MATERIAL RECOVERY FROM MSW: ACTUAL RECOVERY RATES AND ENVIRONMENTAL BENEFITS

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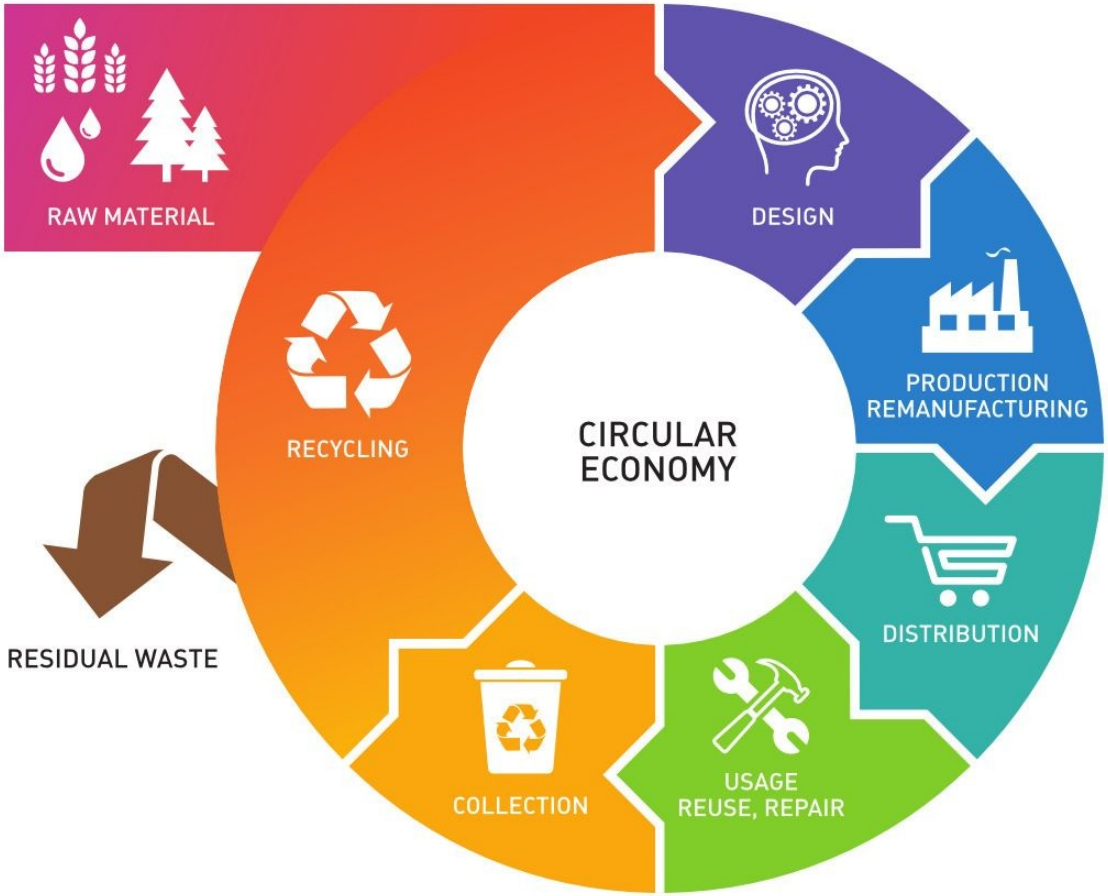
Summary

- Introduction
- Objectives
- Study case
- Data collection
- Results - 1
- LCA
- LCA - Results – 2
- Conclusions

DIRECTIVE (EU) 2018/851 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 30 May 2018 amending Directive 2008/98/EC on waste

"Improving the efficiency of resource use and ensuring that **waste is valued as a resource** can contribute to reducing the Union's dependence on the import of raw materials and facilitate **the transition to more sustainable material management and to a circular economy model**."

"The targets laid down in Directive 2008/98/EC of the European Parliament and of the Council (4) for **preparing for re-use and recycling of waste should be increased** to make them better reflect the Union's



DIRECTIVE 2008/98/EC on waste

Directive 2008/98/EC: TARGETS

«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 ….to a minimum of 70 % by weight».

*'**preparing for re-use**' means checking, cleaning or repairing recovery operations, by which products or components of products that have become waste are prepared so that they can be re-used without any other pre-processing.*

*'**recycling**' means any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material **but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations.***

DIRECTIVE 2008/98/EC on waste

…in Italy

'**separate collection**' means the collection where a waste stream is kept separately by type and nature so as to facilitate a specific treatment.

+

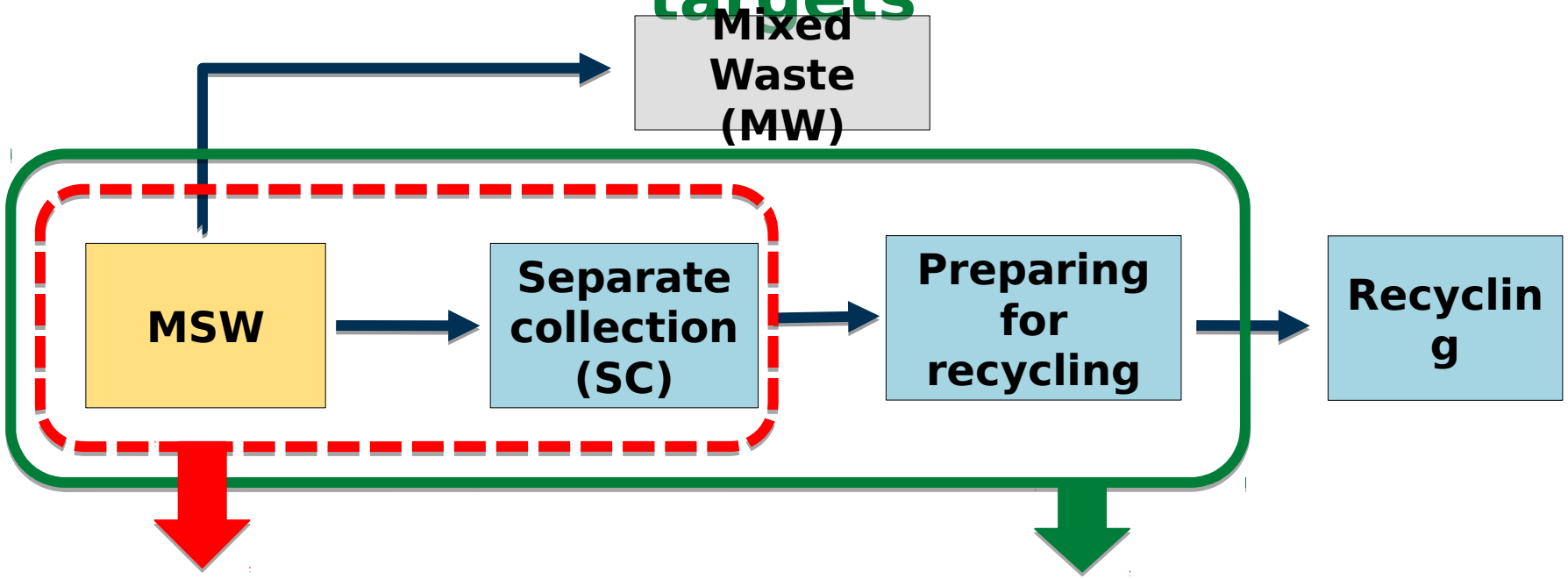
«by 2020, the preparing for re-use and the recycling ….. minimum of overall **50 % by weight**»

D. Lgs. 152/2006

Targets of separate collection of MSW:

- 50 % by 2009
- 60 % by 2011
- **65 % by 2012**

DIRECTIVE (EU) 2018/851: new targets



D. Lgs. 152/2006

Targets of separate collection of MSW:

- 50 % by 2009
- 60 % by 2011
- **65 % by 2012**

$$sc\,(\%) = \frac{\sum sc}{\sum sc+MW} \times 100$$

*The targets for preparing for re-use and recycling of municipal waste **should be increased** in order to deliver substantial environmental, economic and social benefits and to accelerate the shift towards a circular economy.*

