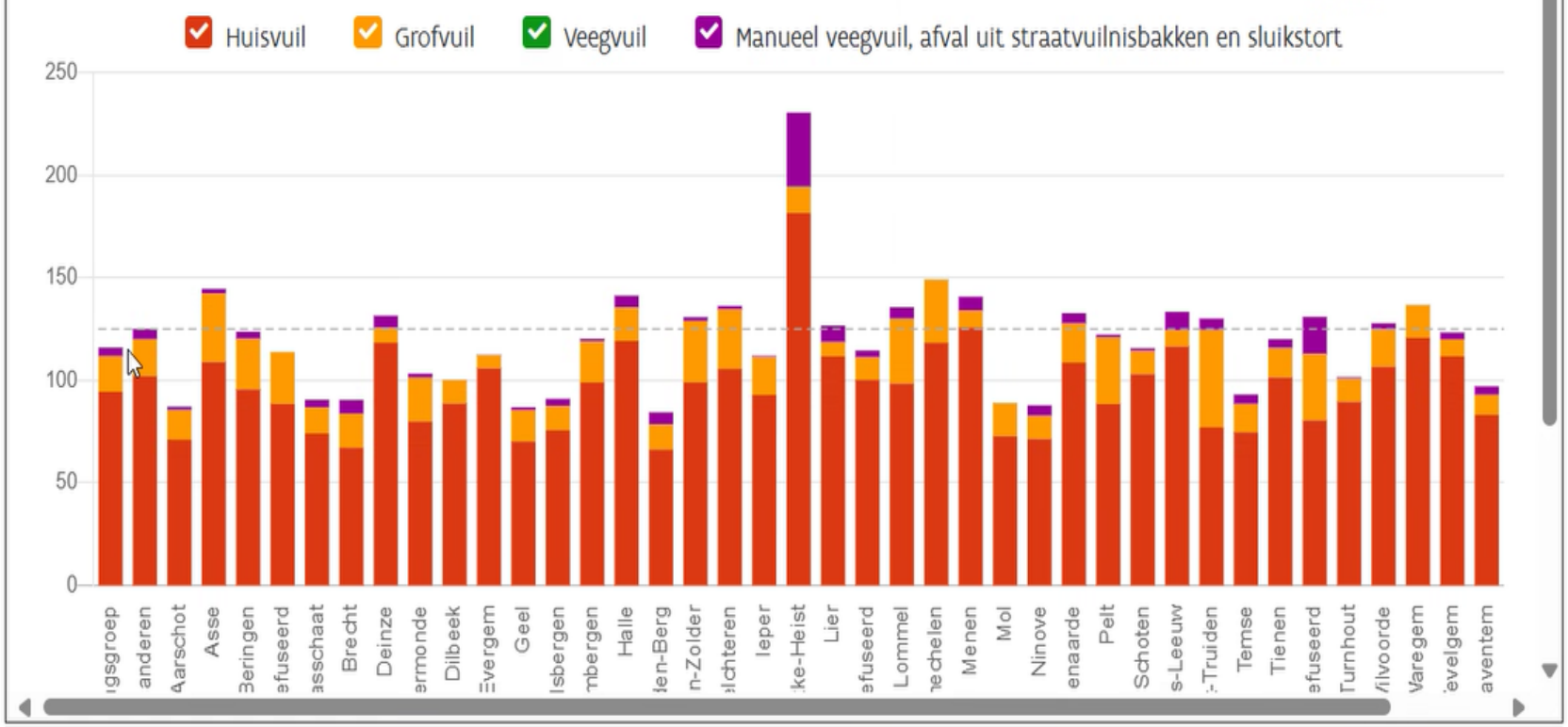
Toevoegen

Actuele vergelijkingsgroep

Aarschot ✕ | Asse ✕ | Beringen ✕ | Bilzen_gefuseerd ✕
Bilzen-Hoeselt ✕ | Brasschaat ✕ | Brecht ✕ | Deinze ✕

Afval - Ingezameld restafval (incl. zwerfvuil)

Productiejaar: 2023 | Type: Totaal | Eenheid: kg/inw



Context- en beleidsindicatoren

Aarschot | Asse | Beringen | Bilzen_gefusee

Context- en beleidsindicatoren

	Aarschot	Asse	Beringen	Bilzen_gefusee
Preventie				
Ja/Nee sticker ongeadresseerd drukwerk	✓	✓	✗	✓
Preventiecampagne(s)	✓	✓	✓	✓
Preventieacties in scholen	✗	✓	✗	✗
Steun thuiskringlopen	3	2	2	1
Thuiscomposteren: communicatie	✓	✓	✓	✗
Thuiscomposteren: materiaal	✗	✓	✓	✓
Thuiscomposteren: kippenactie	✗	✗	✗	✗
Thuiscomposteren: kringloopkrachten	✓	✗	✗	✗
Dienstverlening				
Huis aan huis inzameling van restplastiek	✗	✗	✗	✗
Inzameling van restplastiek via recyclagepark	✗	✗	✗	✗
Openingsuren recyclagepark	36,5	35	37,5	37,5
Beschikbaarheid mini- recyclageparken	✗	✗	✗	✗
Beheerder recyclagepark			intercommunaal	intercommuna
Gebruik van afvalstewards (ja/neen)	✗	✗	✓	✗

Unlocking successful bio-waste management in Europe: key enablers and progress one year after the EU bio-waste separate collection mandate

Illustrations from local players: successful policies and strategies

Improving bio-waste quantity and quality with economic instruments: the Catalonian landfill tax and refund scheme

24 April 2025

Francesc Giró i Fontanals
Director of Strategic Planning
Waste Agency of Catalonia

LIFE BIOBEST

ECESP

Agència de Residus de Catalunya

Generalitat de Catalunya

El Govern de Tothom

Main milestones in biowaste management in Catalonia the last 30 years

1993 — Law on waste

Biowaste Separate Collection compulsory for municipalities with more than 5.000 inhab. *(some years later it was extended to all municipalities)*

1996 — Starting Biowaste SC

Biowaste Separate Collection was implemented for 1st time in a couple of municipalities close to Barcelona, thorough road containers *(in 2025 >850 municipalities)*

2000 — Door to Door

3 municipalities implemented DtD system in order to **improve both Quantity & Quality of Biowaste** *(in 2025 >315 municipalities)*

2004 — Landfill Tax

Landfill fee was cheaper than composting fee. An initial landfill **tax of 10 €/t was implemented in Catalonia** (*in 2025 landfill tax is 70 €/t)*

