**Engineering Conferences International**
**ECI Digital Archives**

Life Cycle Assessment and Other Assessment Tools for Waste Management and Resource Optimization

Proceedings

6-7-2016

# Life Cycle Assessment and economic evaluation of the recovery of materials in an urban waste management system

Giovanni De Feo
*University of Salerno, Department of Industrial Engineering (DIIn), via Giovanni Paolo II, 312 – 84084 Fisciano (Sa), Italy*, g.defeo@unisa.it

Alessio Finelli
*M.Sc. in Environmental Science, via Italo Calvino 14, 80011 Acerra (Na), Italy*

Alberto Grosso
*Agenzia Regionale per la Protezione dell'Ambiente della Campania (ARPAC), via Vicinale*

Santa Maria del Pianto
*Centro Polifunzionale, Torre n. 1, 80143 Naples, Italy*

Follow this and additional works at: http://dc.engconfintl.org/lca_waste

 Part of the Engineering Commons

## Recommended Citation

Giovanni De Feo, Alessio Finelli, Alberto Grosso, and Santa Maria del Pianto, "Life Cycle Assessment and economic evaluation of the recovery of materials in an urban waste management system" in "Life Cycle Assessment and Other Assessment Tools for Waste Management and Resource Optimization", Professor Umberto Arena, Second University of Naples, Italy Professor Thomas Astrup, Denmark Technical University, Denmark Professor Paola Lettieri, University College London, United Kingdom Eds, ECI Symposium Series, (2016). http://dc.engconfintl.org/lca_waste/27

This Abstract and Presentation is brought to you for free and open access by the Proceedings at ECI Digital Archives. It has been accepted for inclusion in Life Cycle Assessment and Other Assessment Tools for Waste Management and Resource Optimization by an authorized administrator of ECI Digital Archives. For more information, please contact franco@bepress.com.

Life Cycle Assessment and Other Assessment Tools for Waste Management and Resource Optimization

# LIFE CYCLE ASSESSMENT (LCA) AND ECONOMIC EVALUATION OF THE RECOVERY OF MATERIALS IN AN URBAN WASTE MANAGEMENT SYSTEM

Giovanni De Feo*, Alessio Finelli, Alberto Grosso

* Department of Industrial Engineering (DIIN), University of Salerno, 84084, via Giovanni Paolo II 132, Fisciano (Sa), Italy, *g.defeo@unisa.it*

Università di Salerno
Dipartimento di Ingegneria Industriale

June 5-10, 2016 - Grand Hotel San Michele - Cetraro (Calabria), Italy

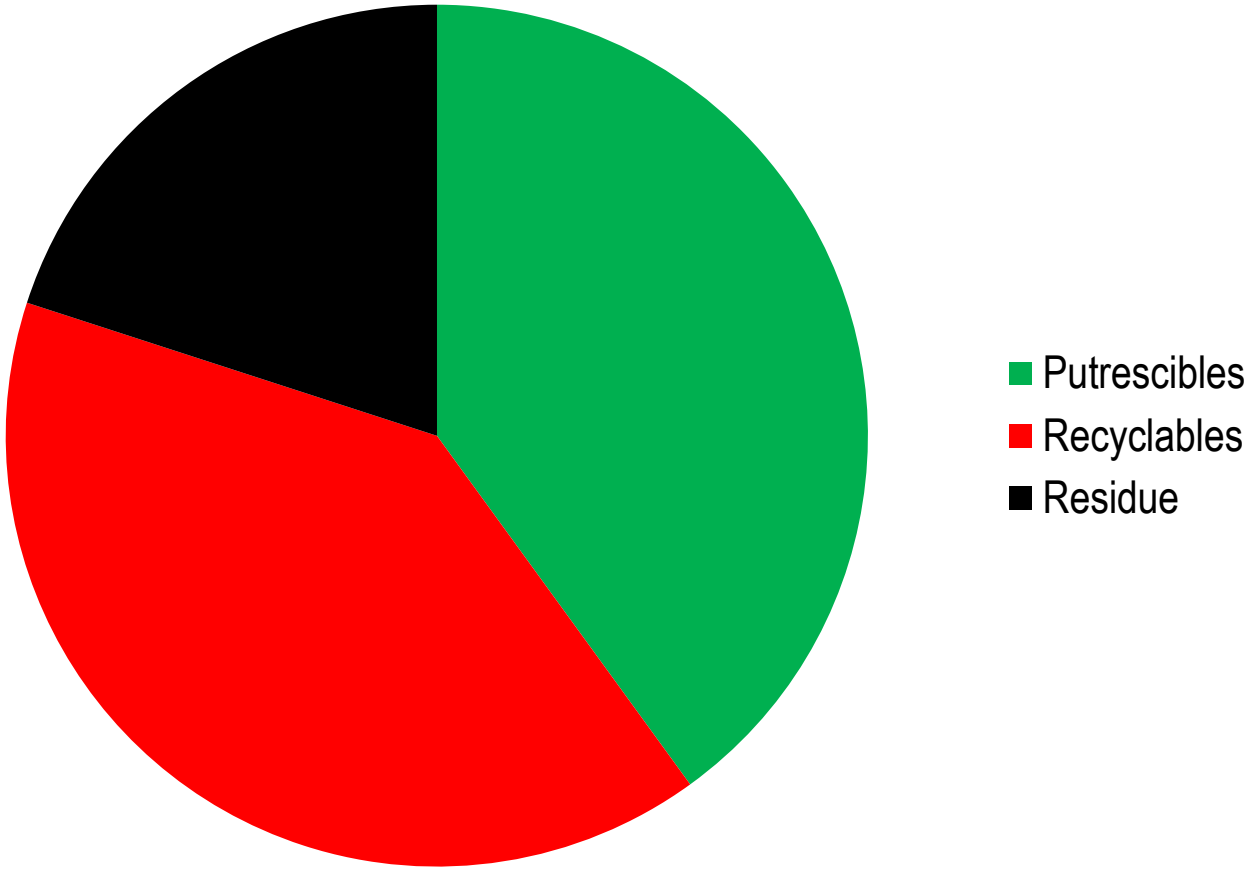
# Main aim of the study

- The main aim of this study was to perform a **Life Cycle Assessment** (**LCA**) as well as an **economic evaluation** of the recovery of **recyclable materials** in an Urban Waste Management System.