Directive 2018/851/UE

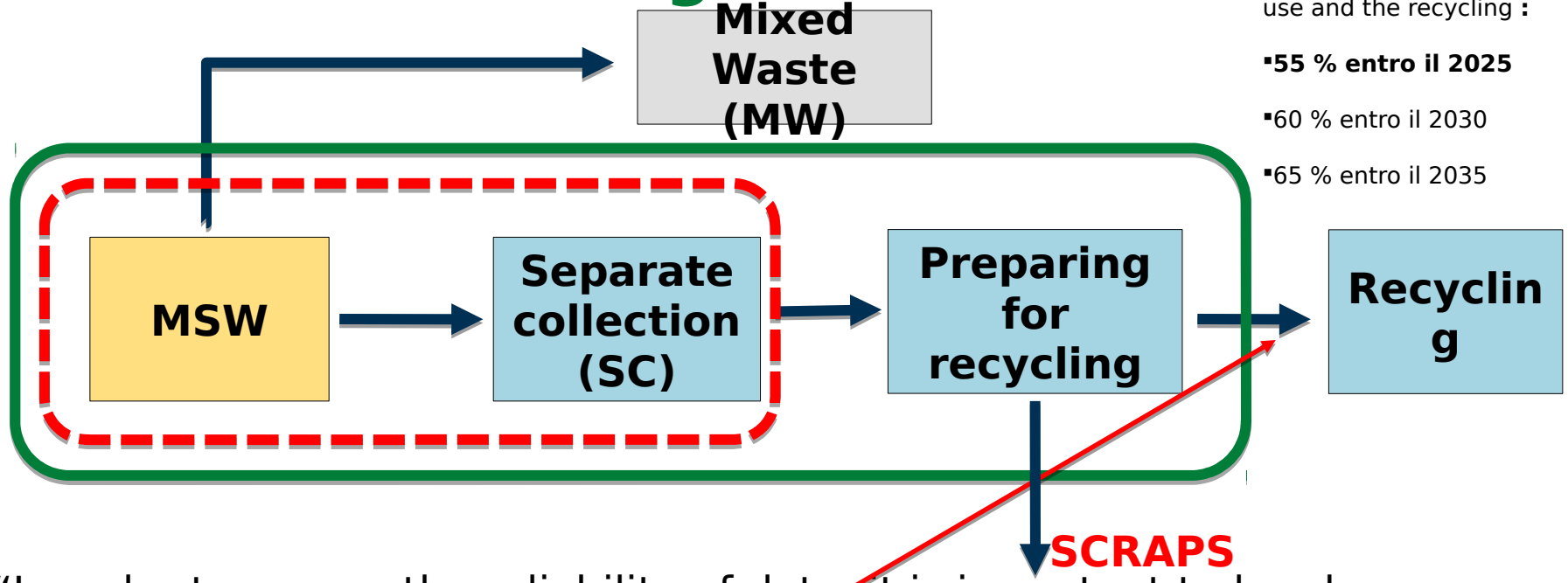
Targets for preparing for re-use and the recycling **:**

- **55 % by 2025**
- 60 % by 2030
- 65 % by 2035

DIRECTIVE (EU) 2018/851: new targets

Directive 2018/851/UE
Targets for preparing for re-use and the recycling **:**

- **55 % entro il 2025**
- 60 % entro il 2030
- 65 % entro il 2035



"In order to ensure the reliability of data, it is important to lay down more precisely the rules according to which Member States should report **what is effectively recycled and prepared for re-use and can be counted towards the attainment of the targets**.

The calculation of the recycling targets should be based **on the weight of municipal waste which enters recycling**.

As a general rule, the actual measurement of the weight of municipal waste counted as recycled should be at the point where municipal waste enters the recycling operation

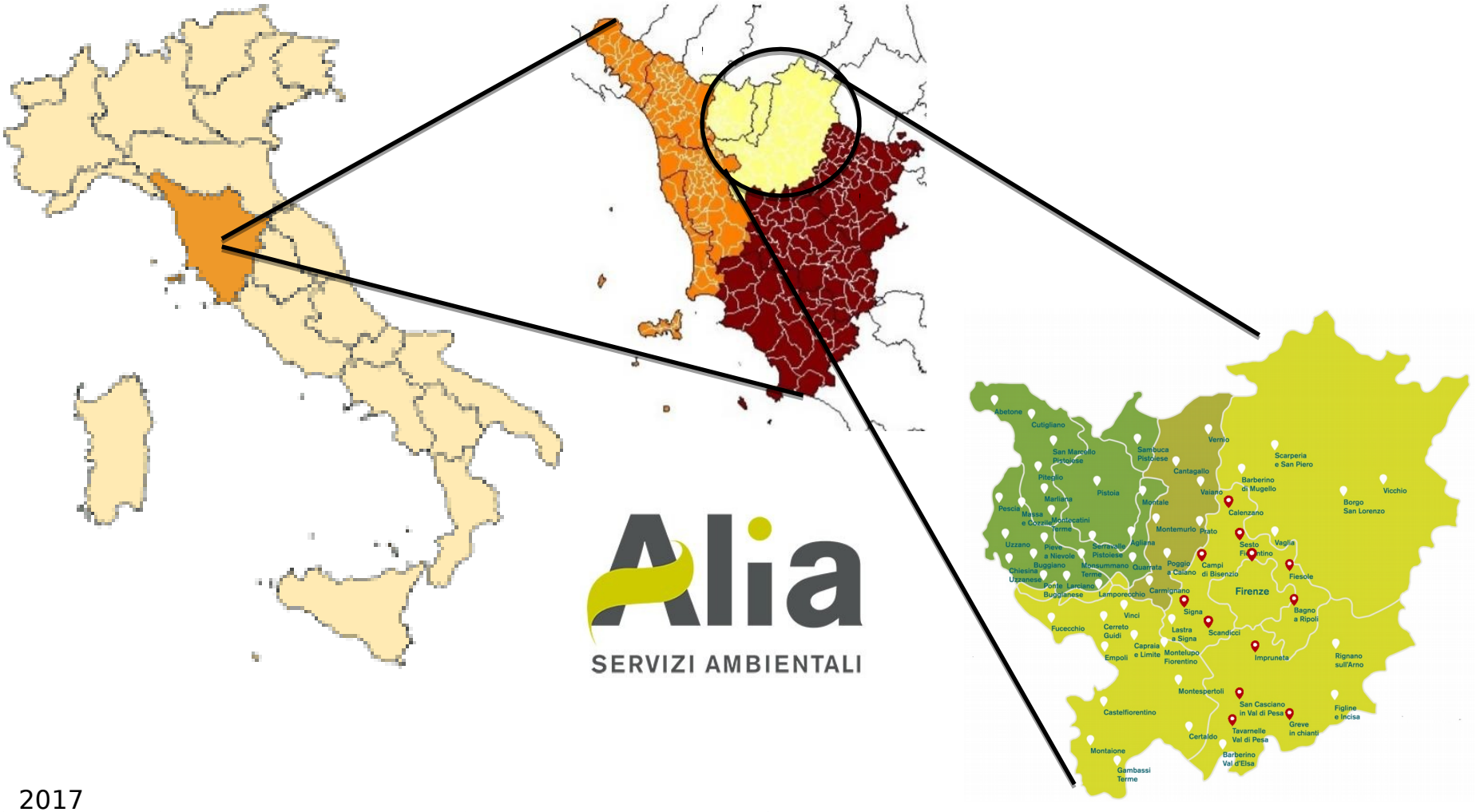
Objectives of this work

- Estimation – for some SC streams – of the amount prepared for recycling (2013-2017).
- Calculation of the "preparing for recycling index", subtracting from the SC the scraps – comparison with SC index.
- Evaluation of the environmental impacts – by *Life Cycle Assessment* (LCA) - for the integrated waste management system (collection-preparation for recycling – recycling – disposal of scraps).

Study case

Study case

Italy Tuscany ATO Toscana Centro DT1



2017

Inhabitants	Total MSW	SC	SC%	Residual MSW	kg/pro capita y
1.387.257	818.686 t	485.376 t	52%	333.310 t	590

