

# Waste management evolution through years :evaluation of improvement using LCA



## CHEMICAL ENGINEERING

*Processes and Sustainable Development*

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1. Context of research
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3. Environmental evaluation of waste management
4. Perspectives in waste management

# Context

- Waste = important concern of our century
- Tool to help management
  - Life Cycle Assessment
- Improvement of waste management processes
  - Reduction of waste quantity
  - Increase of valorization
  - Decrease of the induced environmental impacts



# Waste management – Goals



## ■ Goals of study

- ❑ To evaluate the improvement of waste management through years
  - Belgian situation (Liège) from 1970 until now
- ❑ To help making the best sustainable choice in the future

## ■ Functional unit

- ❑ Treatment and valorization of one ton of average municipal waste

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# 4 systems through years

- Before 1970
  - Open dump
- From 1990 until 2009
  - Waste grinding and sorting



**REFUSED DERIVED FUEL (RDF)**



**REMAINING WASTE**



# 4 systems through years

- From 2009 until now
  - Incineration of the whole fraction of waste



- Short term project
  - Sorting and collection of the biodegradable fraction

**BIODEGRADABLE FRACTION**



**REMAINING WASTE**



# Type of waste

- Functional unit is composed of
  - ❑ Municipal waste = 67,47%
  - ❑ Common industrial waste = 24,90%
  - ❑ Non-milled bulky = 5,20%
  - ❑ Sludge = 2,43%
- Paper, glass and metals already collected



# Included steps

- Steps taken into account are:
  - Landfill – with or without collection of gas and leachates
  - Incineration with
    - Chemicals consumptions for flue gas cleaning
    - Flue gas emissions
    - By-products treatment
  - Biogas with anaerobic digestion and digestate valorization
  - Electricity production

