

AGBOGBLOSHIE GHANA:  
A BRIDGE WITH OLD MONITORS: RECYCLING?



*IT TAKES A METHOD TO RECOVER MATTER AND ENERGY FROM WASTES:  
INTEGRATING RESOURCES' FLOWS, SCIENTIFIC KNOWLEDGE, RISK PERCEPTION  
AND ACTORS' NETWORKS TO OPTIMIZE THE RECOVERY OF VALUE FROM WASTES*

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## THE PROBLEM IS COMPLEX BUT PLANNING SOLUTIONS IS BETTER THAN RELYING ONLY ON COMMUNICATION

In realtà – mormorò Tiresia – se c'è una cosa che mi interessa è che non esistono storie irrilevanti. Tutto è connesso con tutto. Dovunque si cambi qualcosa, il cambiamento riguarda il tutto. [...] Quel dannatissimo ultimo oracolo riguardante la solita eterna pestilenza a Tebe! Invece di costruire una fognatura come si deve, tanto per cambiare ti chiedono un oracolo.

F. Dürrenmatt, La morte della Pizia, 1976

The main **objectives** of the proposed **method** are to:

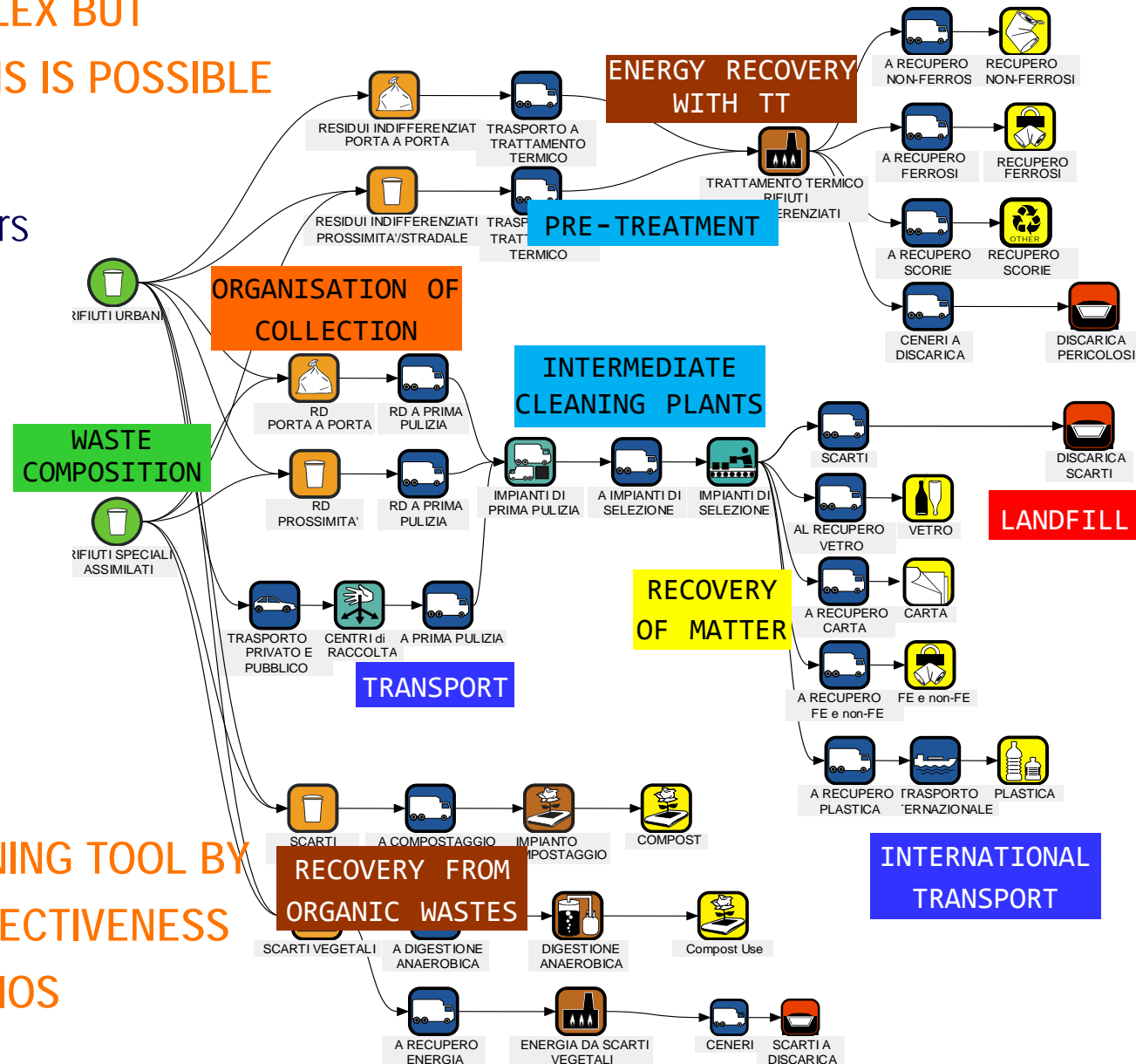
- ✓ argue that it is **possible to sustainably solve the problem of solid waste management**; to offer **a method to overcome empirical approaches** and provide scientific tools for the strategic planning and assessment of waste management;
- ✓ provide a **complete and detailed vision of an integrated waste management system**: underline the needs to innovate and adapt technical solutions to the specificity of different situations and to involve the relevant actors in the building of the system;
- ✓ adopt **scientific and objective criteria to assess the effectiveness** of an integrated WM system and use the results of life cycle assessment to design infrastructural development, support public involvement and a transparent decision making process.