Introduction

# The main components of Urban Waste

- Urban Waste is mainly composed of three fractions: 1) **putrescible materials**, 2) **recyclables materials**, and 3) **residual waste** (‘**residue**’).



# The main components of Urban Waste

- The **PUTRESCIBLE** materials have to be collected separately and sent to **composting** and/or **anaerobic digestion** plants.

- The **RECYCLABLES** materials have to be sorted and sent to the proper **industrial facilities**.

- the **RESIDUE** could be further selected to be sent to **energy recovery** plants.

# Packaging waste

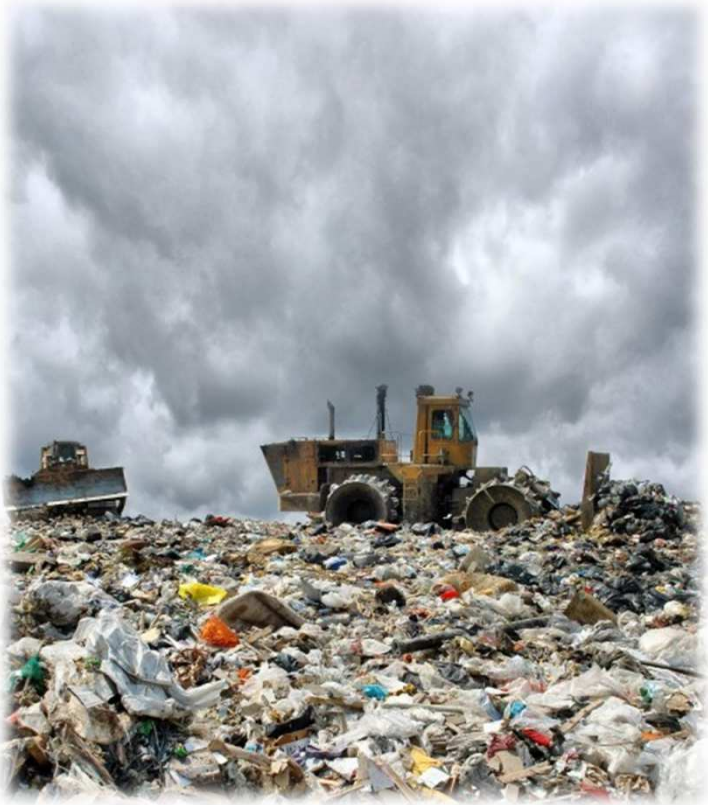
- If **citizens separate erroneously urban waste fractions**, they produce both **environmental** and **economic damages**.

# Packaging waste

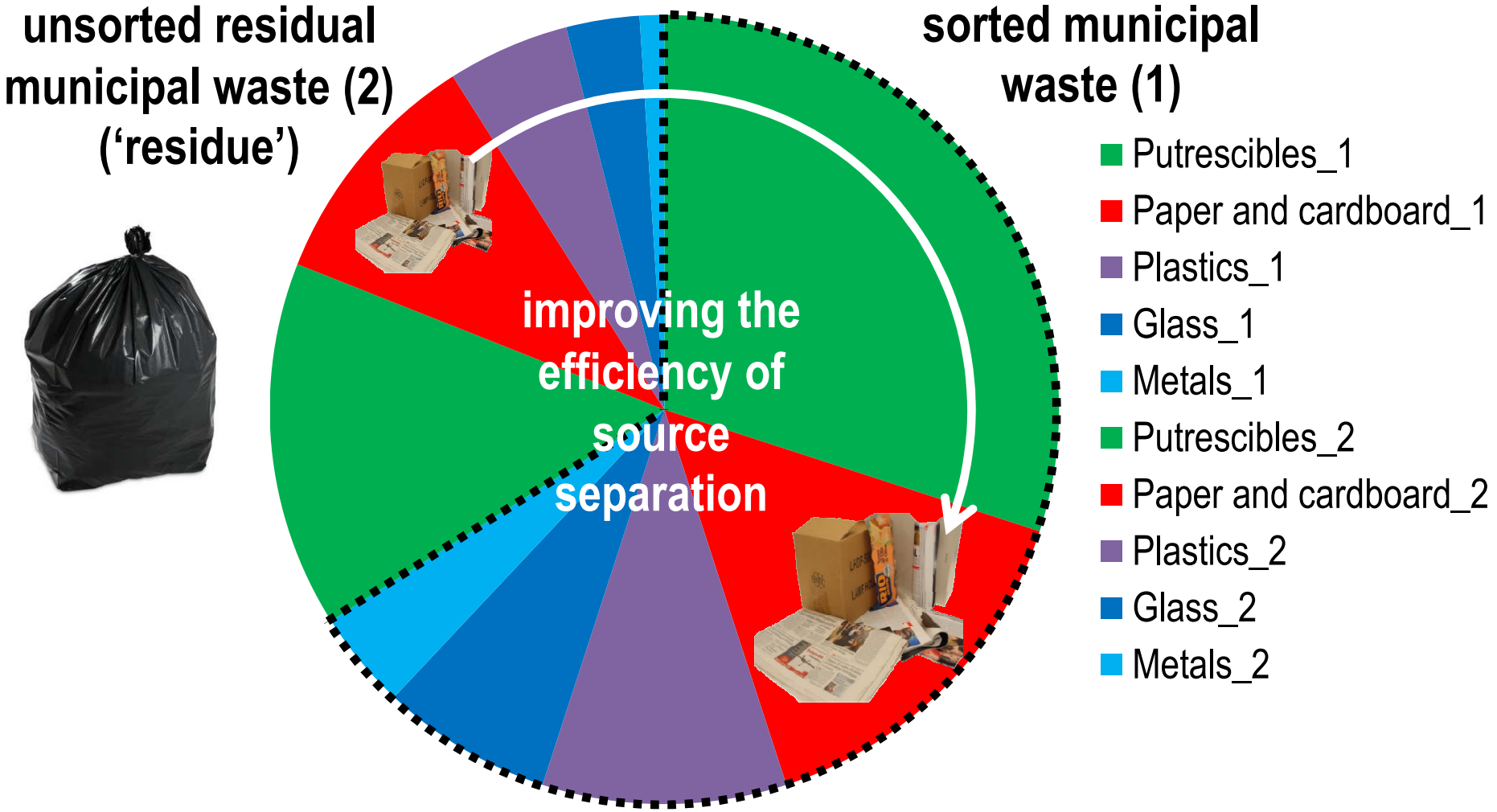
- On the base of the **Extended Producer Responsibility** (**EPR**), **a Municipality receives an economic amount for each kilogram of packaging waste collected**.
- In **Italy**, this activity is managed by **CONAI** (a private system, created and designed by companies).
- The **"CONAI system"** is based on the activities of **six consortia** each dedicated to promoting and control the most used materials in the packaging production i.e. **steel, aluminum, paper, wood, plastics and glass**.