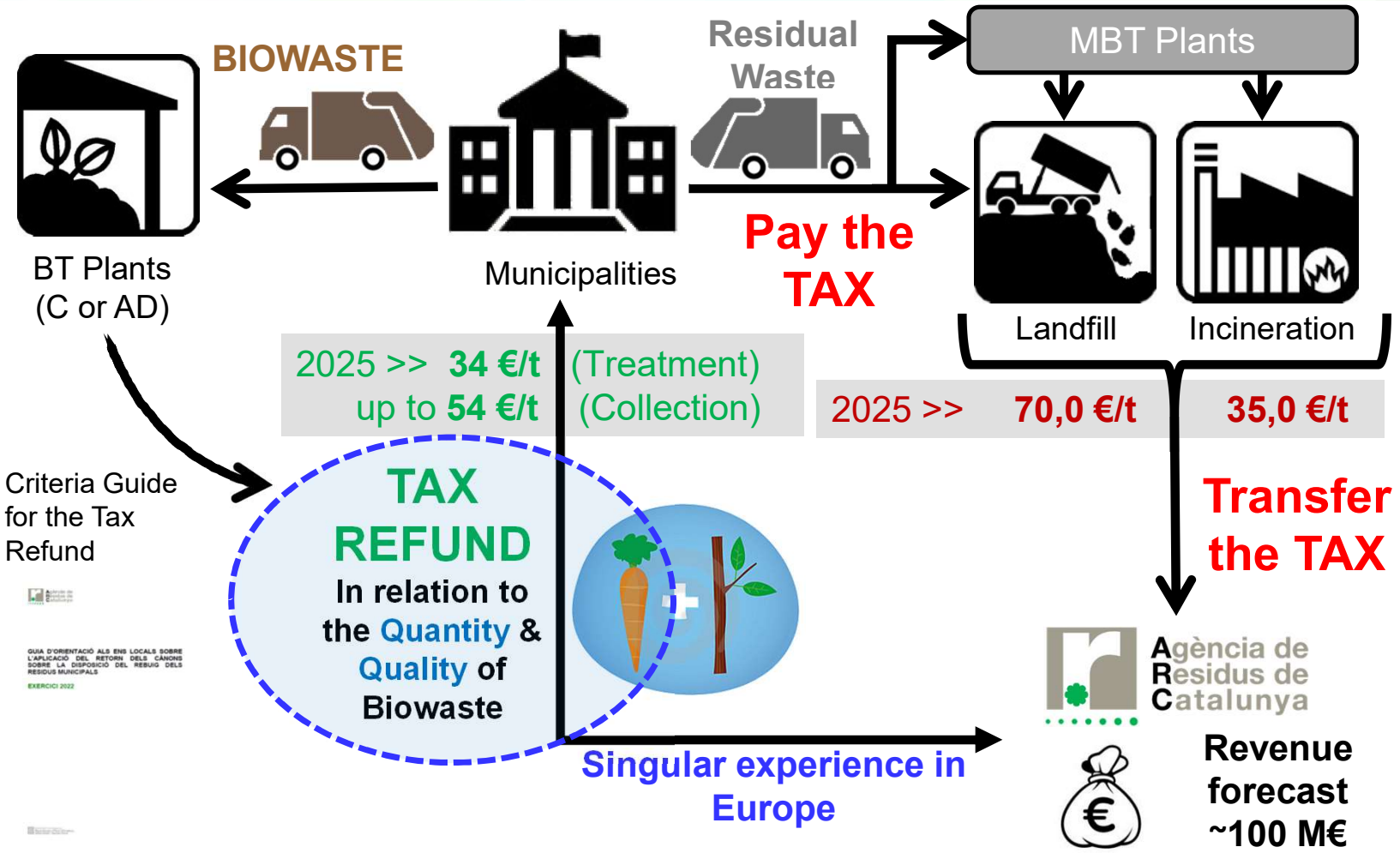
2008 — Incineration Tax

While landfill tax was increasing slowly but year by year, **an incineration tax of 5 €/t was passed in Catalonia** (*in 2025 incineration tax is 35 €/t)*

2022 — Env Taxation in Spain

Landfill & Incineration Tax was implemented in all Spain, “forced” by Europe. This tax has been transferred to Catalonia, which manages it autonomously.

Environmental Taxation on Waste in Catalonia



LANDFILL

Average Fee: 52,0 €/T
Tax 2025: 70,0 €/T
TOTAL = 122,0 €/T

INCINERATION

Average Fee: 70,0 €/T
Tax 2025: 35,0 €/T
TOTAL = 105,0 €/T

In 2035, to achieve the EU targets, the global economic charge (fee + tax) for landfill should reach between 130 €/T – 150 €/T

Environmental Taxation on Waste. How it works since 2004: Traceability (Quantity-Quality), Statistics, etc.

QUANTITY

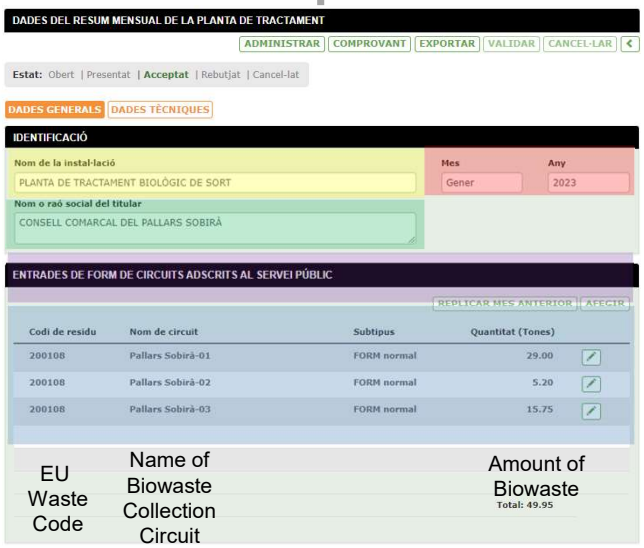
Agència de Residus de Catalunya

QUALITY

Monthly Activity Report

SDR
Sistema Documental de Residus

Quality Quarterly Report



Biological Treatment Plants
(Composting & AD Plants)
or Transfer Plants

OUTPUT

Biowaste
Green Waste
Compost
Digestate
Reject

INPUT

Biowaste
Green Waste

Owner
Operator

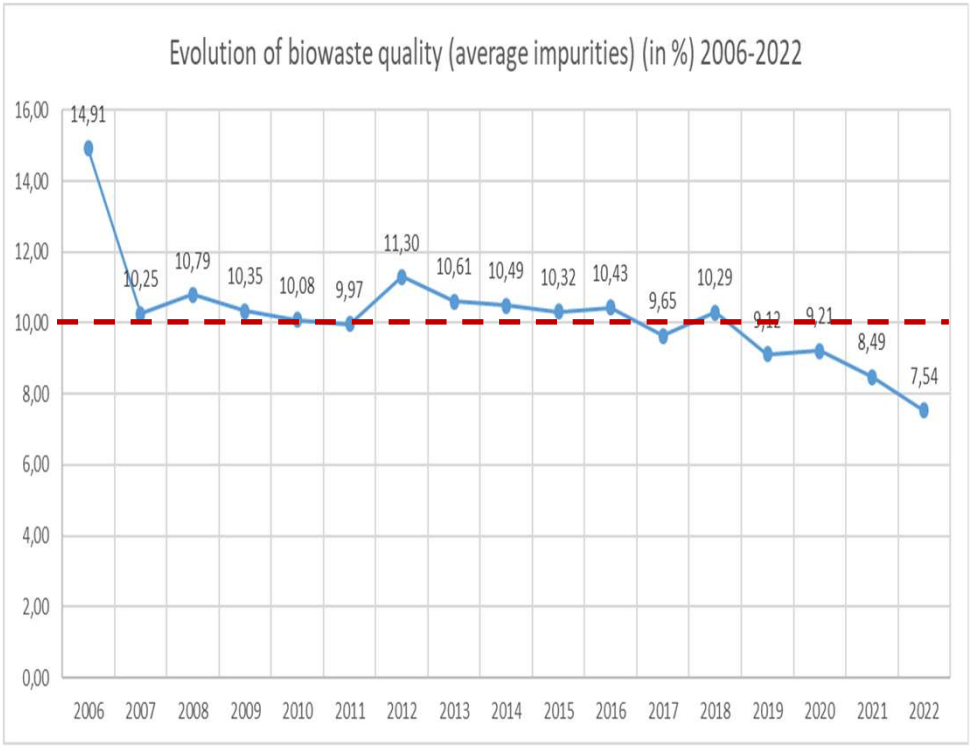
- 625 biowaste circuits
- 6 characterization companies
- Min. 4 controls/year per circuit
- 1 protocol of characterization
- 2,100 biowaste quality controls/year
- 28,000 quality controls (since 2005)