Study case

DT 1 : Firenze Area

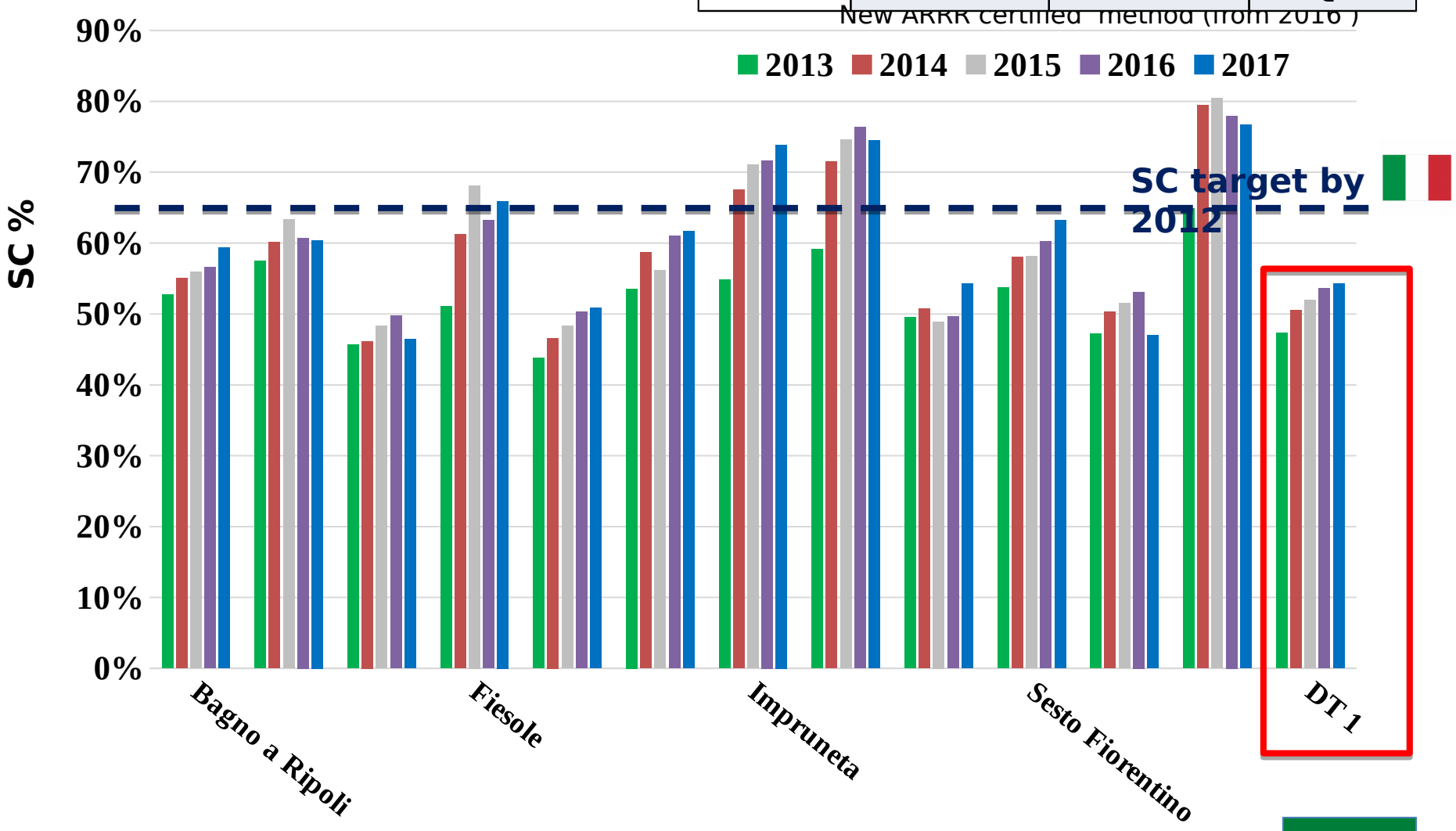
DT 2 : Empoli Area

Municipality	Area (km²)	Inhabitants
Bagno a Ripoli	74,1	25.491
Calenzano	76,97	17.914
Campi Bisenzio	28,75	46.696
Fiesole	42,19	14.127
Firenze	102,32	377.766
Greve in Chianti	169,38	13.814
Impruneta	48,72	14.618
S. Casciano V.P.	107,83	17.023
Scandicci	59,7	50.645
Sesto Fiorentino	48,8	49.091
Signa	18,81	
Tavarnelle	57,03	

Study case

$$SC\,(\%) = \frac{\sum_i SC_i}{\sum_i SC_i + MW} \times 100$$

	SC	MW	MSW
2017	229.858 t	193.862 t	423.720 t



Study case … in progress

Separate collections: plastics, glass, paper and cardboard, bulky waste, bidegradable …

EWC codes

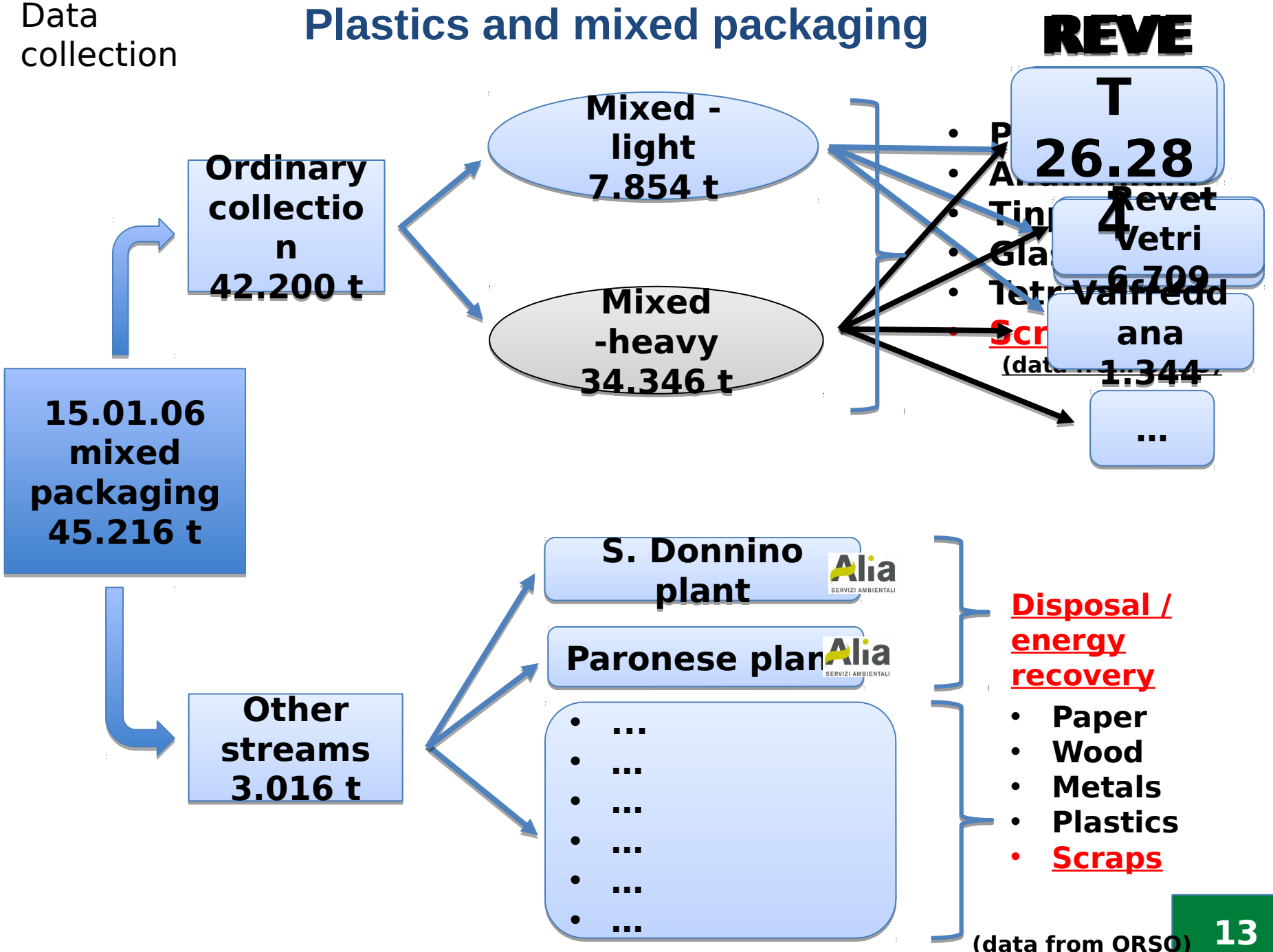
- **15.01.06**: mixed packaging
- **15.01.02**: plastic packaging
- **15.01.05**: composite packaging
- **20.01.39**: plastics
- **15.01.07**: glass packaging
- **20.01.02**: glass
- **15.01.01**: paper and cardboard packaging
- **20.01.01**: paper and cardboard
- **20.03.07**: bulky waste
- **20.01.08** : biodegradable kitchen and canteen waste
- **20.03.02**: waste from markets
- **20.02.01**: garden and park biodegradable wastes