# Packaging waste

- **Packaging waste** that goes into the **residue** represents an **economic damage** (a loss of the **"CONAI contribution"** and the payment of the **disposal fees**) as well as an **environmental burden**.



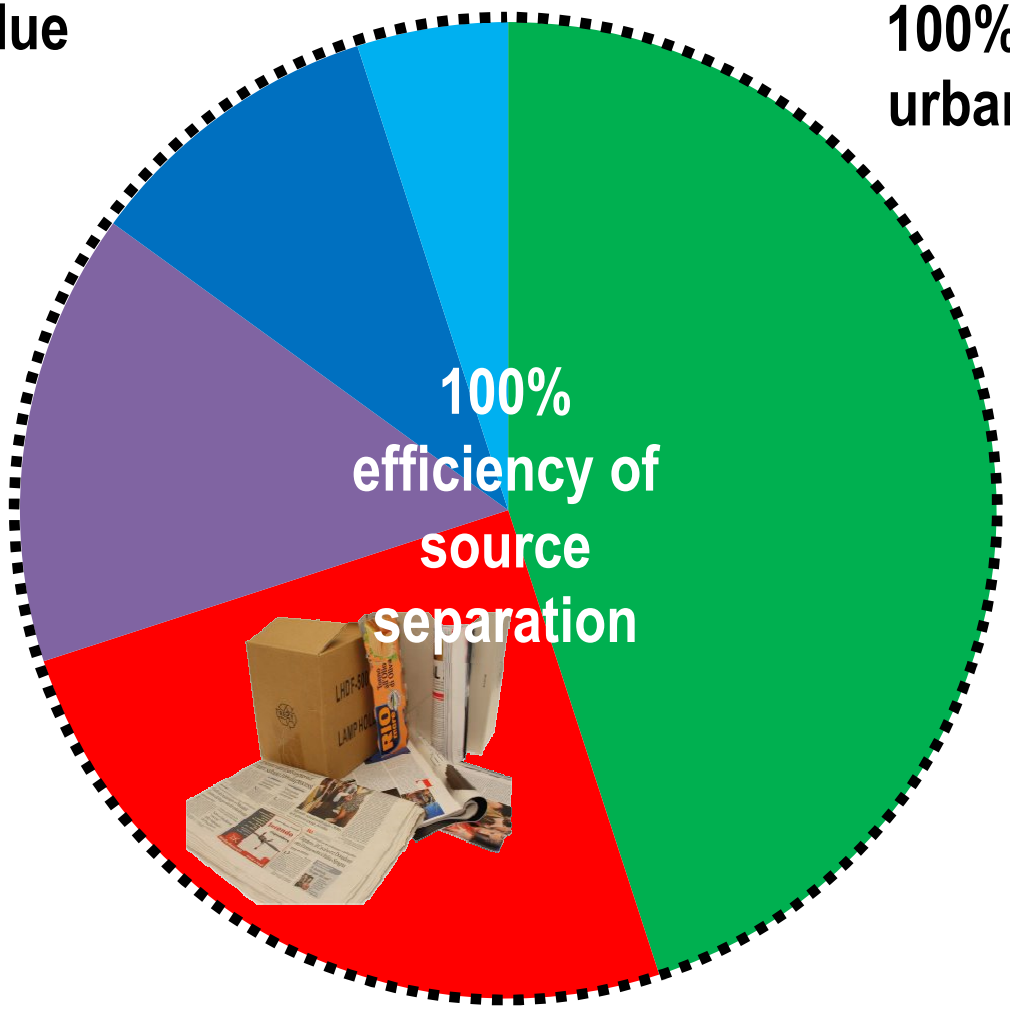
# Improving the efficiency of source separation