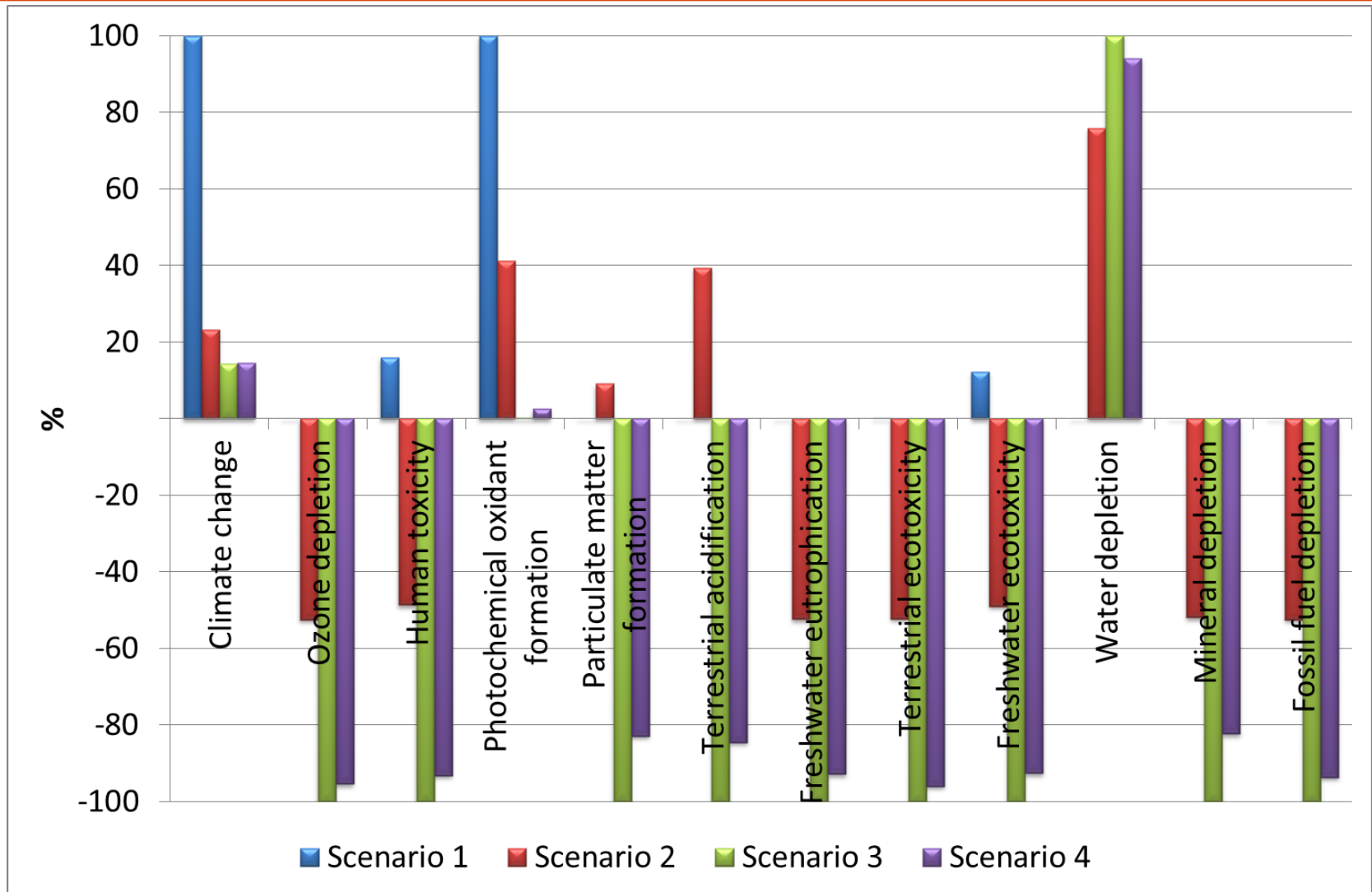
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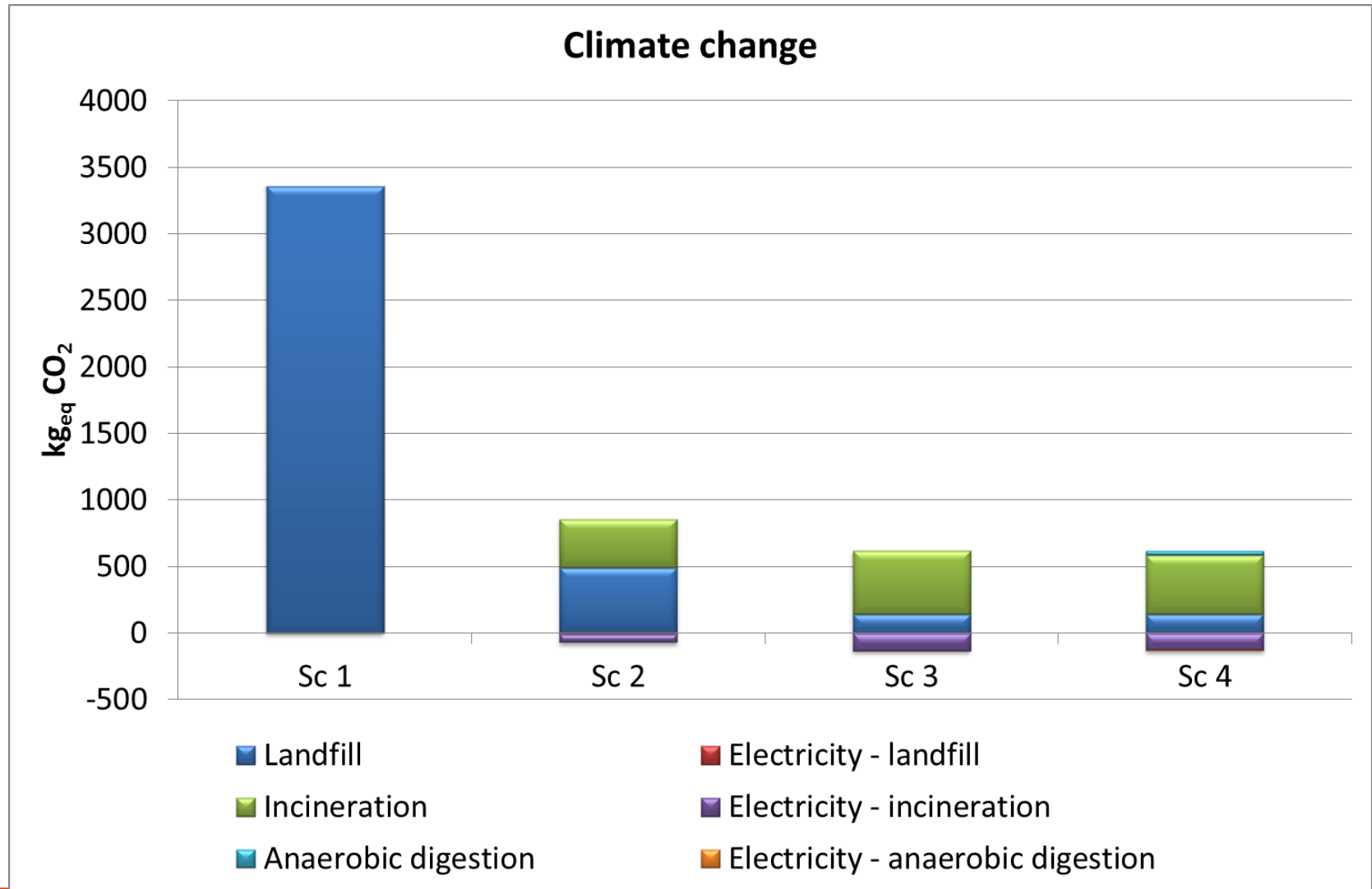
# Waste management – LCI