Traceability of Biowaste Quality (2005-2025)

~ 625 biowaste circuits (public or private)
~ 2.100 biowaste quality controls per year
~ 28.000 biowaste quality controls (since 2005)

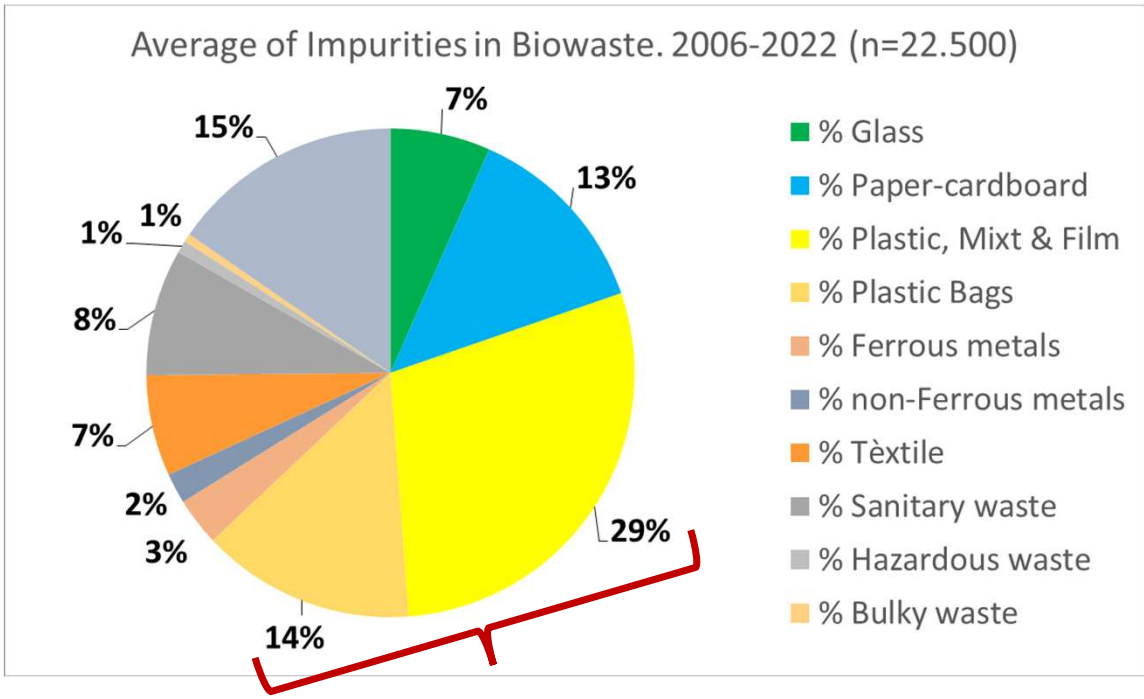
All this info is available in:
https://sdr.arc.cat/cform/ListCaracteritzacions.do

Biowaste Quality Monitoring (since 2005)



Target PRECAT20: < 10 % impurities

Average Impurities (2022): 7.5 %



43% PLASTIC

DRAGGING EFFECT:

Impurities present in Biowaste must be removed but this generates biowaste losses of the order of 2.5 to 3.0 times the amount of impurities

Importance of biowaste quality control

- Need for biowaste quality improvement to ensure high-quality recycling (composting)
- Biological treatment plants are required to establish treatment fees indexed by quality (higher quality, lower fees; worse quality, higher fees)
- Citizen awareness of the need for continuous quality improvement
- Ensure good recycling levels

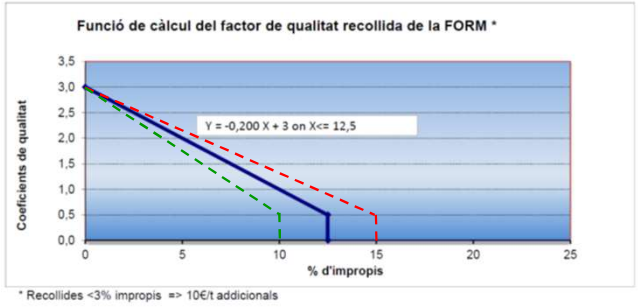
Calculation of TAX REFUND

Guide for local authorities on Law 8/2008, which includes the **Tax Refund Criteria** (annual review) [2025]:

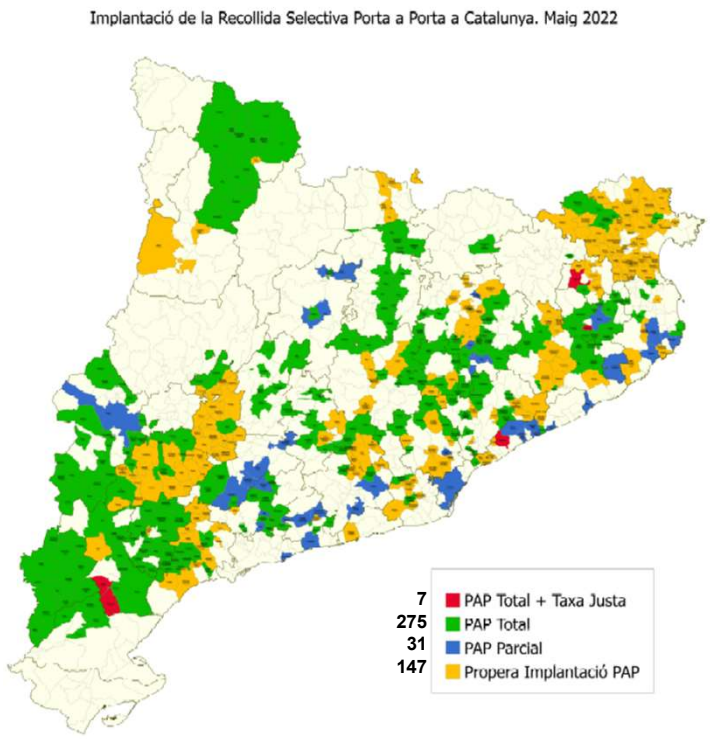
- BIOWASTE TREATMENT [34 €/T] (without impurities)
- BIOWASTE SEPARATE COLLECTION [12 €/T] · f_1 · f_2 [máx. 54 €/T]
  - Quality Factor (f_1)
  - Size Factor (f_2)

Urbana	Semiurbana	Rural
1	1,28	1,5
[a]	[b]	[c]

[a] > 50.000 inhab. (23)
[b] 5.000 – 50.000 inhab. (187)
[c] < 5.000 inhab (738)