AGENZIA REGIONALE RECUPERO RISORSE

ORSO3.0 Osservatorio Rifiuti SOvraregionale

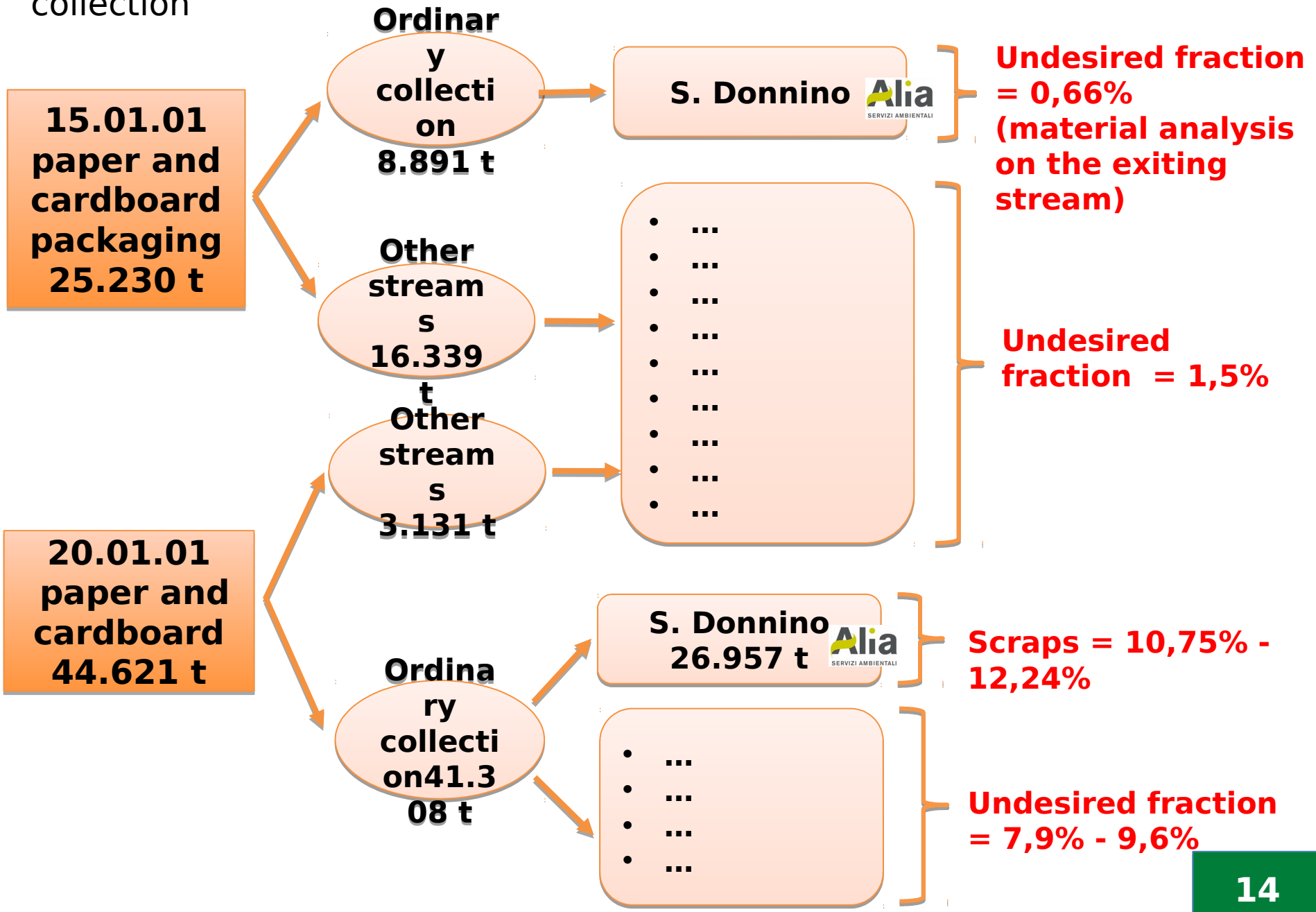
Data collection

Plastics and mixed packaging



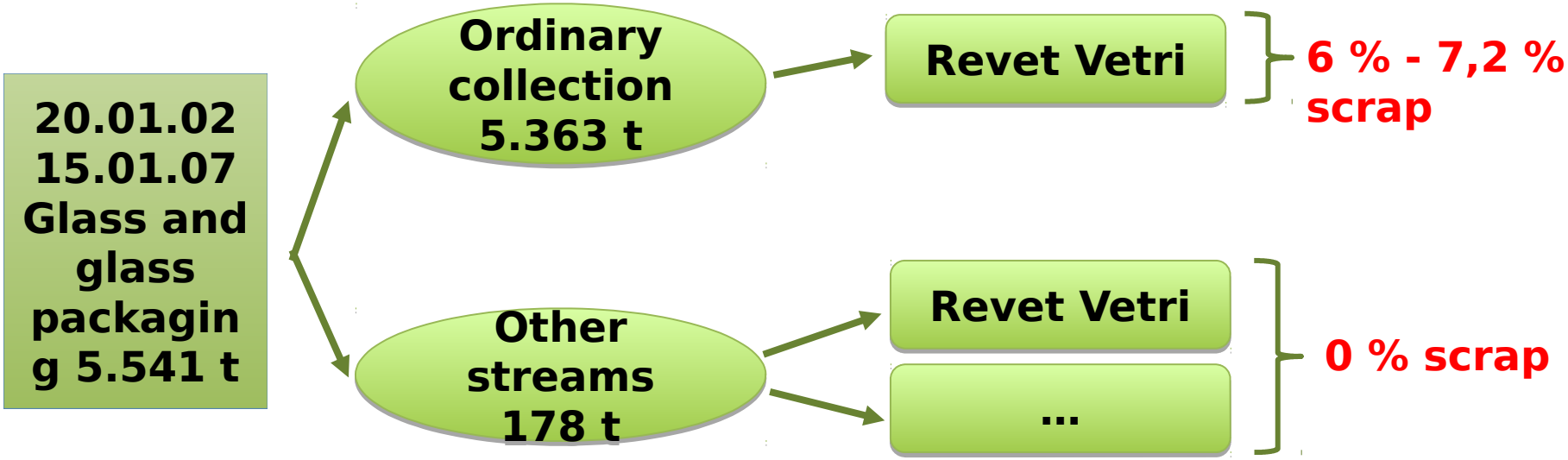
Data collection

Paper and cardboard



Data collection

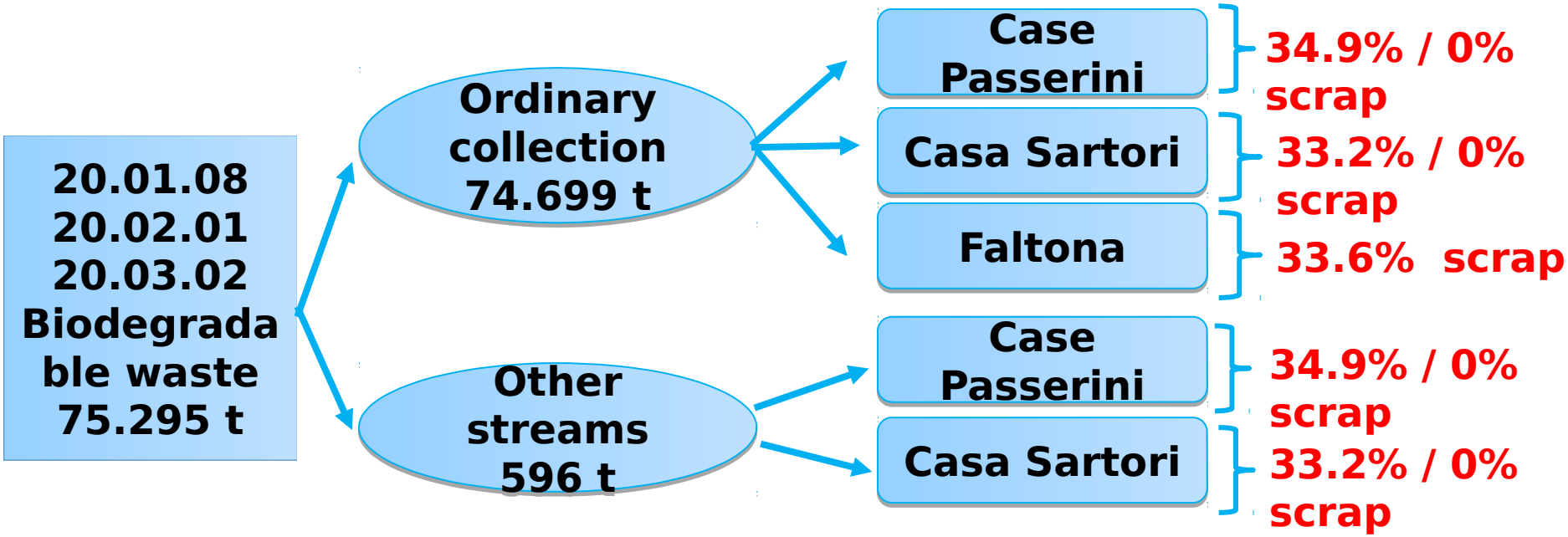
Glass



Bulky waste

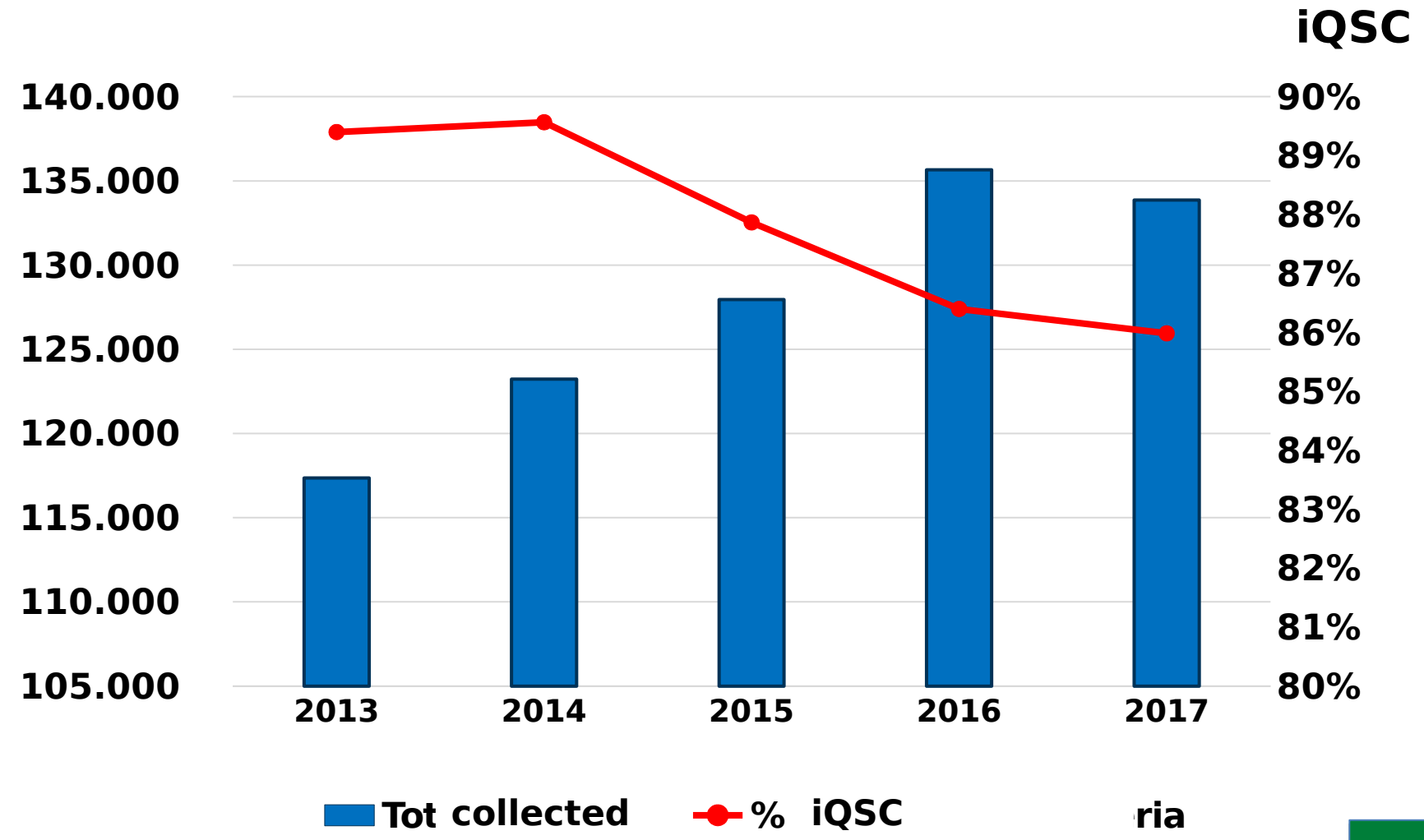
Data collection