- Use of ReCiPe 2008 method
  - Midpoint
  - Hierarchist
- Use of databases
  - Ecoinvent
  - From producers
  - From scientific literature

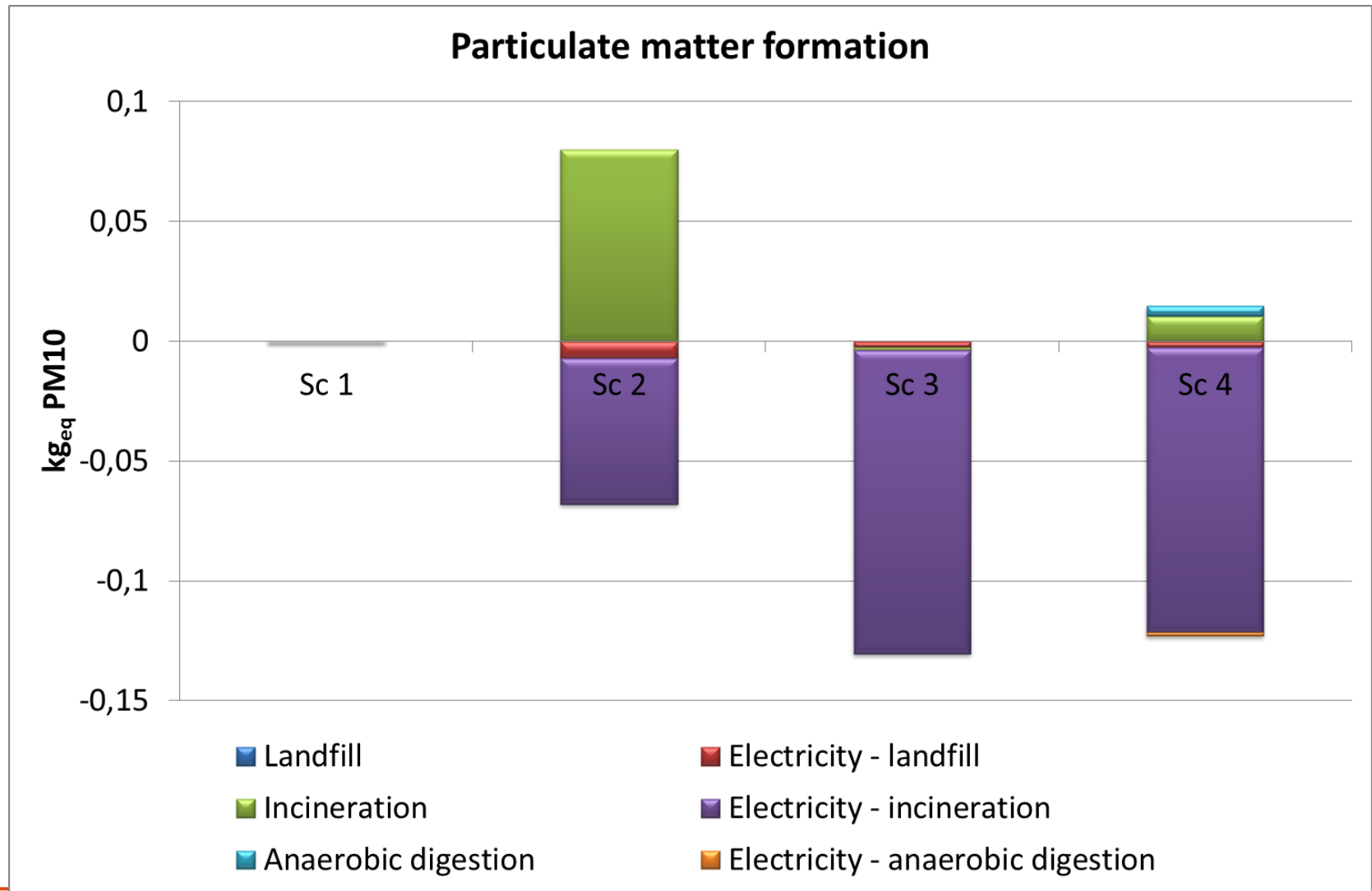
# Waste management - Impact assessment



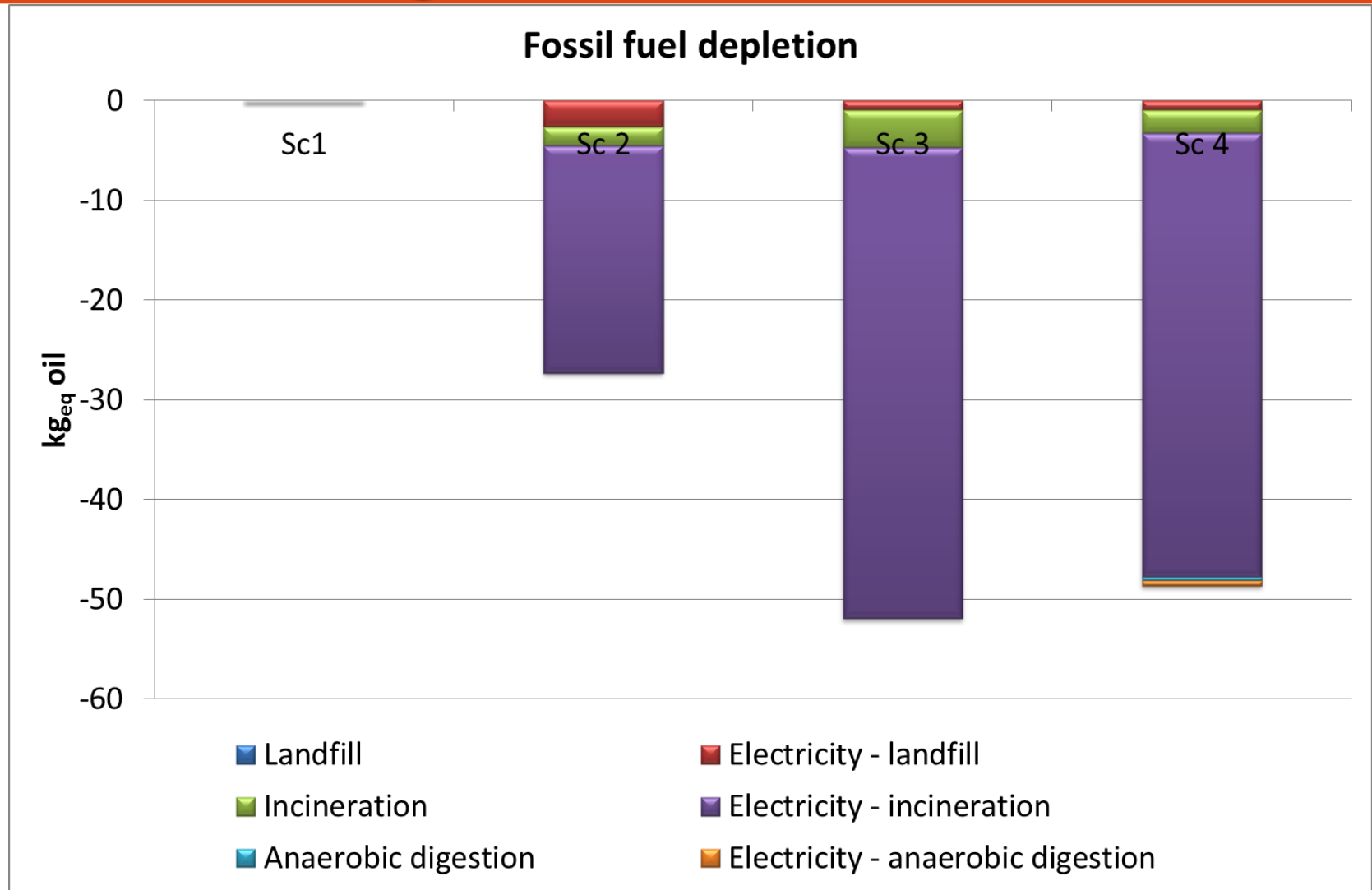
# Waste management - Impact assessment



# Waste management - Impact assessment



# Waste management - Impact assessment



# Waste management – Interpretation

- Global warming and fossil fuel depletion are reduced through years
- Valorization of electricity is helpful
- Decrease of landfill impact



# Waste management – Interpretation

- Limitations of the study
  - ❑ Assumptions about landfilling – uncertainties
  - ❑ Infrastructure to take into account
  - ❑ Possibility in the future ( economic situation and feasibility to evaluate)
  - ❑ Other techniques to consider?

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# Waste management – Perspectives

- Life Cycle Assessment = environmental management tool
  - Decision support tool
  - Need of other tools for economic and sociological aspects → 3 pillars of sustainable development
- Waste
  - FIRST: reduce the quantity → to prevent
  - SECOND: valorize in the best sustainable way

# Waste management – Perspectives

Thank you for your attention!



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