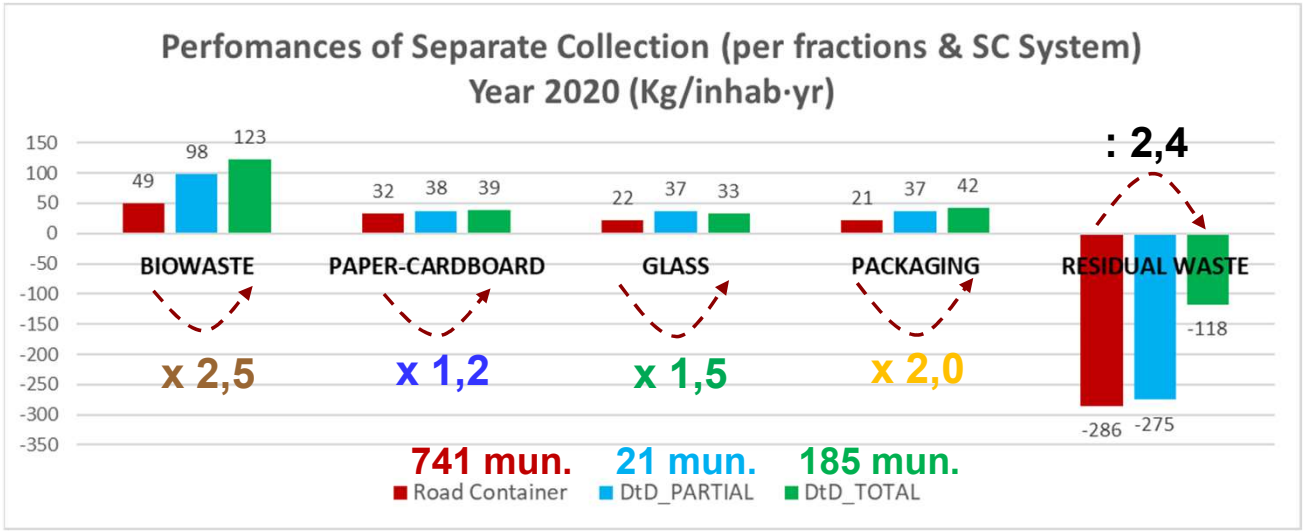


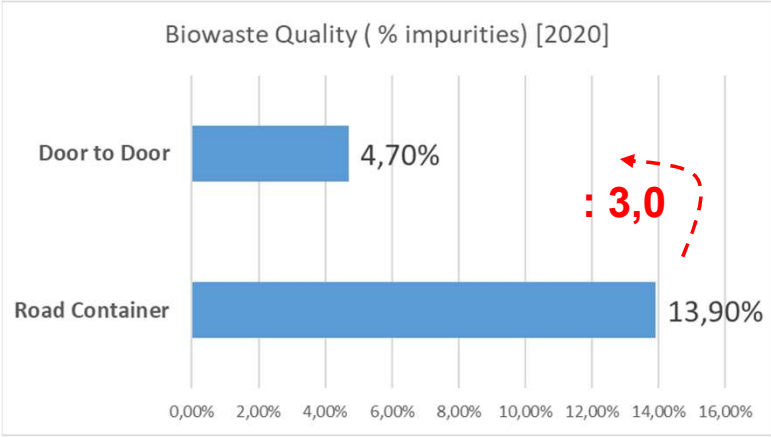
The Contribution of Door-to-Door collection



313 municipalities (33%)
460 municipalities in future (49%)

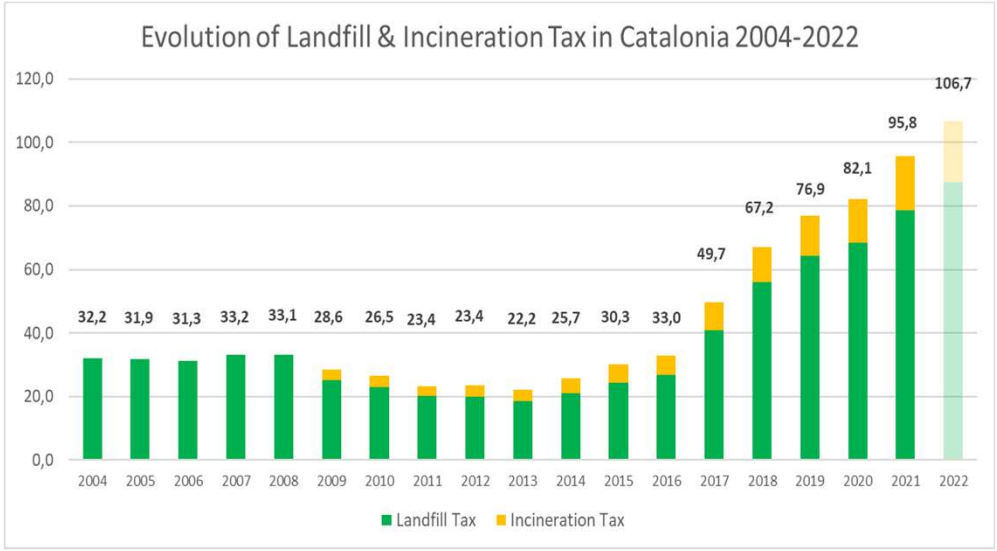
860,000 inhabitants involved (11%)

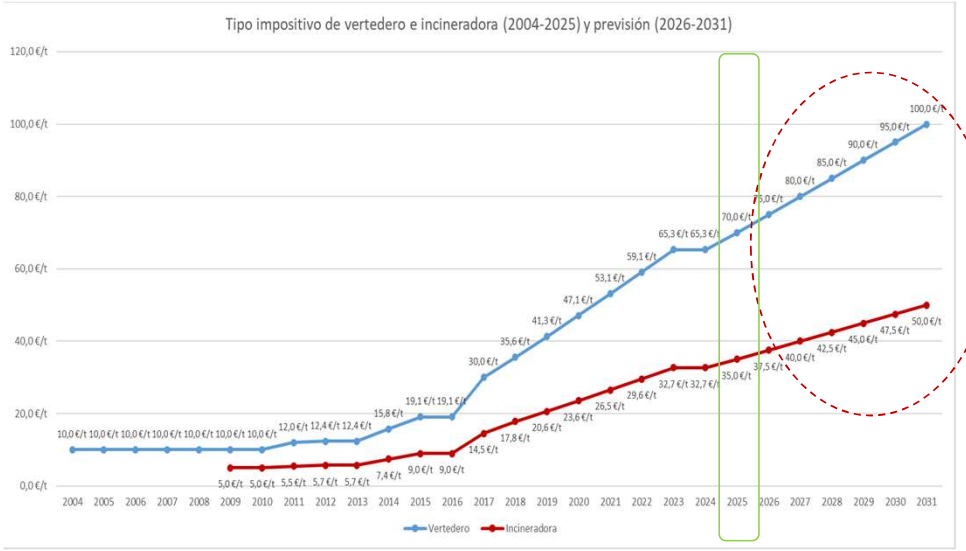




Tax rates, revenue, and forecast future tax rate increase

Tax Rate (€/T)	2004-2008	2009	2010	2011	2012-2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023-2024	2025
Landfill	10	10	10	12	12,4	15,8	19,1	19,1	30	35,6	41,3	47,1	53,1	59,1	65,3	**70,0**
Incineration	---	5	5	5,5	5,7	7,4	9	9	14,5	17,8	20,6	23,6	26,5	29,6	32,7	**35,0**