Biodegradable wastes



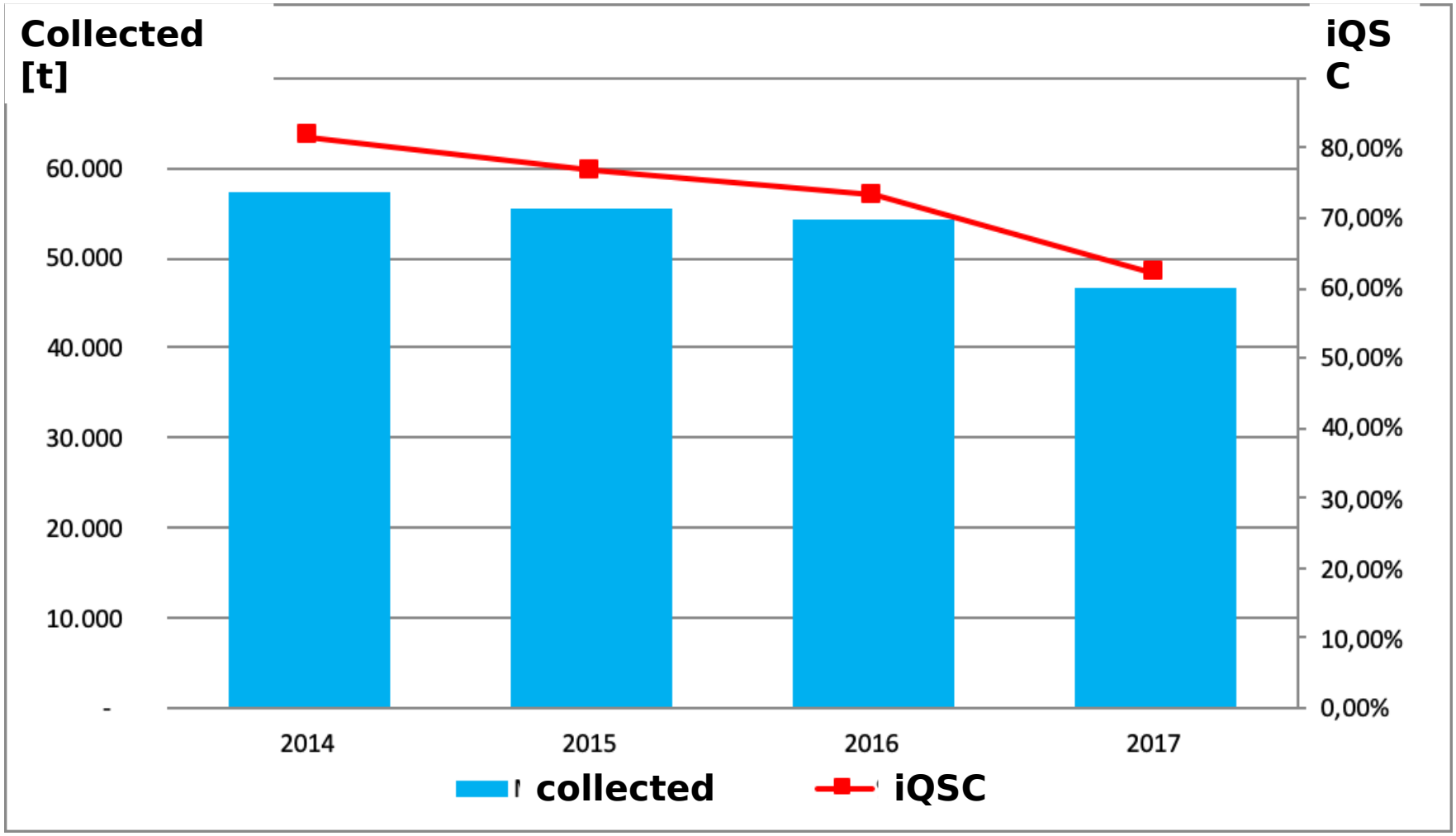
Index of Quality of SC

$$\overline{iQSC} = \frac{Collected - \sum_i Scrap_i}{Collected} = \frac{Prepared\ for\ Recycling}{Collected}$$



Index of Quality of SC – Biodegradable wastes

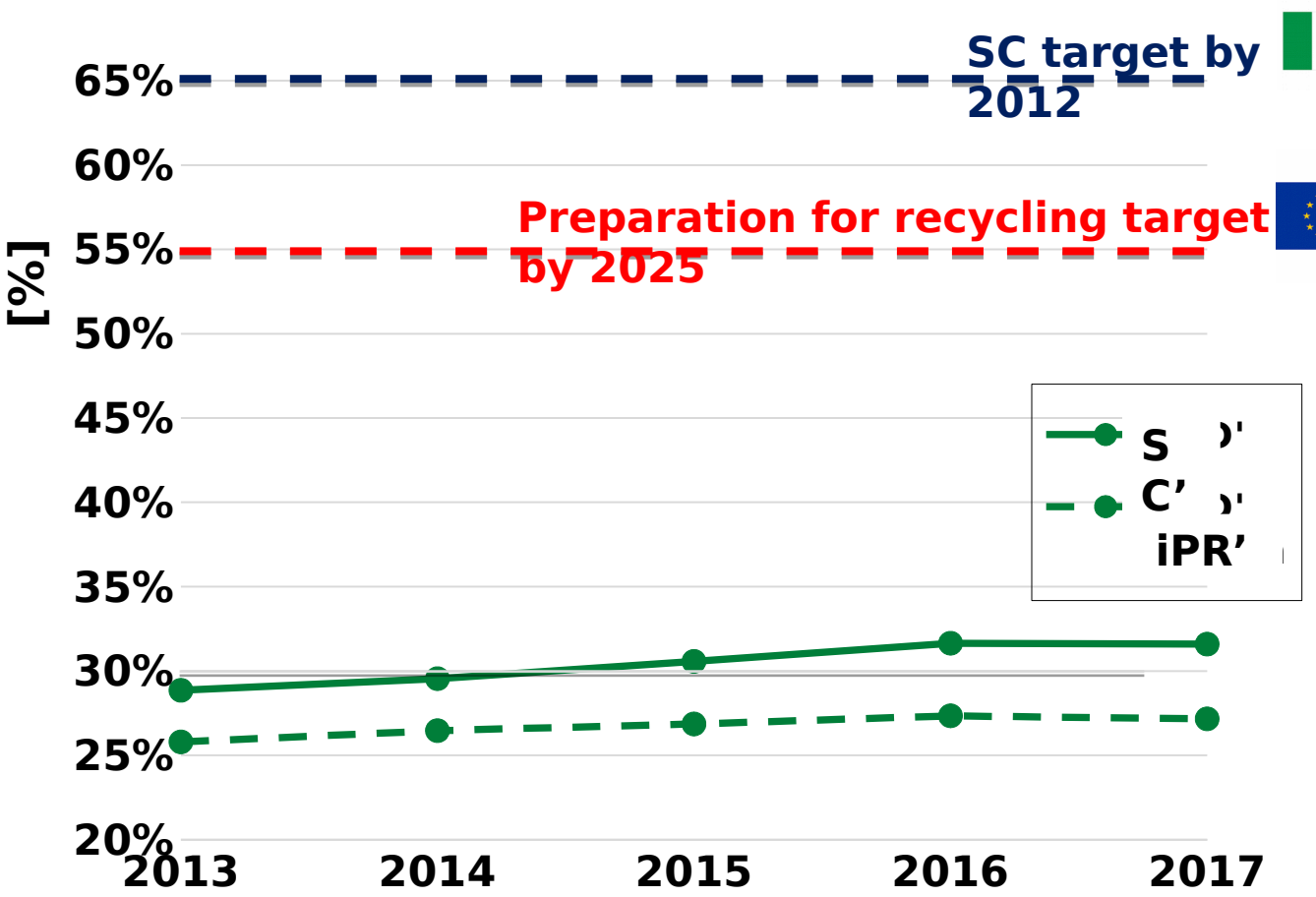
$$\overline{iQSC} = \frac{Collected - \sum_i Scrap_i}{Collected} = \frac{Prepared\ for\ Recycling}{Collected}$$