# A ‘perfect’ source separate collection system

0% residue

100% sorted urban waste

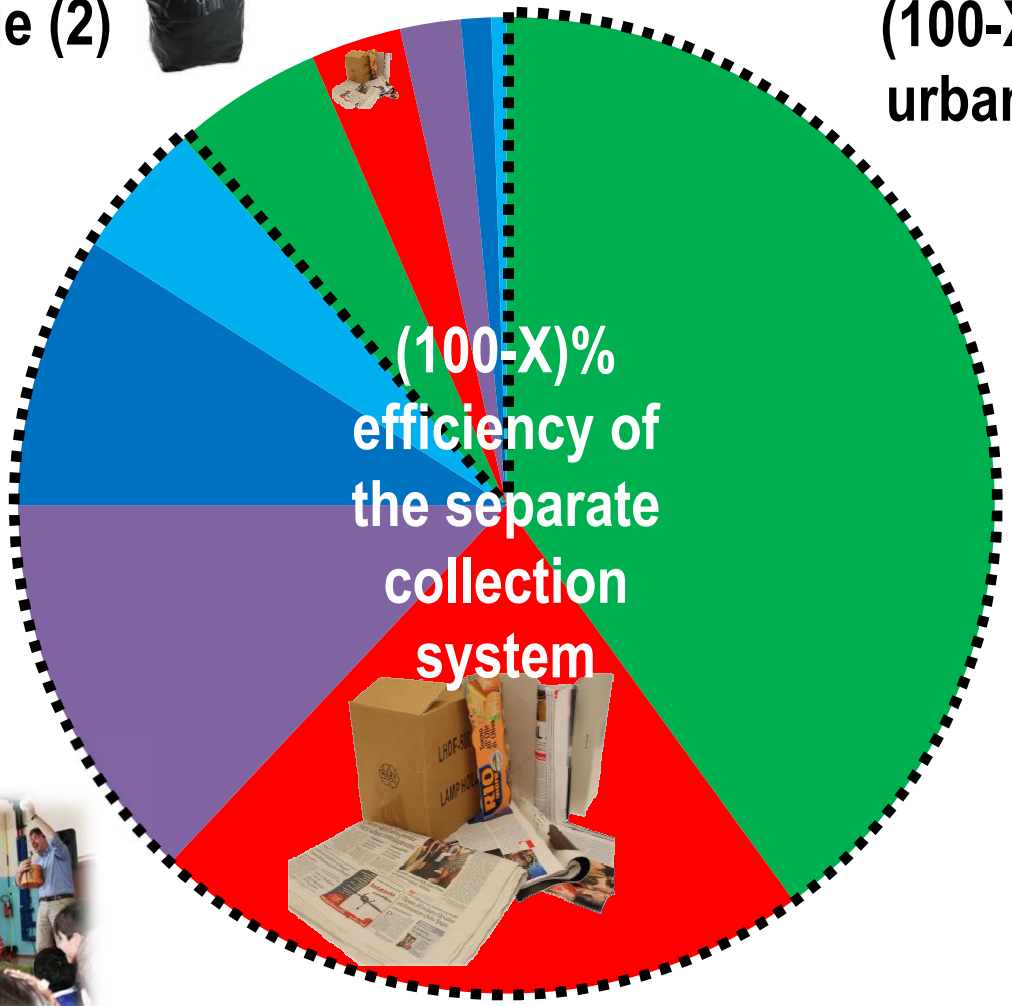



Introduction

# A ‘better’ source separate collection system

X% residue (2)

(100-X)% sorted urban waste (1)




- Putrescibles_1
- Paper and cardboard_1
- Plastics_1
- Glass_1
- Metals_1
- Putrescibles_2
- Paper and cardboard_2
- Plastics_2
- Glass_2
- Metals_2

environmental education campaigns

greenopoli

Introduction

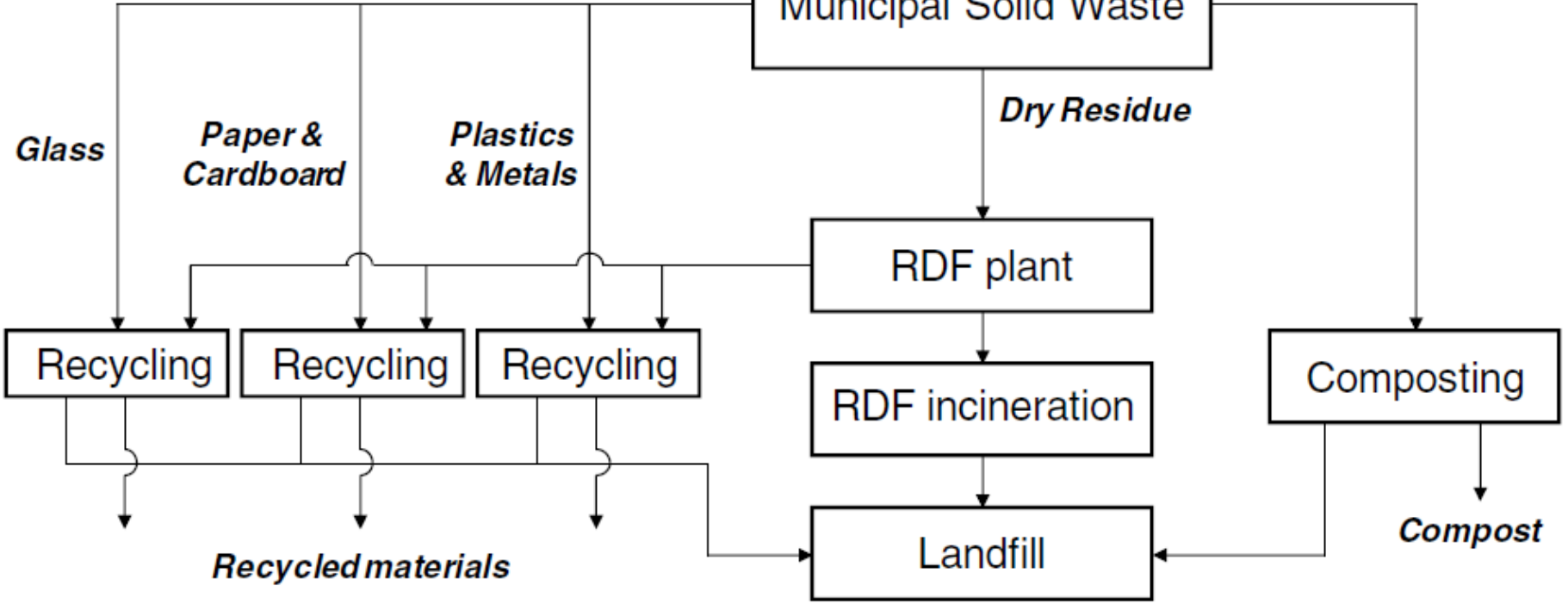
# The case study area

- The environmental and economic evaluation was performed for the case study of **Nola** (**39.19 km²**, **34.349 inhabitants**, and **876.47 ab./km²**) in the **Province on Naples**, in the **Campania Region** of **Southern Italy**.
- Nola has a **kerbside system** which assured a percentage of separate collection of **61%** in **2015**.

## Materials and methods

# Phases included in the LCA analysis

- The LCA analysis included the **treatment and disposal** phases as well as the **collection** and **transport** phases.




## Materials and methods

# LCA software tool and Impacts categories

- **The LCA software tool**: SimaPro

- **Impact assessment methods**:

  - ✓ **ReCiPe 2008** (for the medium-term perspective Hierarchist both for midpoint and endpoint levels)