# THE PROBLEM IS COMPLEX BUT PLANNING SOLUTIONS IS POSSIBLE

- ✓ ample network of actors
- ✓ 'wicked' problem
- ✓ ever changing wastes
- ✓ sophisticated industrial infrastructure
- ✓ risk of incinerators intensely debated

## LCA

IS PROPOSED AS A PLANNING TOOL BY  
THE COMPARISON OF EFFECTIVENESS  
OF ALTERNATIVE SCENARIOS



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# LET'S GIVE OURSELVES A METHOD

DESCRIBE THE WASTE 'ACTORS NETWORK' AND HOW DECISIONS ARE TAKEN

THE SECOND PRINCIPLE OF THERMODYNAMICS IS A PROTAGONIST IN THE WASTE  
NETWORK: NOTHING COMPARES WITH CONSUMING LESS

THE ASSESSMENT OF ENVIRONMENTAL IMPACTS AND EFFECTIVENESS OF ALTERNATIVE  
SCENARIOS OF WASTE MANAGEMENT BY LIFE CYCLE ASSESSMENT

LET'S RECLAIM WASTE

## WASTE MANAGEMENT IS A *WICKED* PROBLEM

" .... you may agree that it becomes morally objectionable for the planner to treat a wicked problem as though it were a tame one, or to tame a wicked problem prematurely, or to refuse to recognize the inherent wickedness of social problems."

### ONE SHOULD NOT DEAL WITH WM AS IF IT WERE A TAME PROBLEM

- *There is no definitive formulation of a wicked problem:* the information needed to understand a wicked problem depends upon one's idea for solving it: to describe a wicked-problem in sufficient detail, one has to develop an inventory of all conceivable solutions ahead of time.
- *Wicked problems have no stopping rule*
- *Solutions to wicked problems are not true-or-false, but good-or-bad*
- *There is no immediate and no ultimate test of a solution to a wicked problem*
- *Every solution to a wicked problem is a "one-shot operation";*
- *Every wicked problem is essentially unique*
- *Every wicked problem can be considered to be a symptom of another problem*
- ....

## Global material extraction and growth rates by main material categories 1980–2008

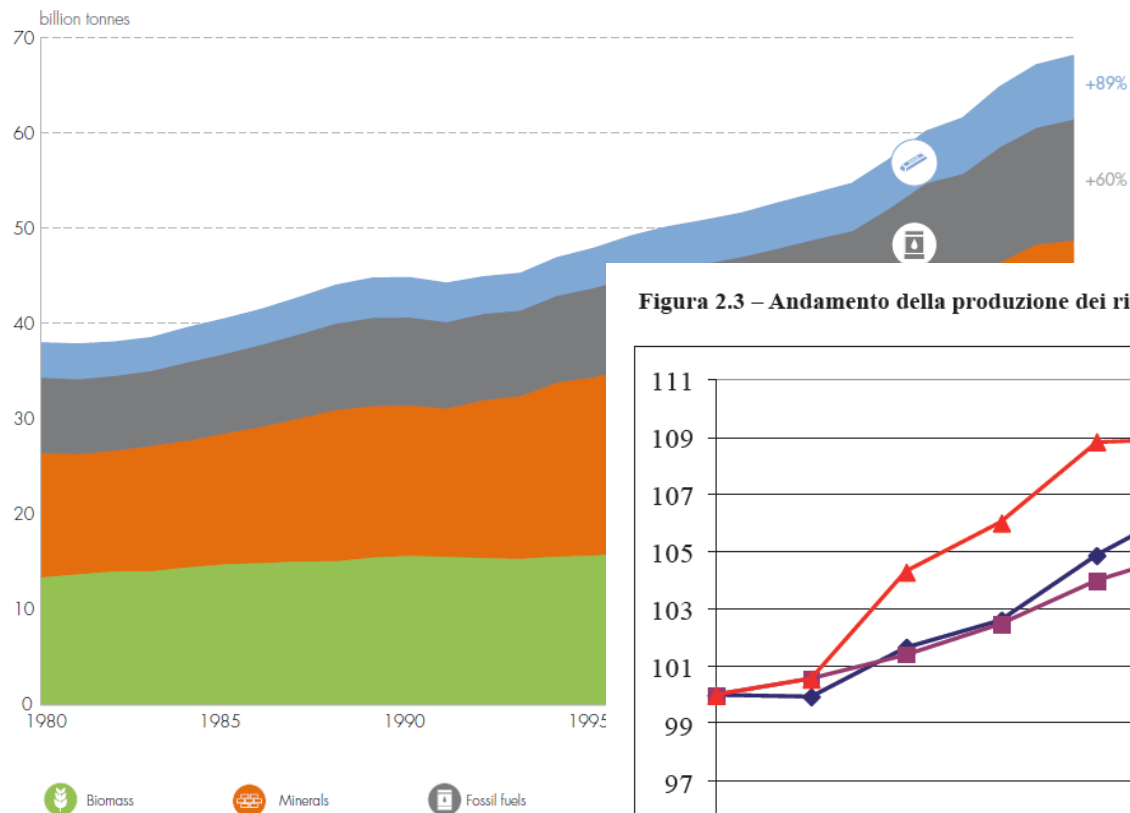
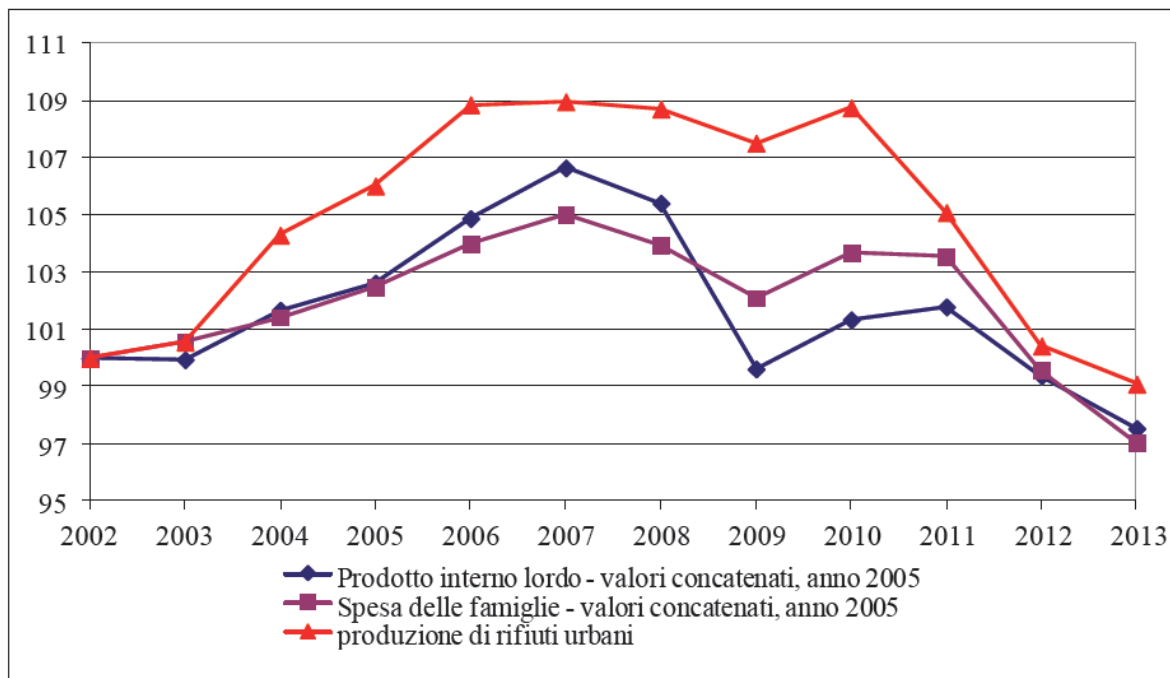