Index of Preparation for Recycling vs. separate collection index

$$SC'(\%) = \frac{Collected}{\sum SC + MW} \times 100$$

$$iPR'(\%) = \frac{Collected - \sum_i Scrap_i}{\sum SC + MW} \times 100$$

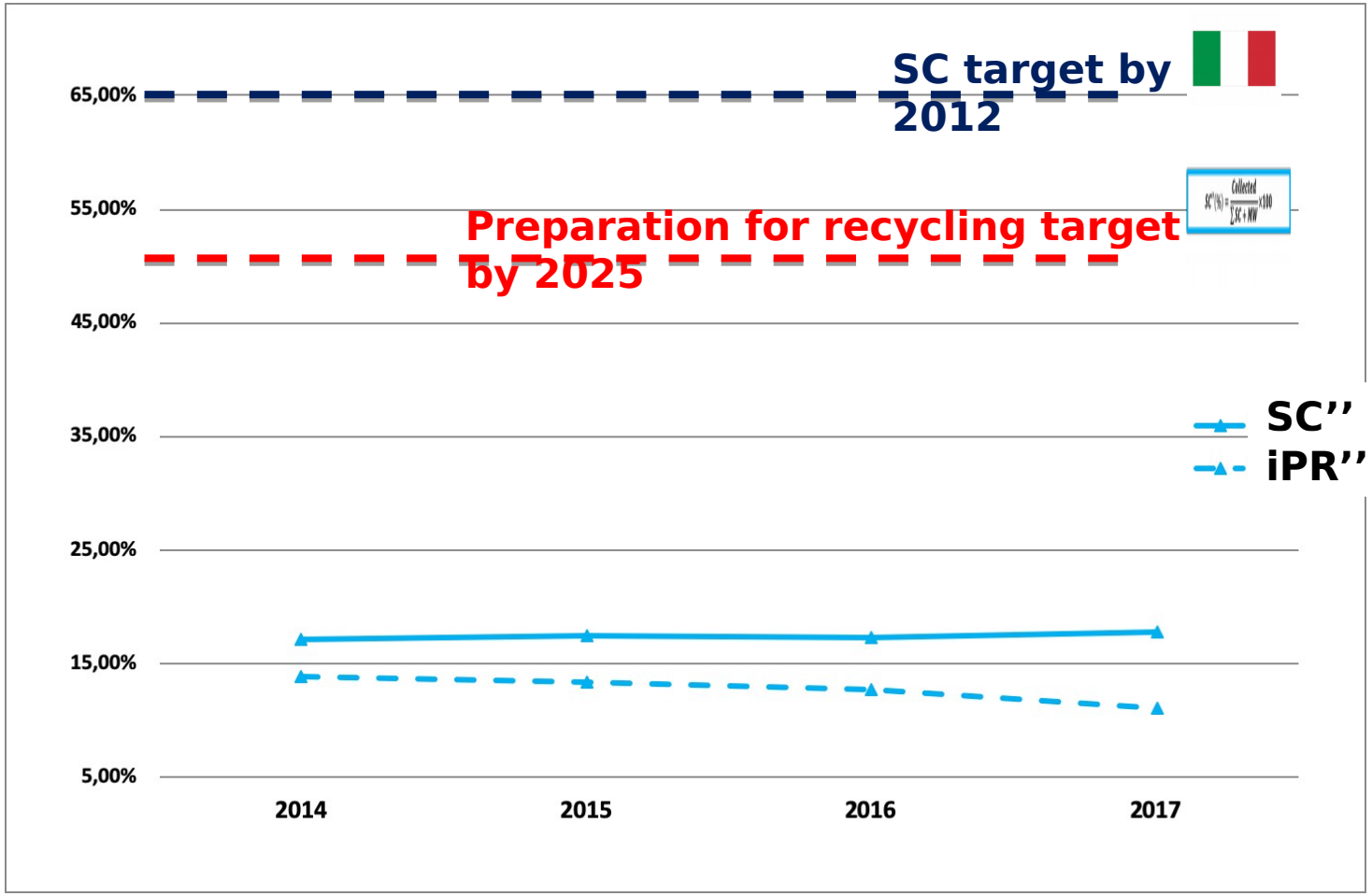


	SC'	iPR	Δ
2013	28,86 %	**25,50 %**	3,06
2014	29,55 %	**26,46 %**	3,08
2015	30,57 %	**26,86 %**	3,71
2016	31,65 %	**27,34 %**	4,30
2017	31,59 %	**27,16 %**	4,43

Index of Preparation for Recycling vs. separate collection index – Biodegradable wastes

$$SC''(\%) = \frac{Collected}{\sum SC + MW} \times 100$$

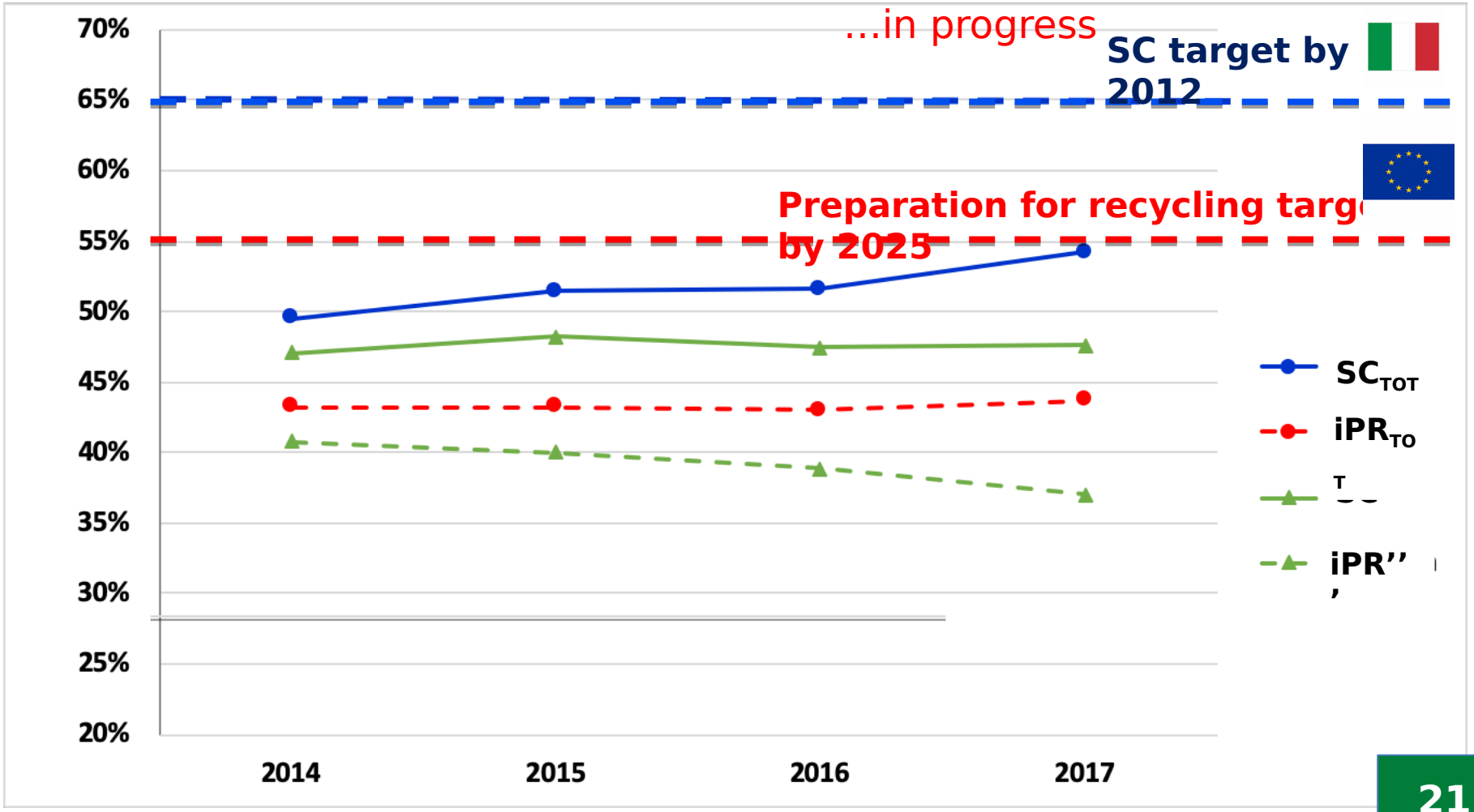
$$iPR''(\%) = \frac{Collected - \sum_i Scrap_i}{\sum SC + MW} \times 100$$