Overall Revenue 2004-2022: 853 M €

Tax Refund 2004-2022: 819 M€ (96%)

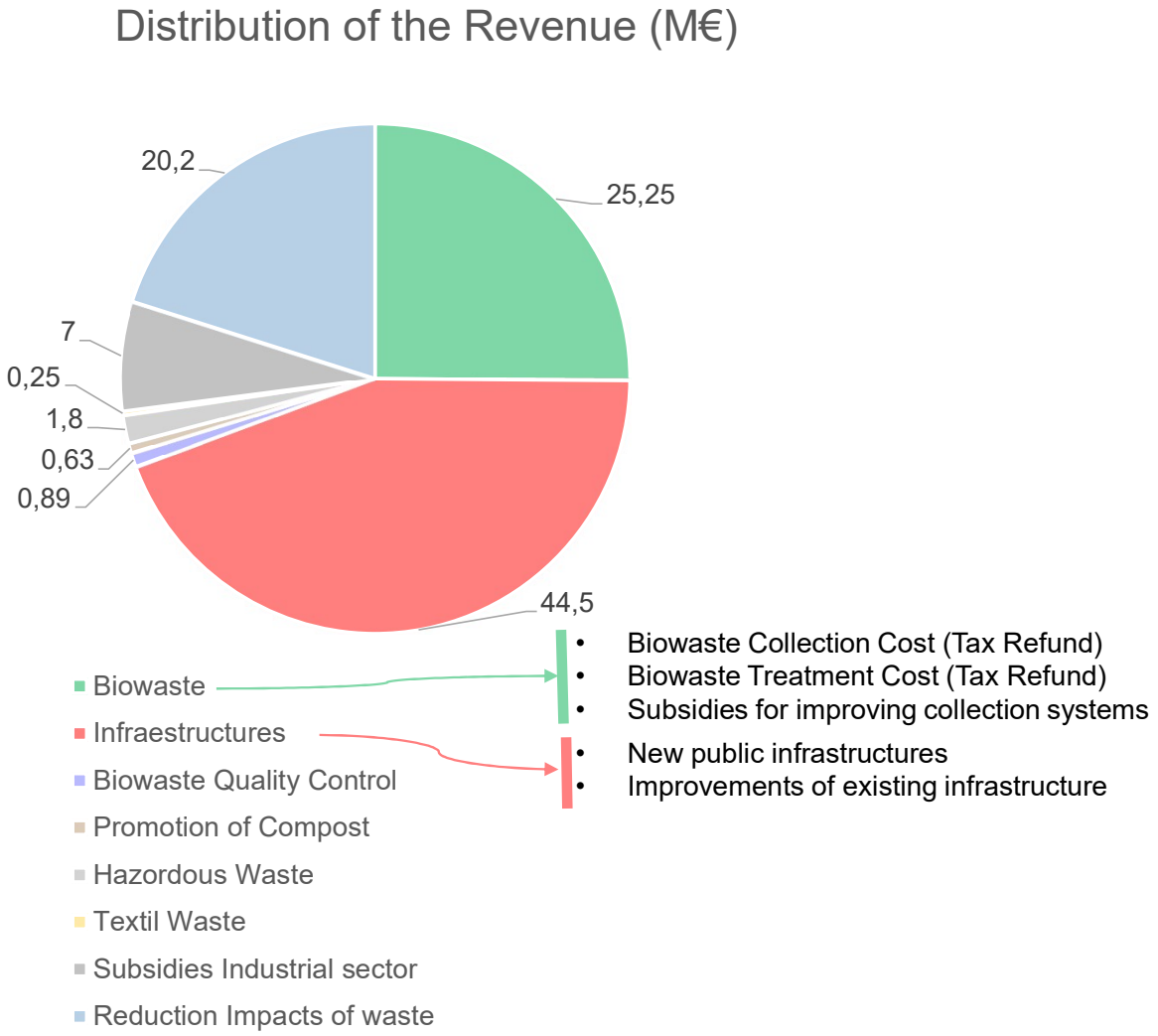
Forecast Future Tax Rate Increase

Distribution of the Revenue

INGRÉS	Tn	Import unit.	Ingrés cànon	% total
Residus Municipals Deposició	1.480.000	59,1	87.468.000	82,0%
Residus Municipals Incineració	650.000	29,6	19.240.000	18,0%
TOTAL	**2.130.000**		**106.708.000**	**100,0%**

RETORN	Tn	Import unit. €/Tn	Cànon Euros	% total ingrés
1.1 Tractament de la FORM (gestió)	440.000	34,0	13.500.000	12,7%
1.2 Caracteritzacions i analítiques			890.000	0,8%
1.3. Infraestructures			44.496.007	41,7%
2.1. Rebuig no refinat a dipòsit controlat	590.250	7,0	4.131.750	3,9%
2.2 Rebuig no refinat a valorització energètica	346.500	14,80	5.128.200	4,8%
2.3 Metanització de l'orgànica			3.300.000	3,1%
2.4 Bioestabilitzat a dipòsit controlat	173.900	59,1	10.277.490	9,6%
2.5 Bioestabilitzat a valorització energètica	27.750	29,6	821.400	0,8%
3. Impuls i comercialització del compost	63.000	10,0	630.000	0,6%
Subtotal Tractament			**83.174.847**	**77,9%**
4. Recollida selectiva FORM	440.000	12,0	7.400.000	6,9%
5. Gestió residus especials a les deixalleries*	3.500	500	1.800.000	1,7%
6. Autocompostatge			300.000	0,3%
7. Recollida roba	25.000	10,0	250.000	0,2%
8. Retorn gestors industrials assimilables			7.000.000	6,6%
9. Poda	150.000	5,0	750.000	0,7%
10. Despeses de gestió ARC			3.201.240	3,0%
11. Despeses gestió ens locals			200.000	0,2%
12. Infraestructura verda i millora ambiental			2.134.160	2,0%
13. Control Fiscal (*)			497.753	0,5%
Subtotal Recollides i Altres			**23.533.153**	**22,1%**
TOTAL			**106.708.000**	**100,0%**