Figura 2.3 – Andamento della produzione dei rifiuti urbani e degli indicatori socio economici, anni 2002 - 2013



Note: sono stati assunti pari a 100 i valori della produzione dei rifiuti urbani, del PIL e della spesa delle famiglie dell'anno 2002.

Fonte: ISPRA; dati degli indicatori socio economici: ISTAT

IT TAKES A METHOD TO RECOVER MATTER AND ENERGY



## WM REQUIRES AN INDUSTRIAL SUPPLY CHAIN

RESPONSIBILITY OF OLD INDUSTRIALISATION  
COUNTRIES TO PRODUCE AND EXPORT  
TECHNOLOGY WHICH CAN TAKE CARE OF ITS  
CONSEQUENCES

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*SIMONETTA TUNESI MILANO - FEEM- IEFE 10 DECEMBER 2014*



# THE DEVELOPMENT OF THERMAL TREATMENT AND EMISSION ABATEMENT TECHNOLOGIES DEMONSTRATE THAT: TECHNOLOGY CAN BE MADE TO TAKE CARE OF ITS CONSEQUENCES

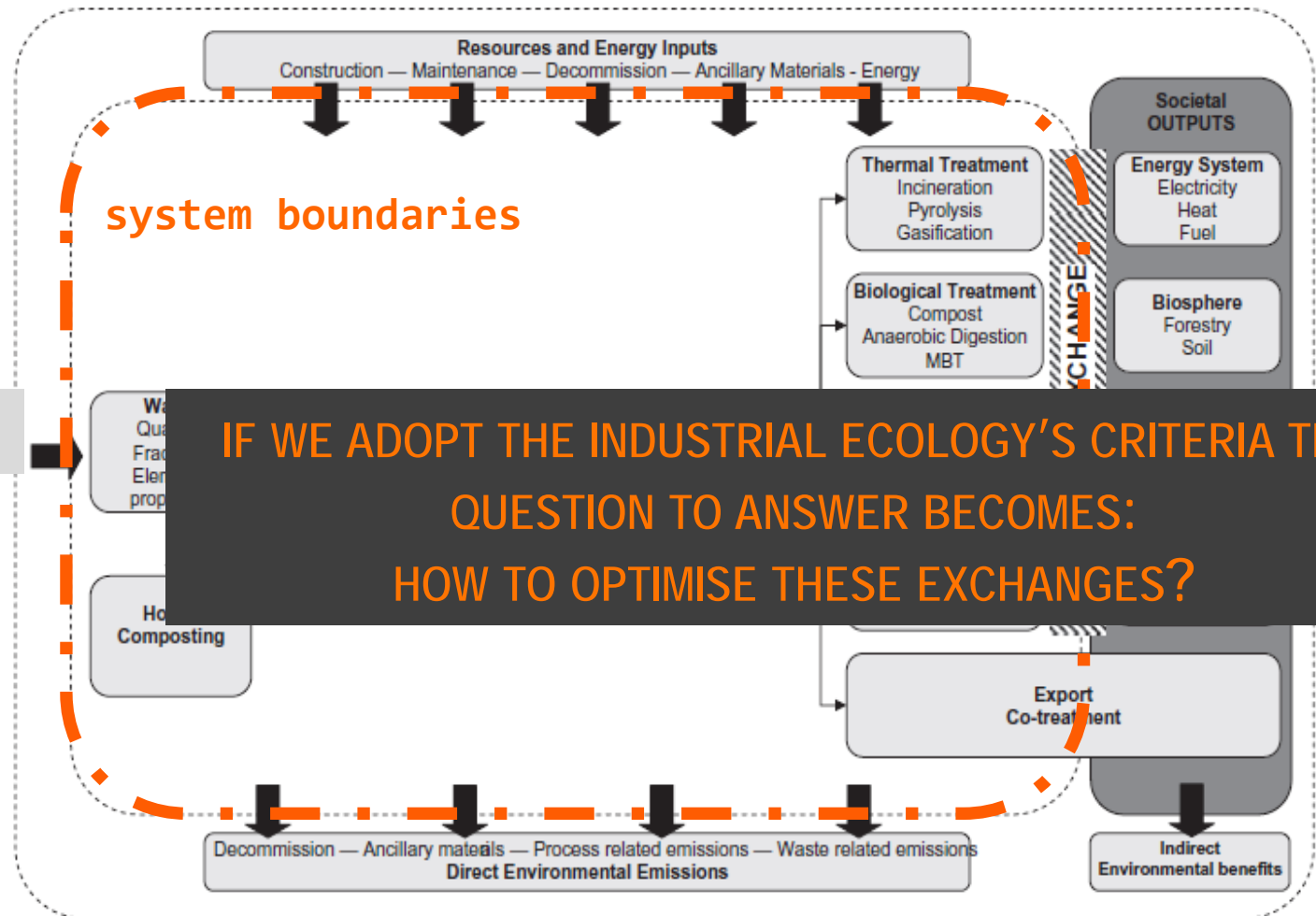


These workers are doing the same thing: extracting precious metals from WEEE



Laborer heating acid mixture to extract gold from imported computer chips: waste acids and sludges are dumped on soil and into the river. The only protective equipment used are rubber boots and gloves. from BAN