Separate collection index - clean

$$SC_{TOT}(\%) = \frac{\sum SC}{\sum SC+MW} \times 100$$

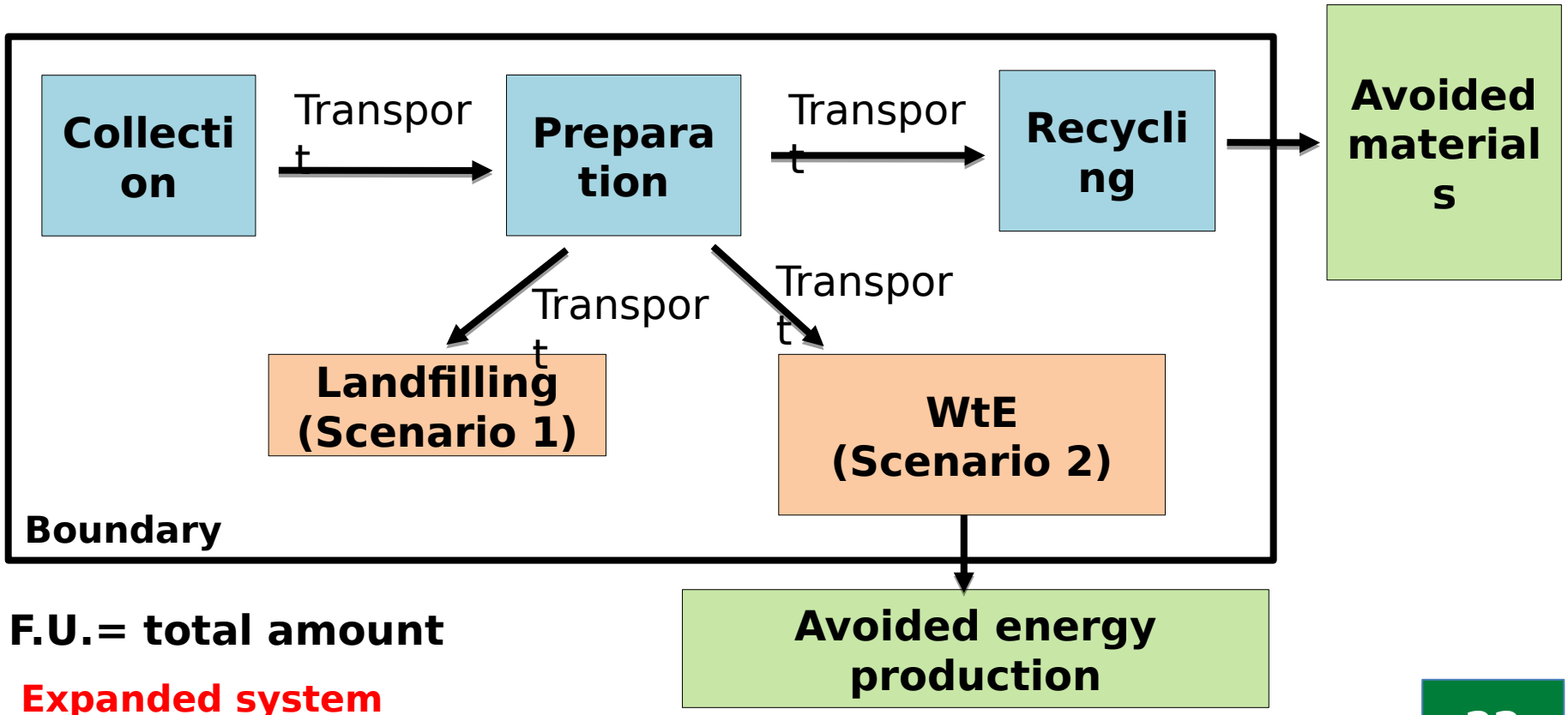
$$iPR_{TOT}(\%) = \frac{\sum SC - \sum_i S_i}{\sum SC+MW} \times 100$$



Life Cycle Assessment: Goal and Scope

Aim:

Evaluation of the environmental impacts generated by the considered separate collection systems and their evolution along the time



Life Cycle Assessment: Inventory Analysis

- **Collection and transport:**

Data about distances and/or average consumption for collection and transport vehicles
(sources: Revet, literature);

- **Preparation:**

Electricity consumption at the preparation plants (Revet, S. Donnino) or estimated from literature data;

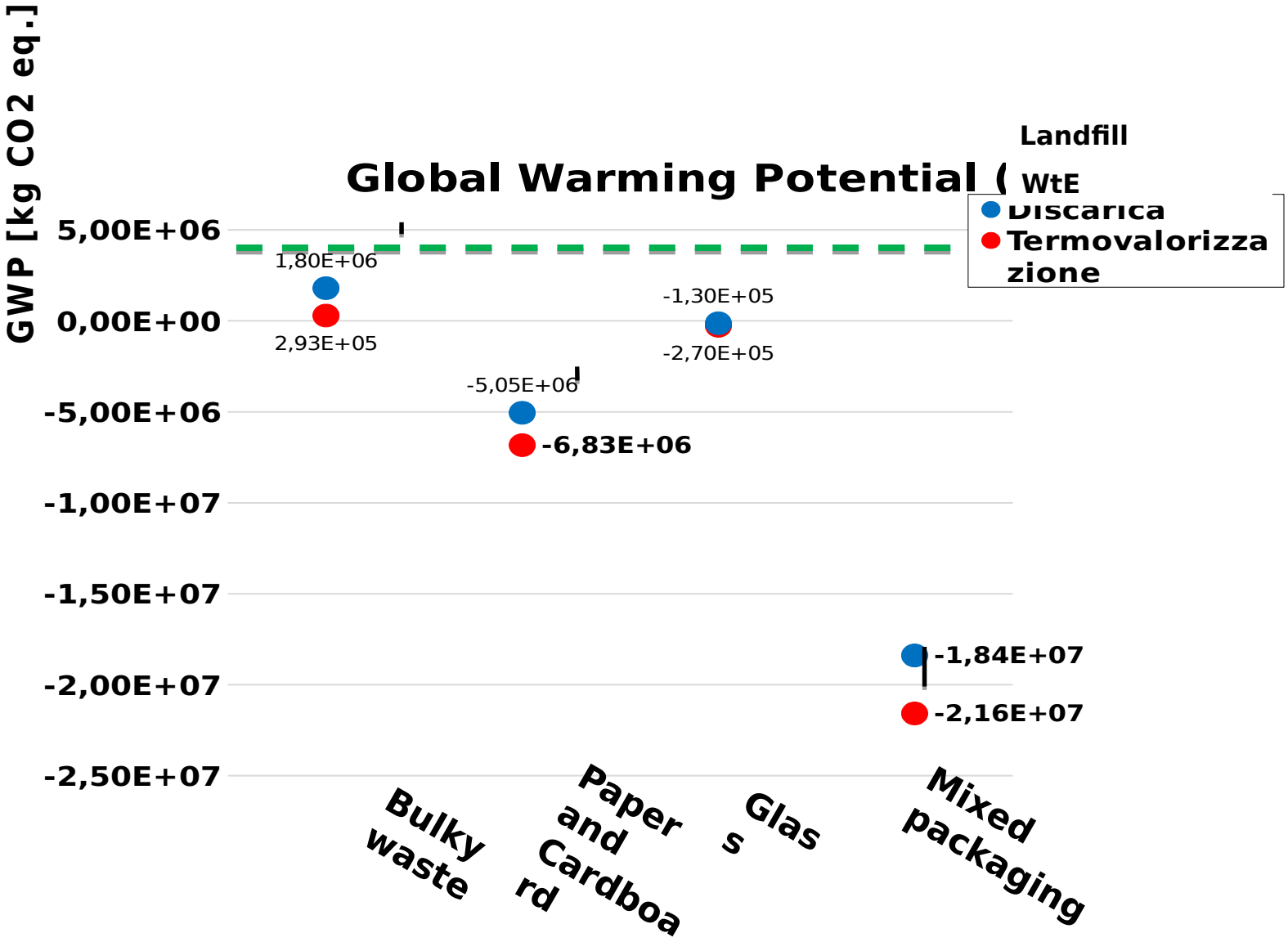
- **Recycling:**

Input (electricity, fuels, water, chemicals, etc.) from Ecoinvent database or literature;