  - ✓ **Ecological footprint**

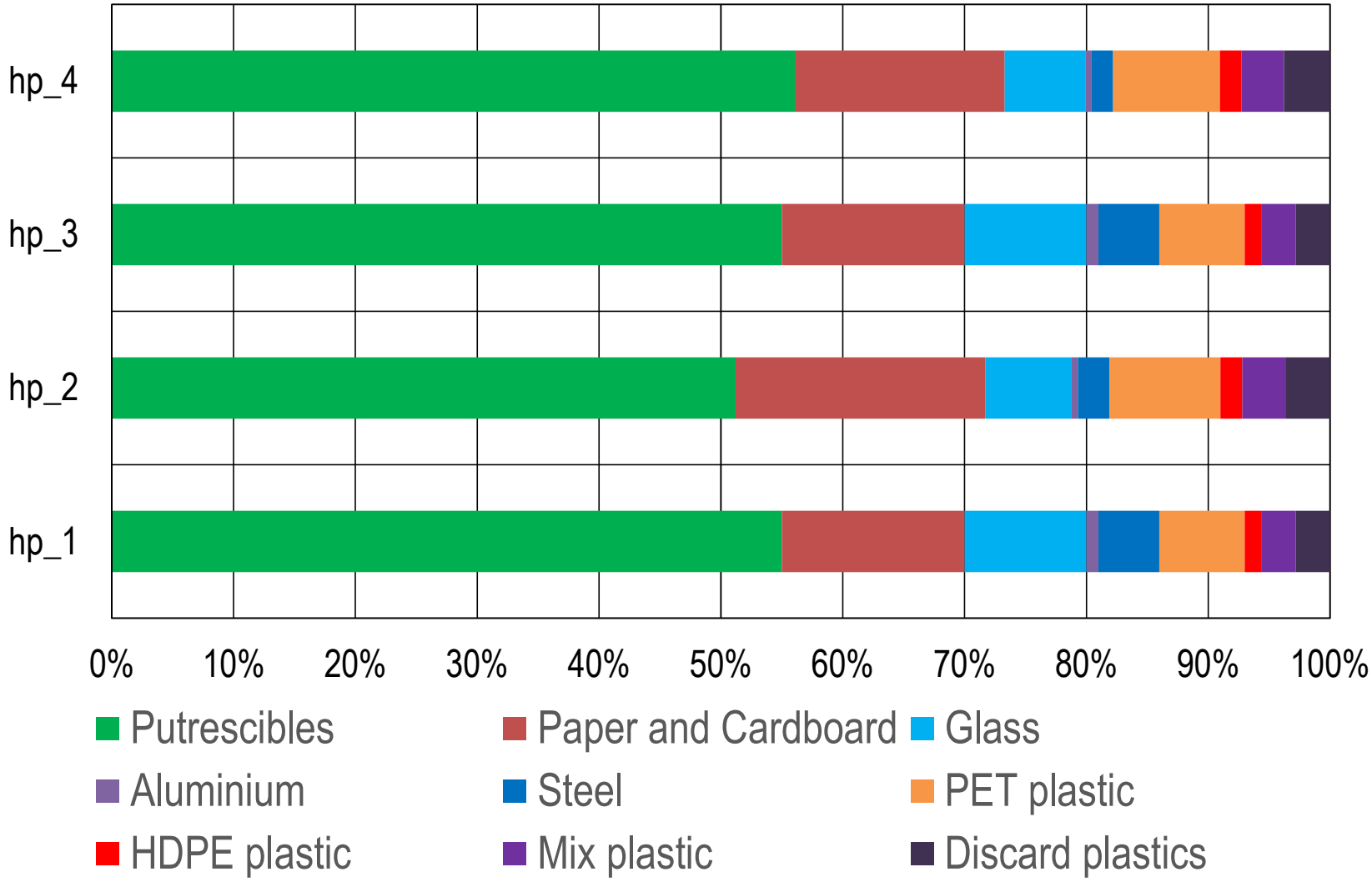
  - ✓ **IPCC 2013 (100 years)**

## Materials and methods

# The scenarios analysed

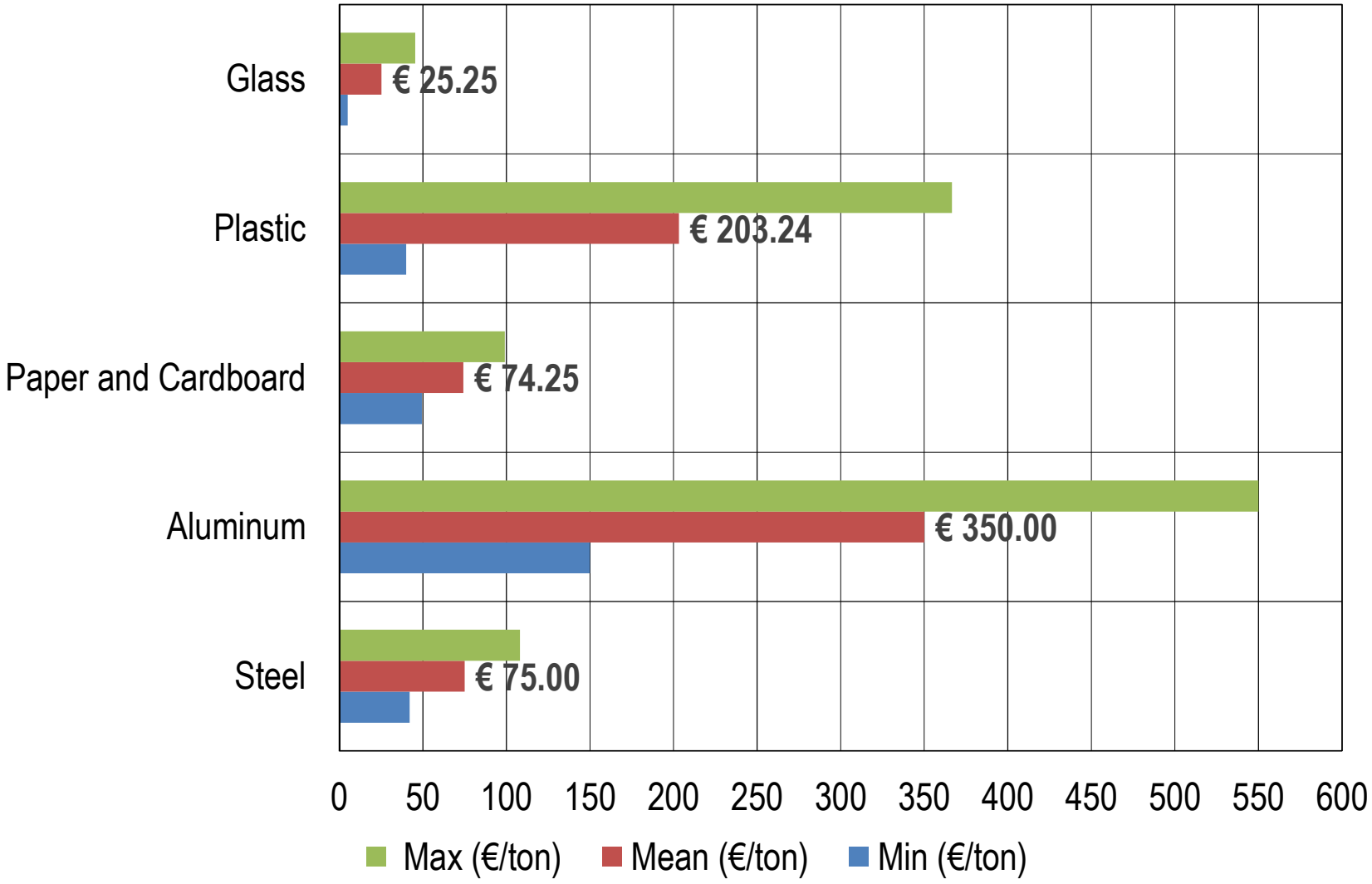
- The environmental and economic analysis were developed for **different real and hypothetical scenarios** based on:
  - ✓ **increasing percentages of separate collection**, and
  - ✓ **different composition analyses of urban waste**.
    - ➢ **2013 (hp1) (real%)**
    - ➢ **2014 (hp1) (real%)**
      - **2014 (hp1) (65%)**
      - **2014 (hp1) (70%)**
      - **2014 (hp1) (75%)**
      - **2014 (hp1) (80%)**
    - ➢ **2014 (hp2) (real%)**
    - ➢ **2014 (hp3) (real%)**
    - ➢ **2014 (hp4) (real%)**