# AN INTEGRATED WM SYSTEM CONSTANTLY EXCHANGES MATTER AND ENERGY WITH THE REST OF THE SOCIETY AND THE PRODUCTIVE SYSTEM



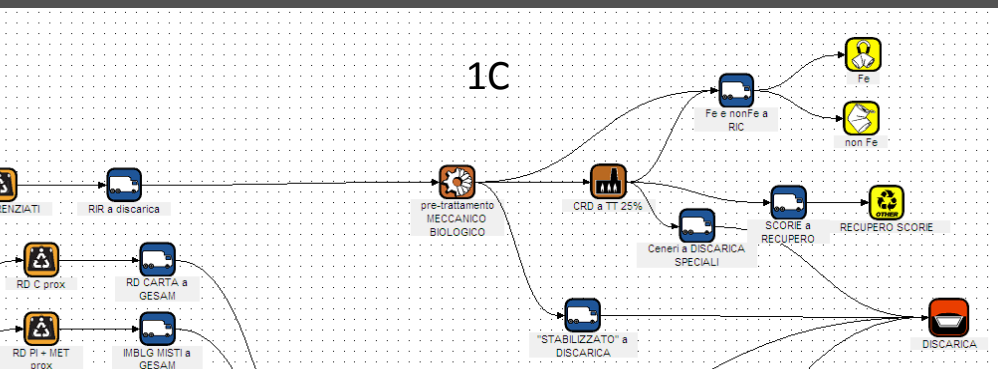
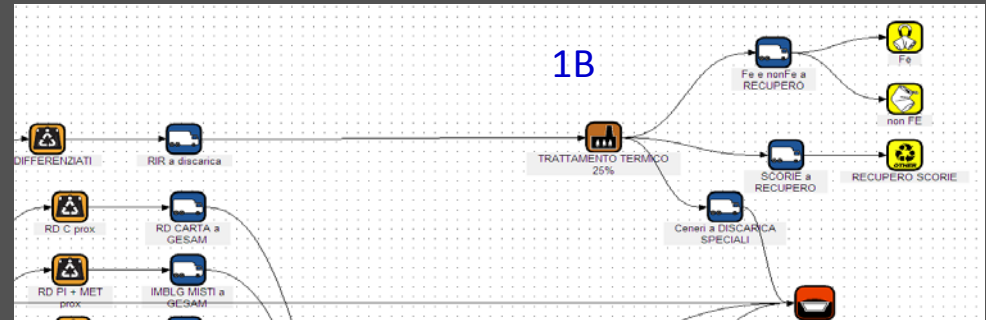
PREVENTION

IF WE ADOPT THE INDUSTRIAL ECOLOGY'S CRITERIA THE QUESTION TO ANSWER BECOMES:  
HOW TO OPTIMISE THESE EXCHANGES?

### 3 strategies for recovery of energy from residual waste

Differing for organisation, recovery efficiency and environmental impacts:

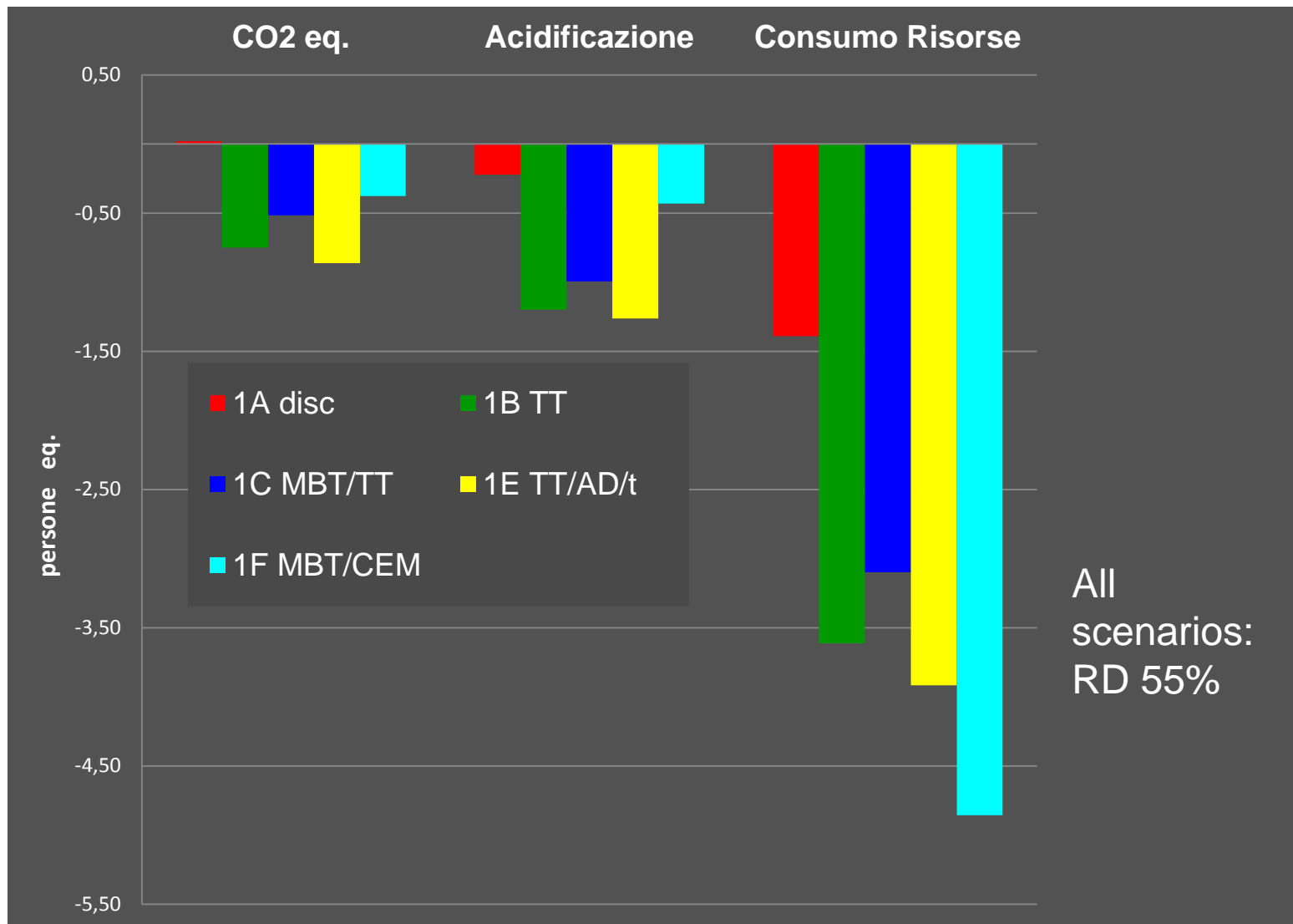
#### 1. Energy recovery from residual waste in thermal treatment plants