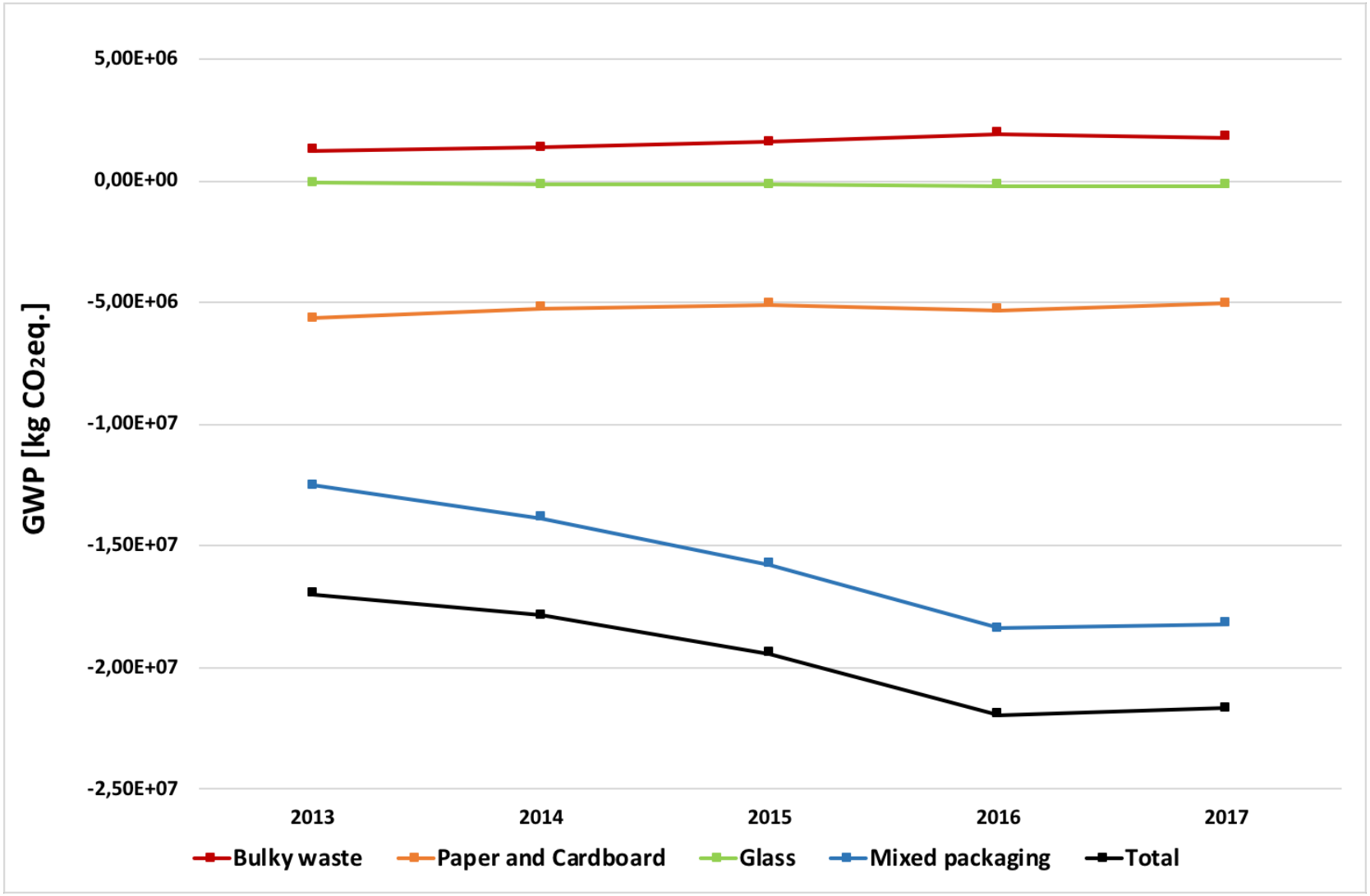
- **Fate of the scraps:**

Assumptions about composition and LHV of the scraps

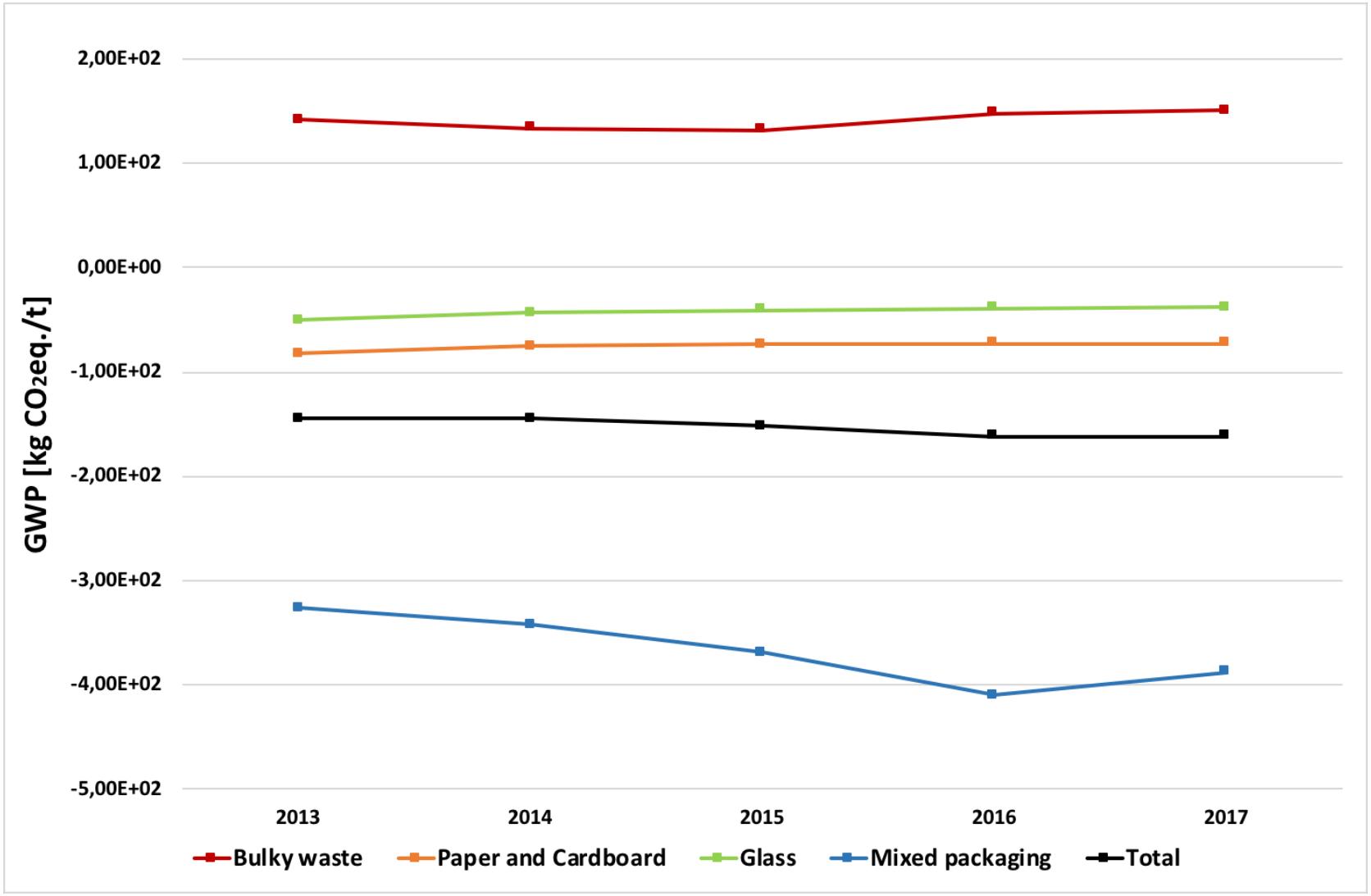
Life Cycle Assessment: Impact Assessment



Life Cycle Assessment: Impact Assessment



Life Cycle Assessment: Impact Assessment



Conclusions - 1

Difficulties

- Fragmented destination of streams
- Impossible to keep the details per munipality
- Database are improving, but for the past data are hard to be collected

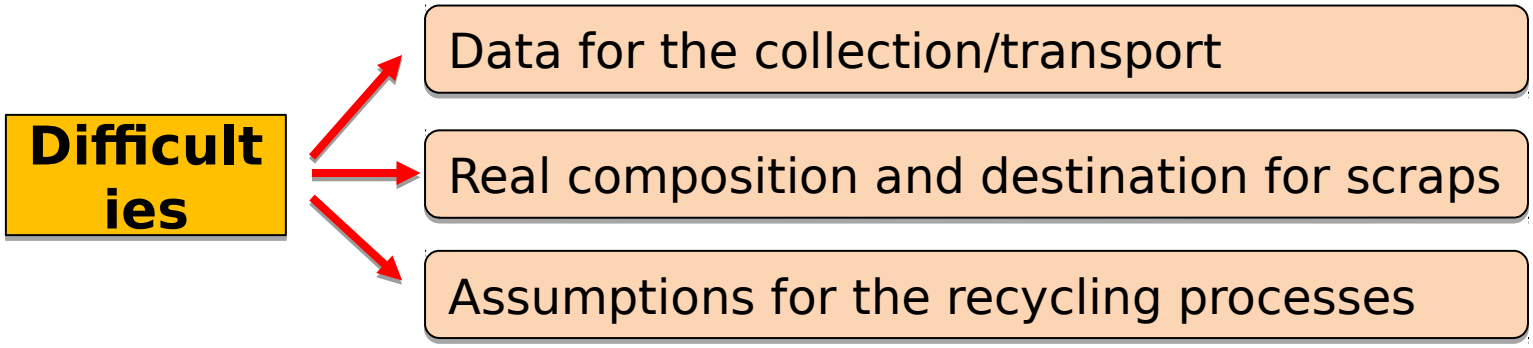
- **Increase of waste collected separatly (+18.000 t);**
- **Increase of certified SC (%) (from 47,3% to 54,2**

- **Decrease of quality**
- **Reduction of percentage prepared for recycling (-3-4%);**
- **Net SC reduction (up to -3-4%).**

! 2016-2017: amount collected separatly decreased, but also quality decreased (update with 2018)

! Other separate streams must be accounted for (Organic fraction, WEEE, etc.) to calculate the net SC or total iRR

Conclusions - 2



- GWP for the integrated system is negative for alla the SC except for bulky waste
- Mixed packaging system offer the highest benefits.
- However, for the mixed packaging the the decrease in quality in 2017 corresponded to a decrease of the environmental benefit.

Thank you for your attention!

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