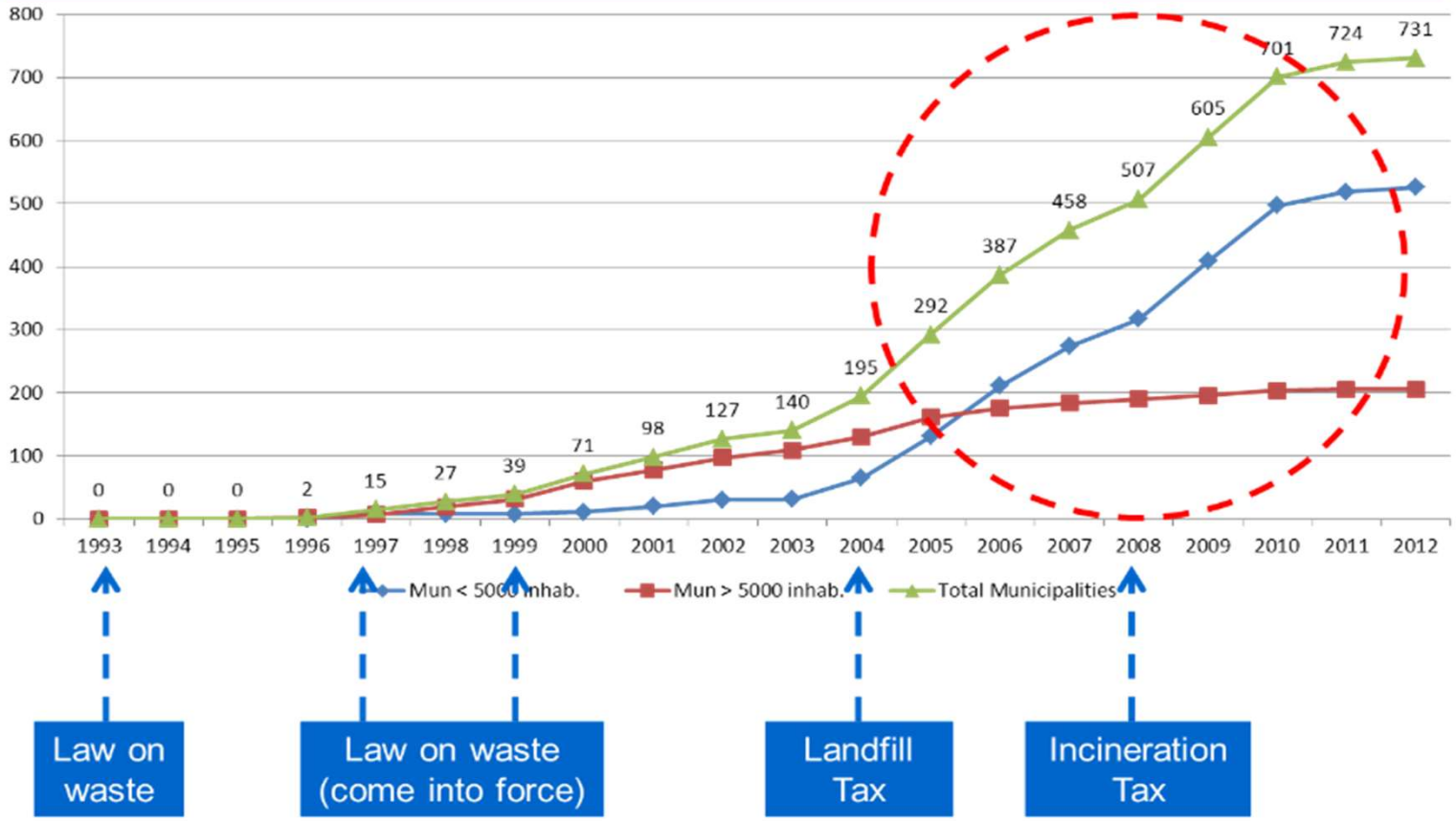
Forecast Balance Incomes and Refunds. Year 2022



Positive effect of Environmental Taxation on waste in Catalonia

The Landfill and Incineration Tax <u>has been very effective in stimulating the implementation of Separate Collection of Biowaste</u>

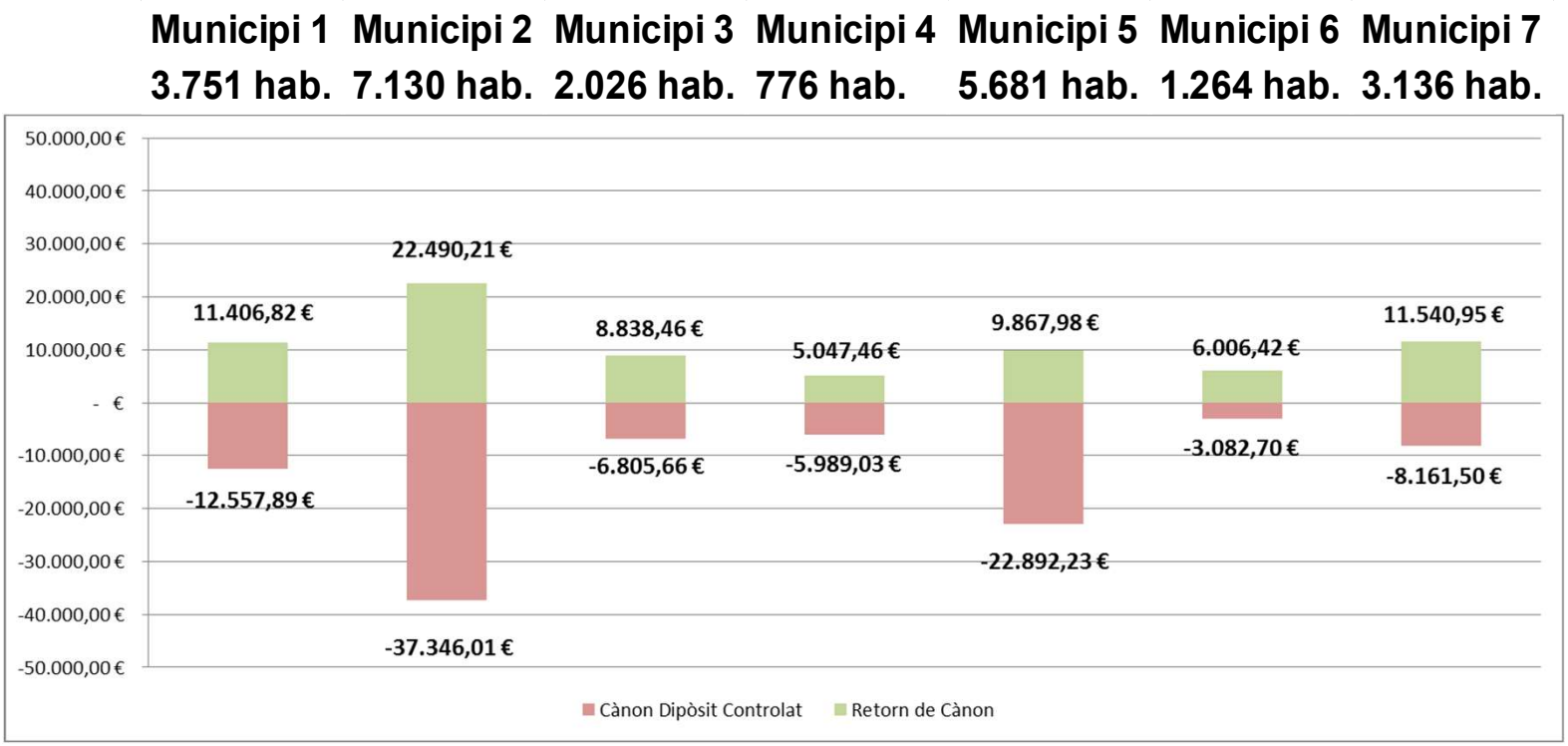
Number of Catalan municipalities that implemented separate collection of biowaste since Law on Waste was approved



Impact of Environmental Taxation on waste in Catalonia

How does the landfill and incinerator tax affect Catalan municipalities?