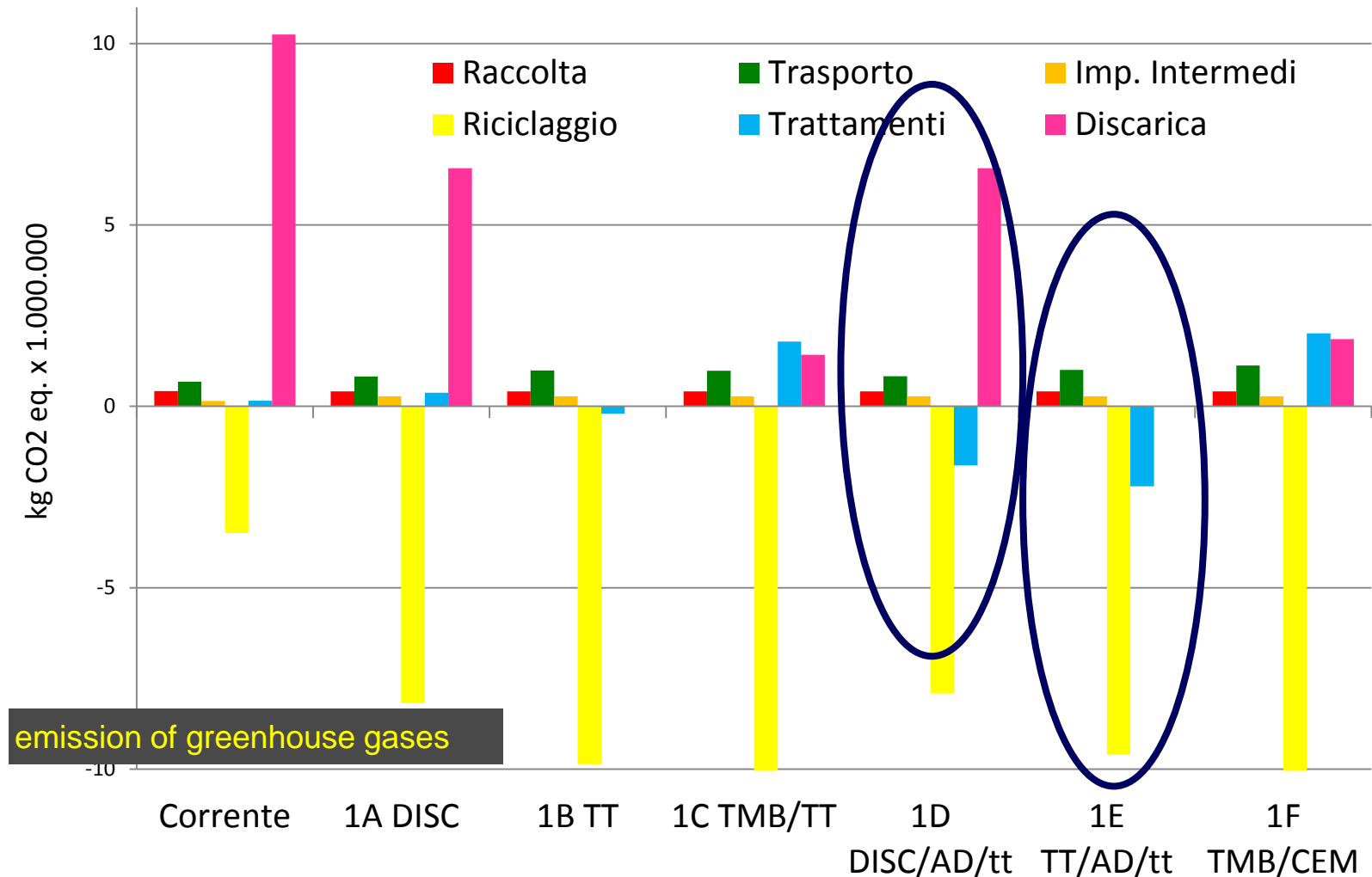
#### 2. pre-treatment (MBT) of residual waste and energy recovery from RDF (refuse derived fuel) in a dedicated plant, existing of built on purpose

#### 3. pre-treatment (MBT) of residual waste: BUT for energy recovery from RDF no dedicated plants is planned: RDF is left to the market, for thermal treatment in 'incinerators' or co-inceneration in cement kiln and power plants often outside the area where waste are produced and managed.