# Composition analysis hypothesis



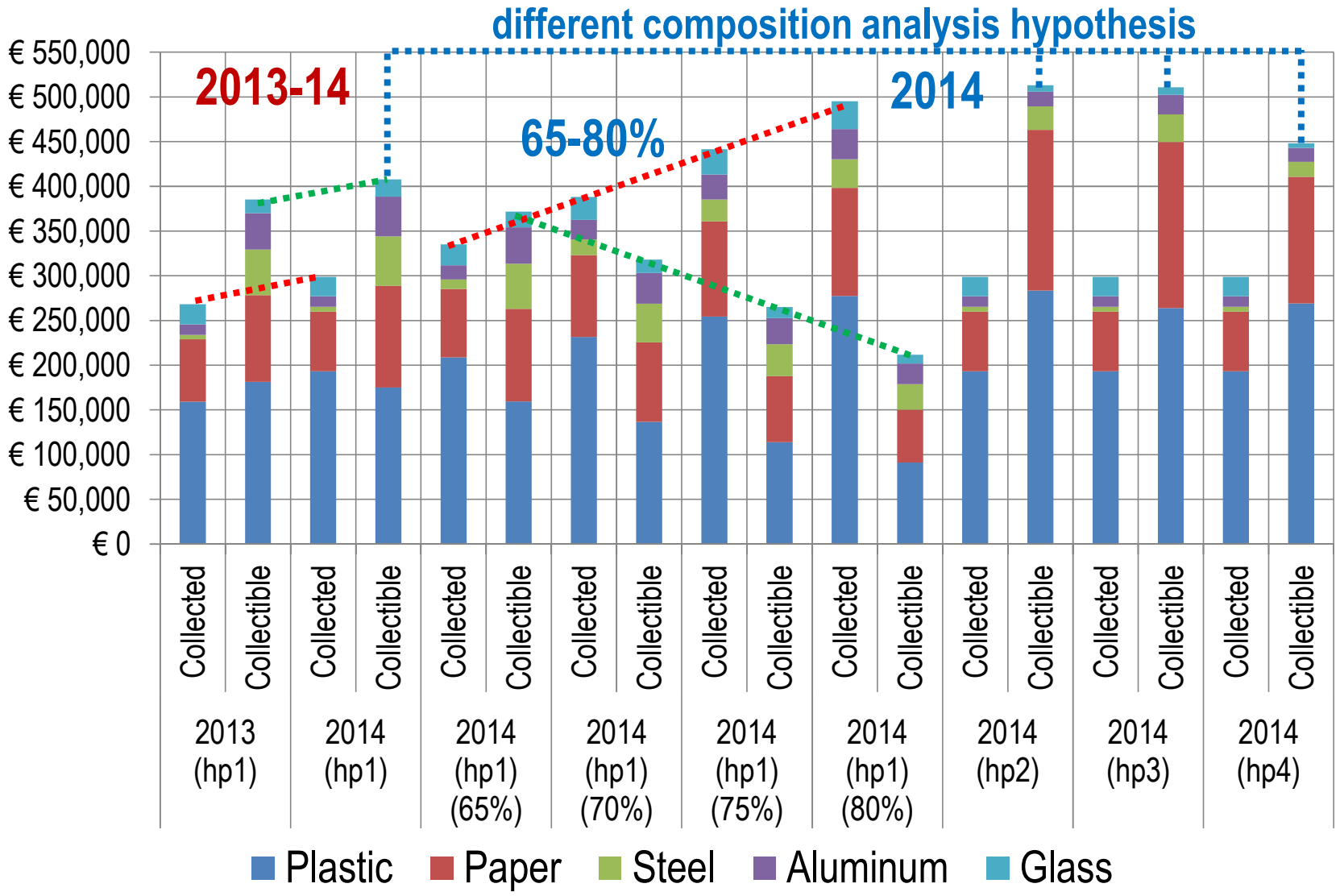

# Materials and methods

# Economic hypothesis



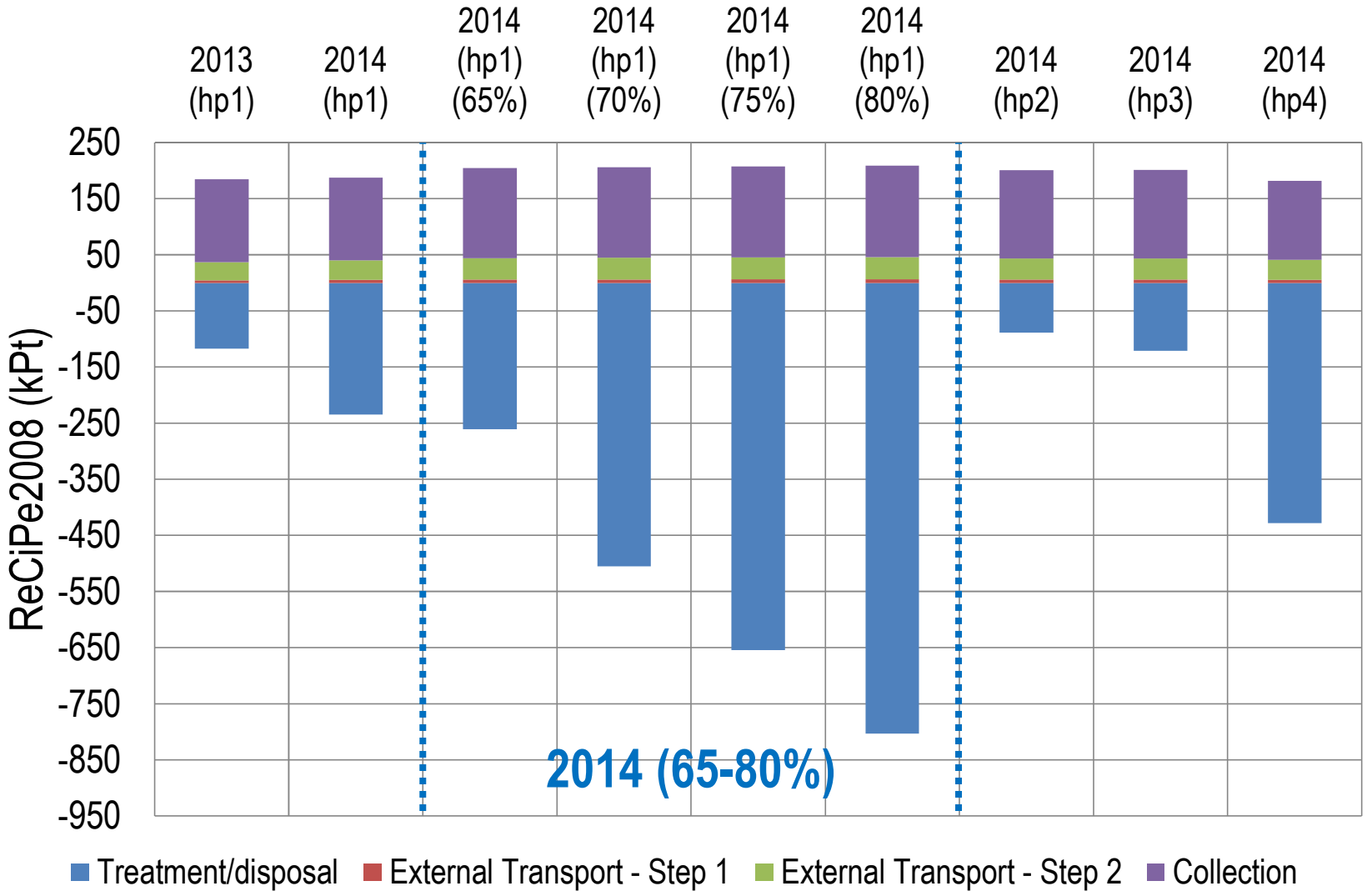

# Materials and methods

# Moneys for Collected and Collectible materials



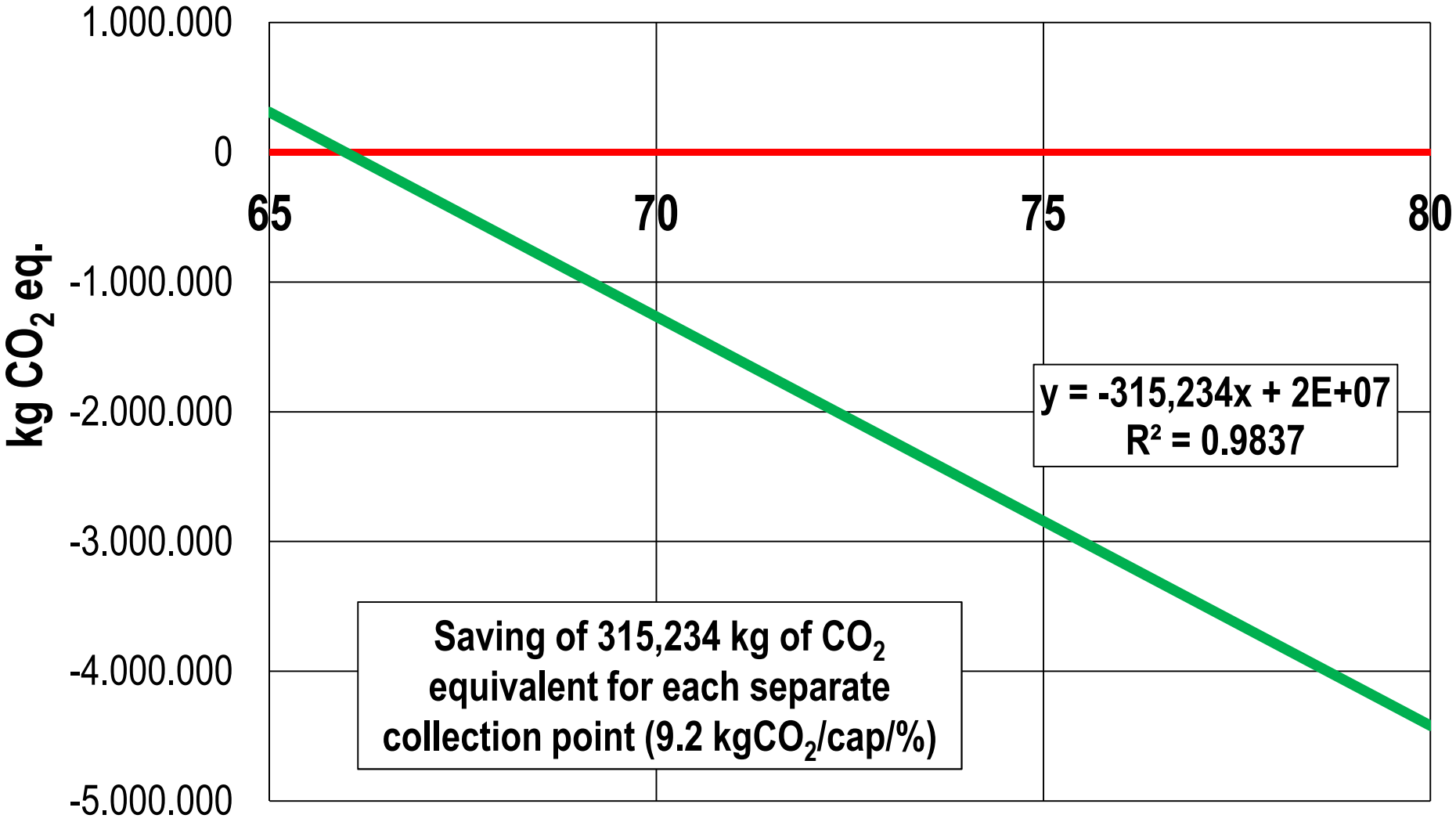

## Results

# ReCiPe 2008 single endpoint



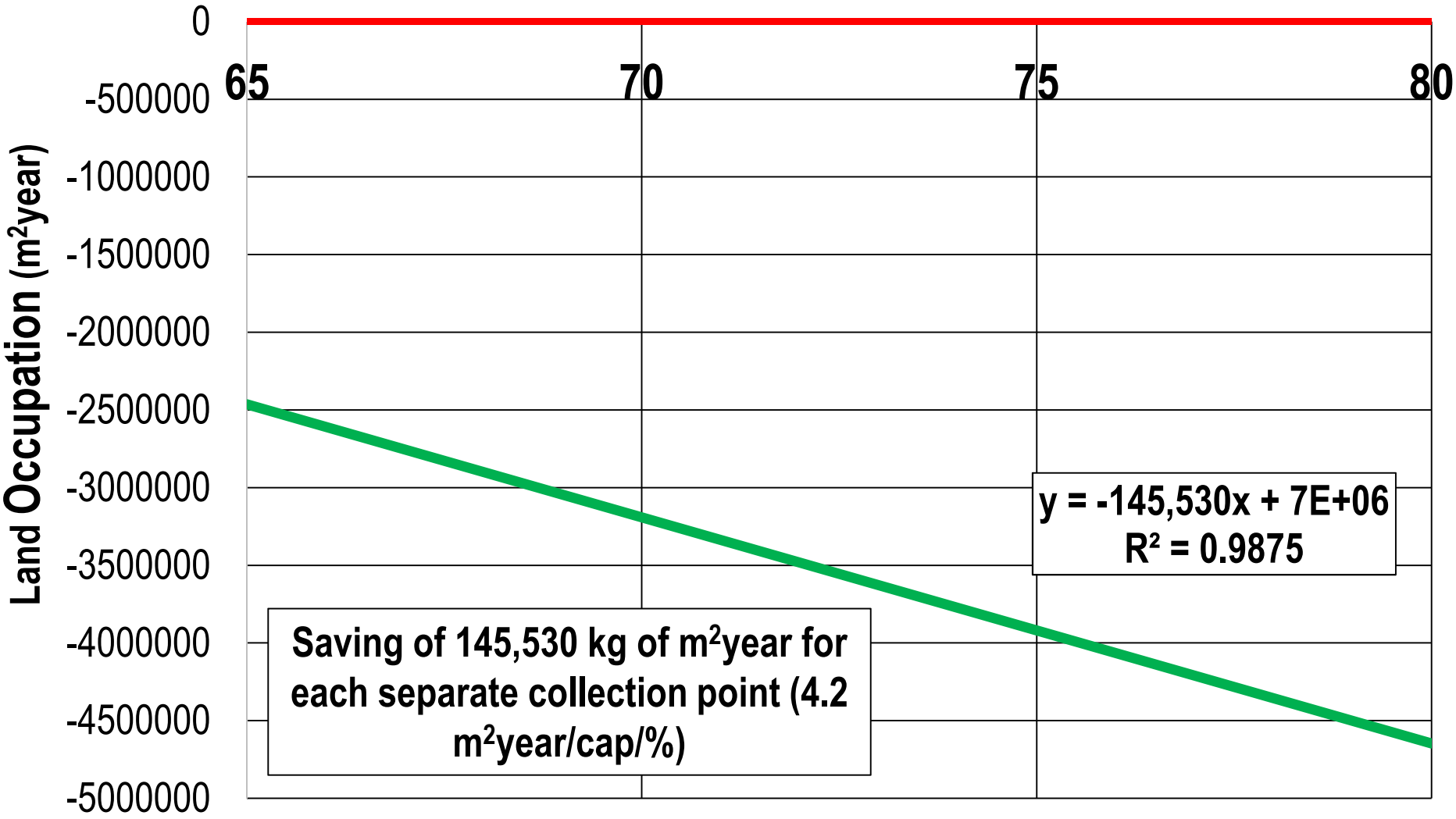

## Results

# Carbon Footprint 2014 (65-80%) saving




## Results

# Land Occupation 2014 (65-80%) saving




## Results

# Environmental, economic and social benefits

- Avoiding that **recyclable materials** go into **residual waste** is a **benefit** both in **environmental** and **economic** terms.