Balance in 7 Catalan municipalities



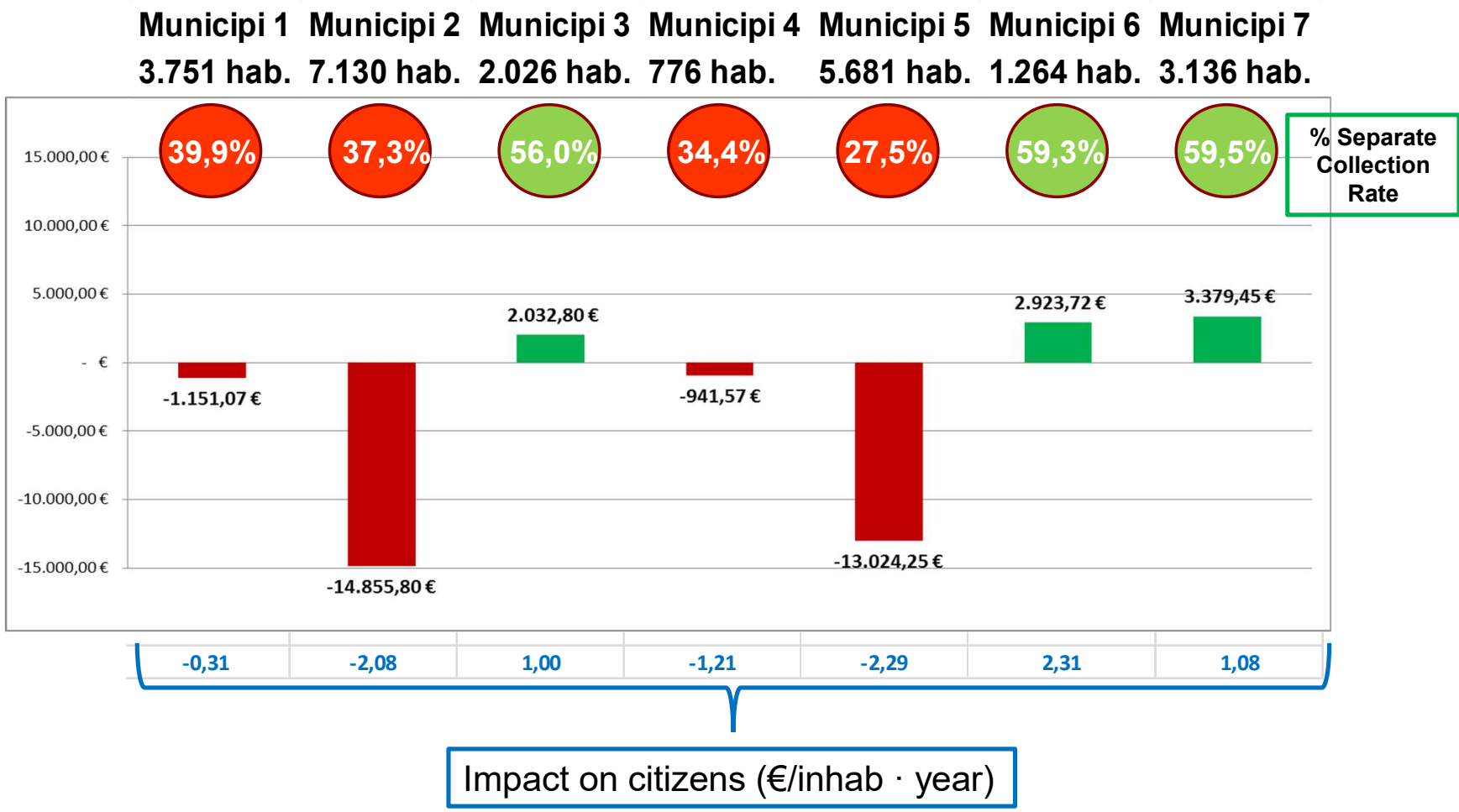
Economic amount supported through the landfill / incinerator tax

Economic amount corresponding to the Tax refund received

Impact of Environmental Taxation on waste in Catalonia

How does the landfill and incinerator tax affect Catalan municipalities?

Balance in 7 Catalan municipalities



Future challenges for biowaste management

Challenge-1

Advance in "efficient" separate collection systems in large cities and in municipalities with high density in order to achieve the European targets

Challenge-2

All municipalities should apply a fair tax (PAYT or equivalent) to citizens and economic activities in order to encourage better municipal waste management

Challenge-3

Keep improving the quality of biowaste, always promoting the separate collection with a compostable bag, and achieving less than 5% of impurities

Challenge-4

Increase in 10 years the biological treatment capacity by around 400,000 tons of biowaste, with a vision of decentralized management and km 0

Challenge-5

Facing the appearance of biodegradable / compostable materials & products (packaging or not) in the joint collection and treatment of biowaste

Thank you for your attention

https://twitter.com/residuscat

https://www.facebook.com/residuscat

https://www.instagram.com/residus_cat/

https://www.linkedin.com/company/agència-de-residus-de-catalunya

https://www.youtube.com/user/residuscat/videos

UNIVERSITY OF LJUBLJANA | BF Biotechnical Faculty

Integrating Insect Bioconversion for Sustainable Circular Food Systems

Tim Ratajc, M.Sc.

24 Apr 2025

ORGANIZATION, RESEARCHERS AND REFERENCES

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- Assoc. Prof. Dr. Alenka Levart, Prof. Dr. Janez Salobir (Chem. Analysis, Feed Trials)
- Assist. Prof. Dr. Luka Juvančič (Circular Bioeconomy, Policy)
- Prof. Dr. Tatjana Pirman (Laboratory Animals)

Industrial partners

- Better Origin: Entomics Biosystems Ltd, Cambridge UK
- Municipality of Ljubljana: Ljubljana Regional Waste Management Centre
- KOTO Ltd.: handling of animal by-products

PROBLEM

PRESSURE

2050:
9.7 billion people,
+**250M tons** of
protein/year
needed

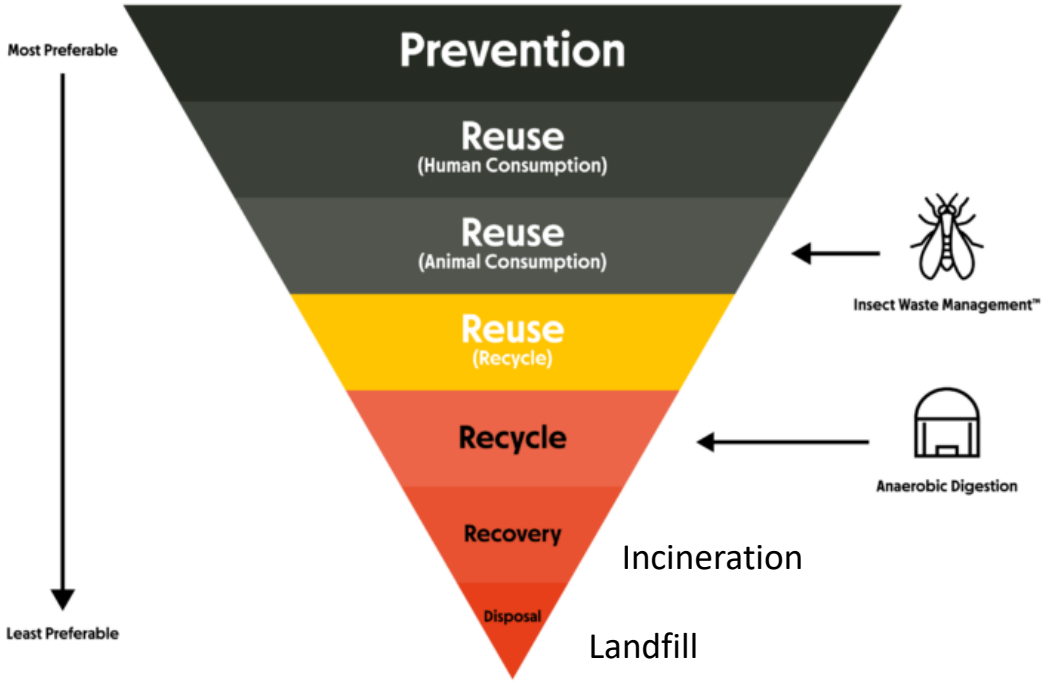
1/3 of food for
human
consumption is
wasted yearly
= **1.3B tons**