# LCA PROVIDES A SYNTHETIC VIEW OF THE EFFECTIVENESS OF ALTERNATIVE SCENARIOS



To disassemble complexity and understand which elements govern the environmental efficiency of a whole WM system, the analysis deepens and the impacts of the each WM phases are quantified





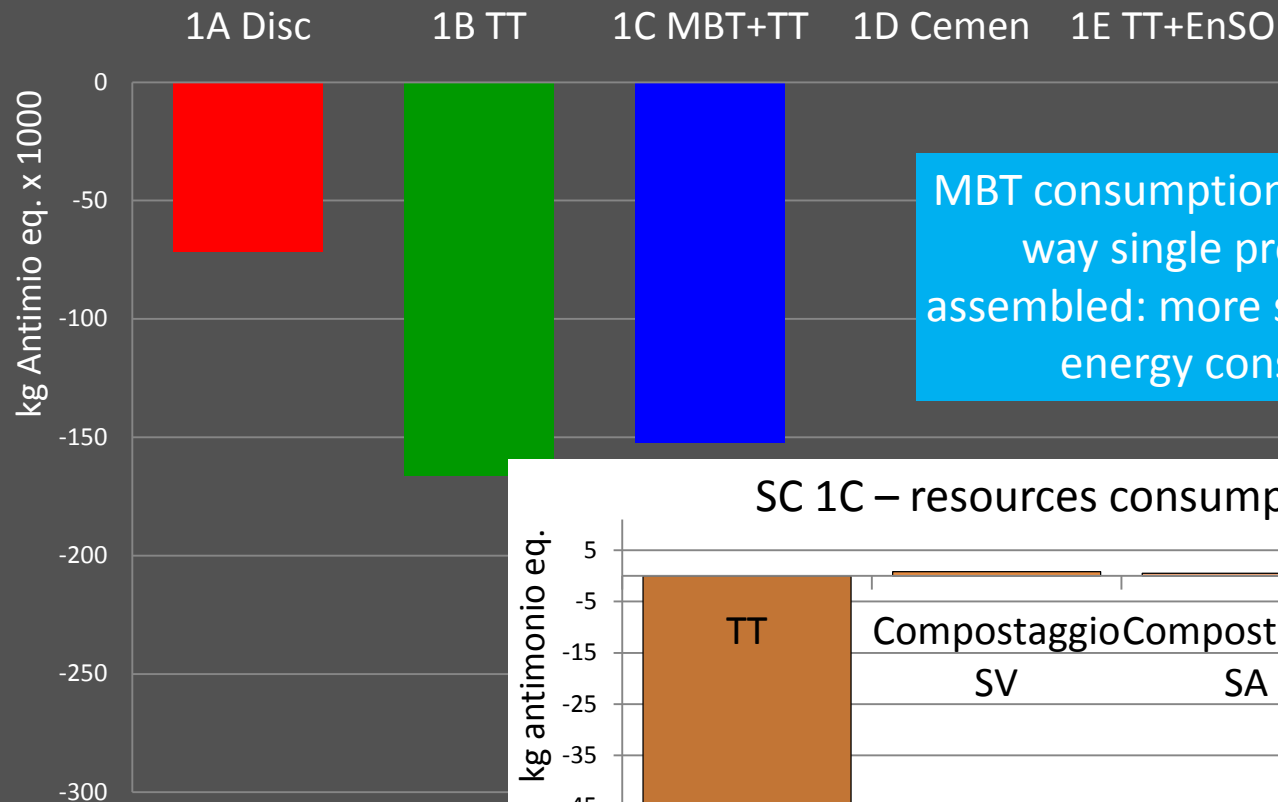
# LCA COMPARISON OF ALTERNATIVE STRATEGIES FOR THE RECOVERY OF ENERGY FROM WASTE

Abiotic resources saving: sensitivity analysis



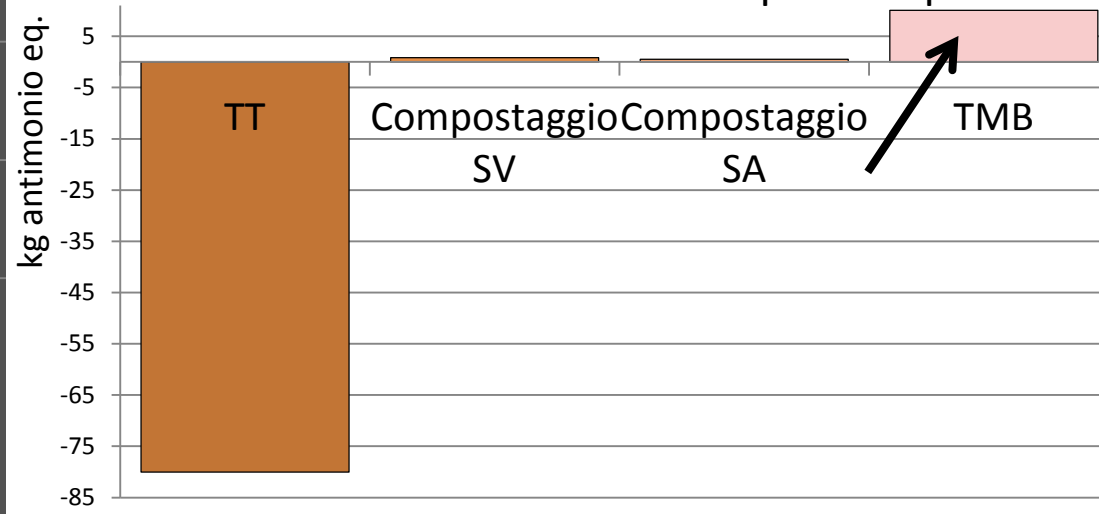
# LCA COMPARISON OF ALTERNATIVE STRATEGIES FOR THE RECOVERY OF ENERGY FROM WASTE