- It is also a **social potential benefit** because the Municipality could invest the economic saving in **environmental campaigns** entrusted to **young people**.

Comune di Nola

GREENOPOLI

**- CONVEGNO -**

***Valutazione economica e ambientale del recupero di materiali dal sistema di gestione dei rifiuti urbani del Comune di Nola***

***LUNEDÌ 9 MAGGIO - ORE 10,00***

Convento di Santo Spirito, via Merliano - Nola

**PROGRAMMA**

**ore 10,00 - SALUTI**

- *Sindaco* - ***Avv. Geremia Biancardi***
- *Assessore all'Ambiente* - ***Dott. Luciano Parisi***
- *Dirigente LL.PP., Tutela Ambiente e Urbanistica* - ***Arch. Stefania Duraccio***
- *Assessore ai Beni Culturali e alla Pubblica Istruzione* - ***Arch. Cinzia Trinchese***

**ore 10,30 - INTERVENTI**

- ***Dott. Alessio Finelli,*** *Presentazione della tesi di laurea magistrale in Scienze Ambientali*
  "Life Cycle Assessment (LCA) e valutazione economica del recupero di materiale in un sistema di gestione dei rifiuti urbani: il caso studio di Nola"
- *Dott.ssa Carolina D'Avino:*
  "L'importanza della comunicazione nella raccolta differenziata: dai rifiuti ai materiali!"

**MODERA**

- ***Giovanni De Feo,*** *Università degli Studi di Salerno, Greenopoli.*

Arti Grafiche «Giovanni Scala» - Nola (NA)

## Conclusion