SOLUTION

INSECTS

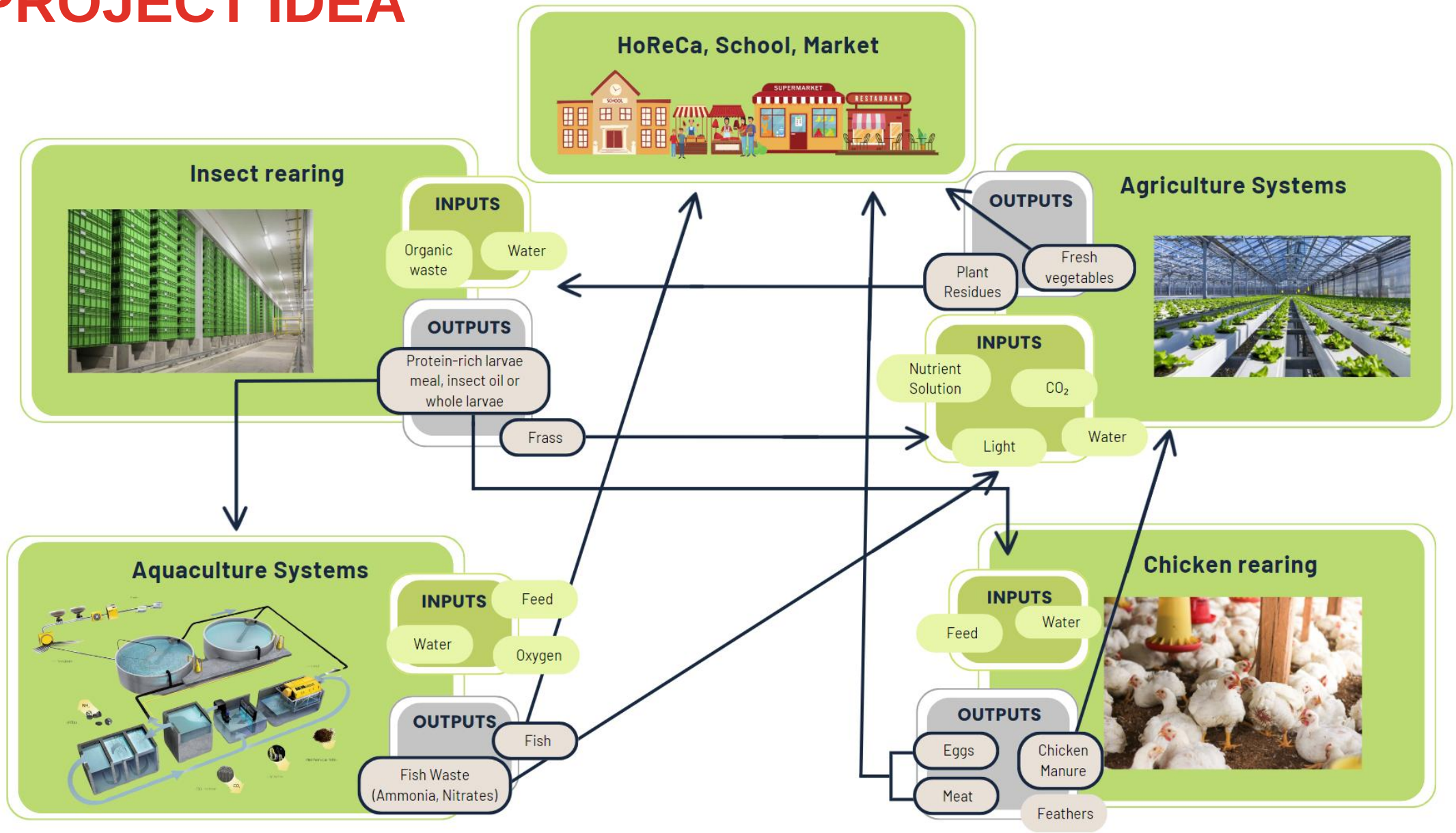
- Insects offer a solution to global challenges: protein supply & organic waste disposal
- They recycle nutrients from waste into the food value chain

Today, this sustainable solution is **feasible**, **scalable**, and **economical**



Source of The Waste Management Hierarchy Chart: https://flybox.bio/rethinking-waste-insect-waste-management/

PROJECT IDEA



FIELDS OF EXPERTISE

INSECT REARING

Digitalized Black Soldier Fly (BSF) rearing lab:

- Feed trials
- Rearing optimisation and upscaling
- Bioremediation research (digestion of microplastics)

IDENTIFICATION OF ORGANIC MASS STREAMS

- Mapping of potential feedstock streams from farm to fork
- Feedstock characterization
- Feed formulation for optimal nutrition from available organic side streams

VALORISATION OF PRODUCTS

- Characterisation of BSF products and by-products
- Exploring alternative use of BSF products
- Incorporating circular bioeconomy to current waste management practices

BSF PRODUCTS

PROTEIN MEAL

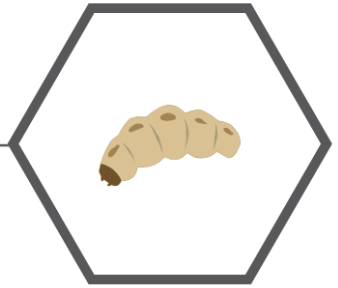
Has protein availability and an amino-acid profile comparable to soybean meal.

FAT

Contains about 50 % lauric acid, which has antimicrobial properties and helps support the immune system of both farmed animals and pets.

FRASS

A by-product made up of insect exoskeletons, droppings and leftover substrate. Rich in organic matter, minerals and chitin, it boosts plants' natural defenses.



LIVE OR PROCESSED WHOLE LARVAE

Have a beneficial nutrient profile, including high levels of crude protein, essential amino acids, lipids and minerals such as calcium and phosphorus.

FRASS IN AGRICULTURE: EXPERIMENTAL TRIALS

UL | BF

High nutrient content; suitable as an additive in both compost and soil.

SALAD

control group (without *frass*) | 10 % addition *of frass*

PAPRIKA

control group (without *frass*) | 10 % addition *of frass* | 30 % addition *of frass*

TOMATO

control group (without *frass*) | 10 % addition *of frass*

Source: Preliminary experiments

POTENTIAL IMPACT

Scientific impact
Examining circular economy models
Exploring bioconversion processes
Waste-to-product innovation

Societal impact
Education and awareness through partnerships
Sustainable food promotion (HORECA,
Community engagement)

Economic/Technological impact
Implementation of circular economy systems
BSF farming integration
Resource efficiency
Local food branding

Sustainable Development Goals (SDGs)

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QUESTIONS?

Thank you for your attention!