## Abiotic resources saving: sensitivity analysis



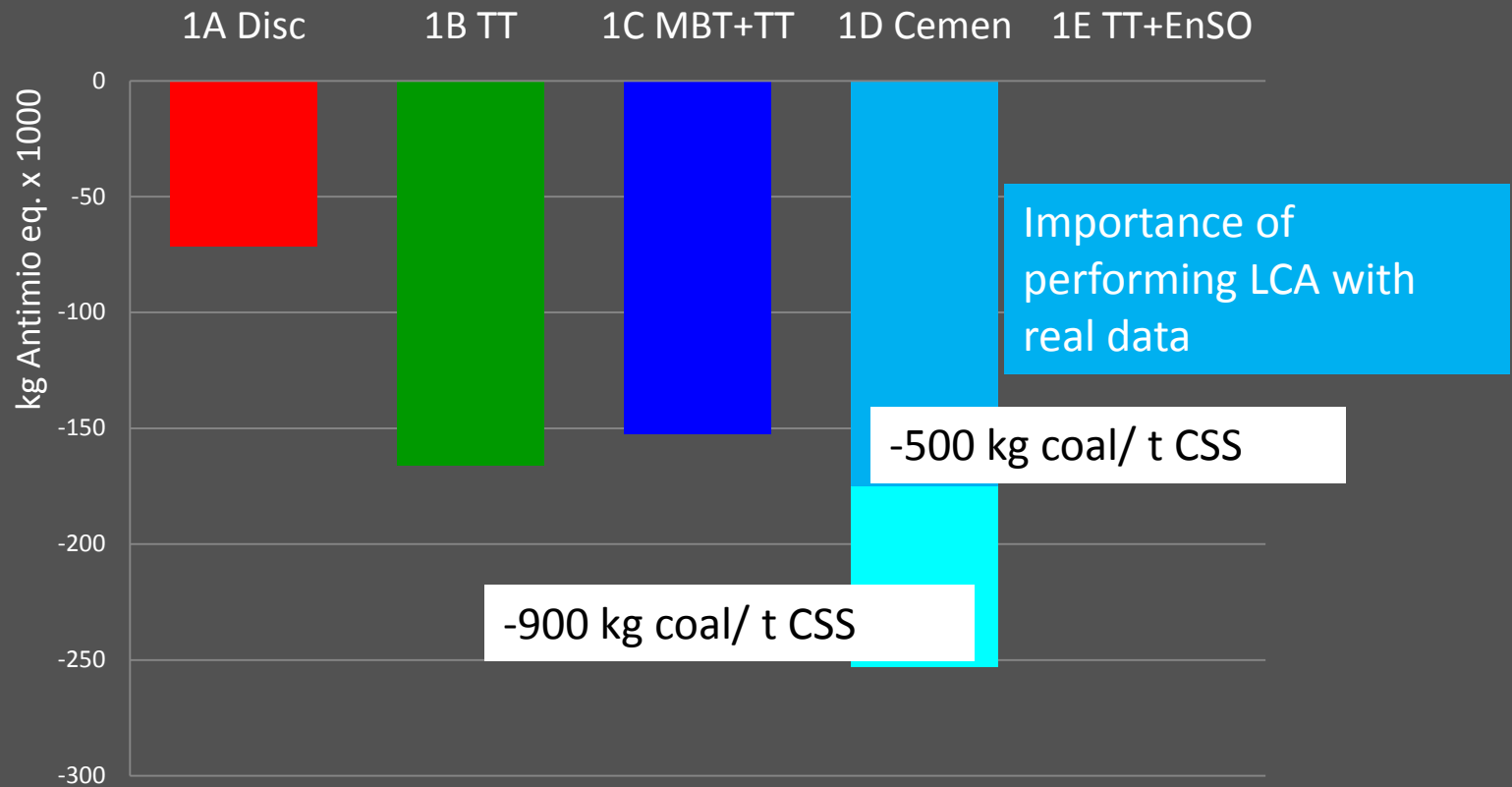
MBT consumption depend on the way single processes are assembled: more separation more energy consumption

## SC 1C – resources consumption of plants



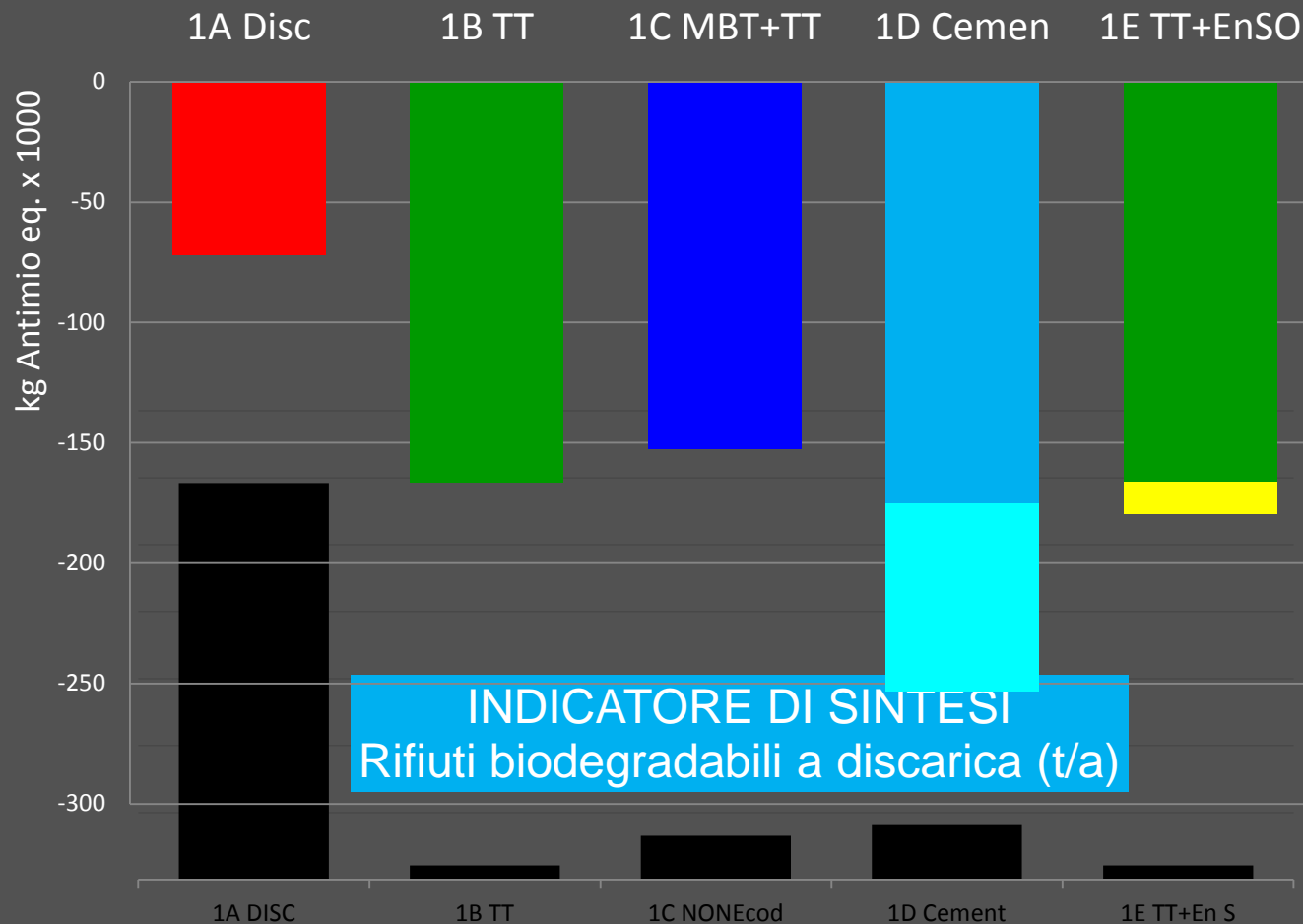
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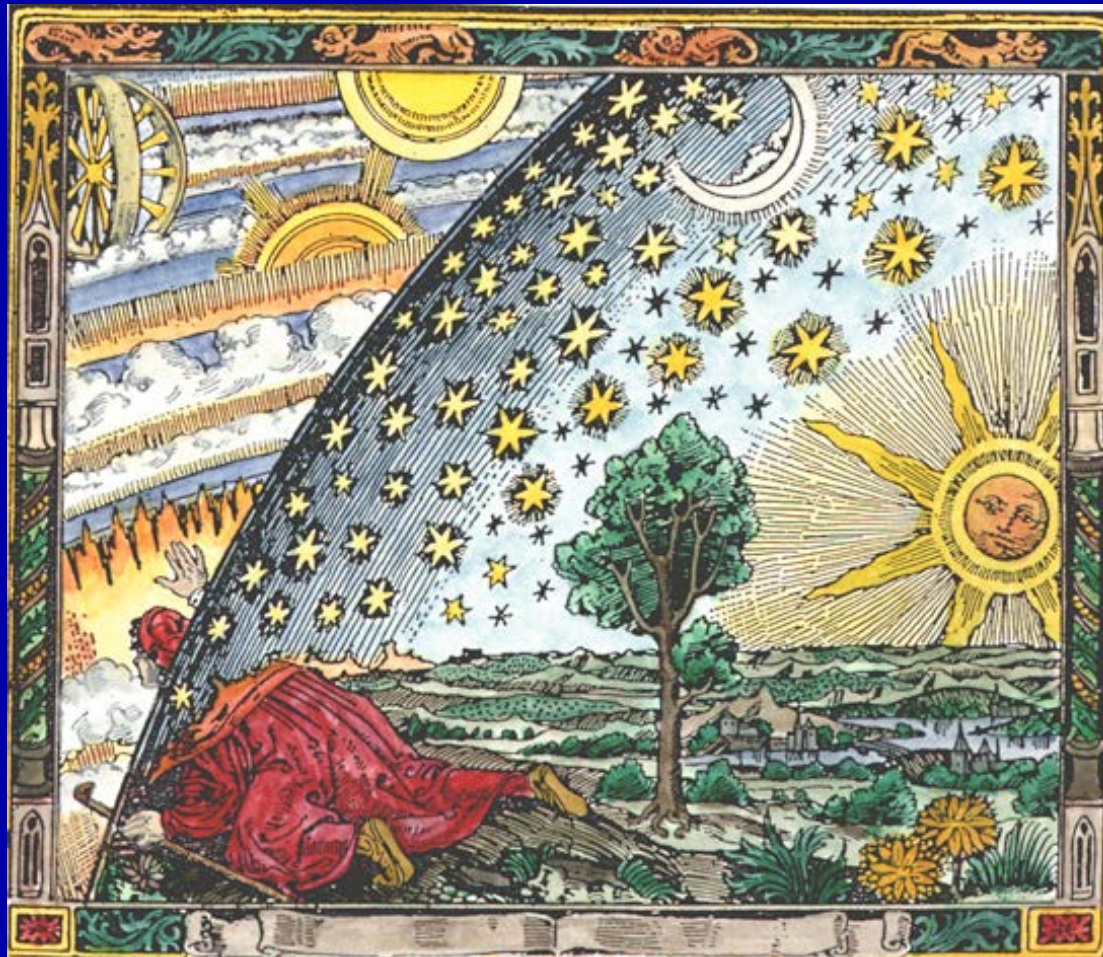
## RECCOMENDATIONS

- ✓ *Coordinate and assess policy at the NATIONAL SCALE: establish a National Plan for WM.*
- ✓ *Openly discuss the need to INTEGRATE WM within the NATIONAL ENERGY SYSTEM and to exploit its potential for the reduction of greenhouse gases emissions.*
- ✓ *Properly select the number, type and capacity of the plants necessary to complete the waste infrastructure system at the national and regional scales, using LCA and GIS.*
- ✓ *Recognise the urgency of SETTING IN PLACE A SIGNIFICANT INFRASTRUCTURE CAPACITY to overcome main national differences, of planning towards national self-sufficiency and of reducing illegal trafficking.*



## RECCOMENDATIONS

- ✓ *Homogenise national legislation on environmental crimes and international efforts to PREVENT ILLEGAL behaviour.*
- ✓ *Give VALUE TO PUBLIC ENGAGEMENT AND DISCUSSION on waste management and risk communication; and give full disclosure to the results of monitoring health and air emissions from all treatment plants*
- ✓ *Define a public national strategy to use TECHNOLOGICAL INNOVATION to support a shift in consumption patterns, the evolution of waste management and the creation of new JOBS.*
- ✓ *Assess the system: adopt Criteria and Indicators for an effective and sustainable WM development and operation.*



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