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materials & energy from refuse

CEWEP STAC Meeting
Piacenza - 12 April 2016

Thoughts on *Zero-Waste*

as basis for a paper for Waste Management & Research

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and the MatER Team

A philosophy of waste management (and society)

The advocates of the Zero Waste concept aim at achieving a «*true sense of sustainable waste management system*» through:

- **Sustainable production and consumption**
- **«Optimum» recycling and resource recovery**
- **Elimination of incineration and landfilling.**

The concept is translated differently, according to the institution who embraces the Zero Waste concept

Policymakers assume that Zero Waste may inspire strategy and goals for waste management.

The Zero Waste World

A large amount of organizations and institutions worldwide have adopted the concept of Zero Waste, although there is no common definition.

Also, there is no regulation or coordination: every association can «declare» the status of «Zero Waste» by itself

U.S. zero waste BUSINESS COUNCIL

ZERO WASTE EUROPE

U.S. ZERO WASTE zero waste CERTIFIED BUSINESS COUNCIL

Zero Waste

ZERO WASTE INTERNATIONAL ALLIANCE working towards a world without waste

RIFIUTI ZERO

"Passi concreti verso Rifiuti Zero"
Comune di Capannori

Opotiki District Council
Strong Community
Strong Future

ZERO WASTE SA

ZERO WASTE ITALY

THE PATHWAY TO ZERO WASTE

The Zero Waste International Alliance (ZWIA)

The ZWIA has been established in 2003 to promote alternatives to landfill and incineration and to raise community awareness of the social and economic benefits that can be gained when waste is regarded as a resource

ZWIA operates at the international, national and local level by:

- **Promoting "research" and information sharing for the spread of the Zero Waste practice**
- **Building capacity to effectively implement Zero Waste**
- **Setting standards for the application of Zero Waste**

ZWIA articles

The end of garbage

Can you imagine a world of zero waste? Cities and towns across the world - and a surprising number of companies - have adopted that goal, says Fortune's Marc Gunther

By Marc Gunther, Fortune senior writer
March 14 2007: 6:21 AM EDT

A world without waste

The Boston Globe

The 'zero waste' movement imagines a future where everything is a renewable resource. Sound impossible? From New Zealand to New England, it's already changing the way governments and companies do business.

By Jessica Winter | March 11, 2007

TIME

Can We Make Garbage Disappear?

Through the magic of recycling and modern alchemy, we will move swiftly toward a world without waste

By Ivan Amato | Monday, Nov. 08, 1999

Whoever said "waste not, want not" hasn't had much influence on 276 million Americans. In 1997 we gave a collective heave-ho to more than 430 billion lbs. of garbage. That means each man, woman and child tossed out an average of nearly 1,600 lbs. of banana peels, Cheerios boxes, gum wrappers, Coke cans, ratty sofas, TIME magazines, car batteries, disposable diapers, yard trimmings, junk mail, worn-out Nikes--plus whatever else goes into your trash cans. An equivalent weight of water could fill 68,000 Olympic-size pools.

Zero Waste International Alliance
working towards a world without waste

Zero Waste according to ZWIA

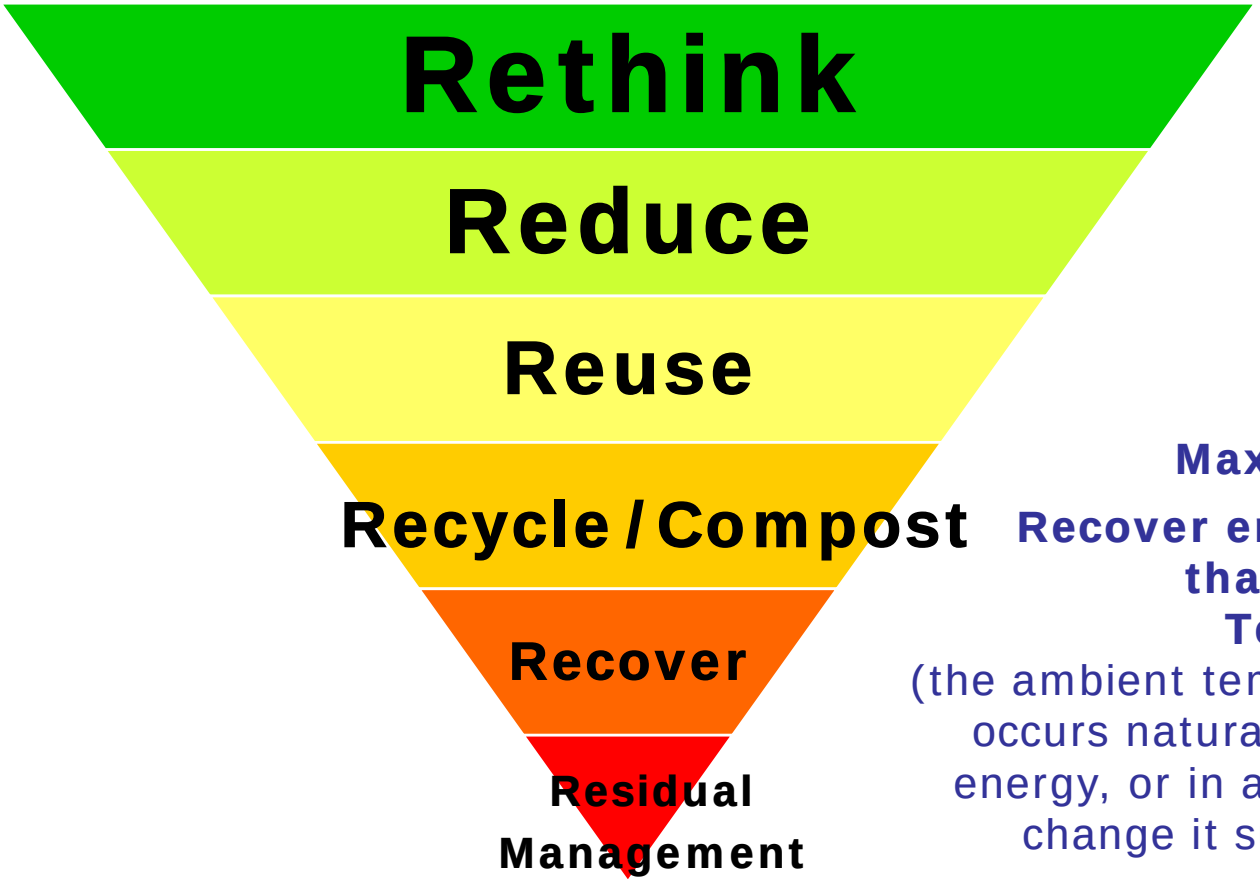
Zero Waste is a goal that is ethical, economical, efficient and visionary, to guide people in changing their lifestyles and practices to emulate sustainable natural cycles, where all discarded materials are designed to become resources for others to use.

Zero Waste means designing and managing products and processes to systematically avoid and eliminate the volume and toxicity of waste and materials, conserve and recover all resources, and not burn or bury them. Implementing Zero Waste will eliminate all discharges to land, water or air that are a threat to planetary, human, animal or plant health.

(Zero Waste International Alliance - ZWIA, 2009*).

* The Planning Group of the Zero Waste International Alliance adopted the first peer-reviewed internationally accepted definition of Zero Waste on November 29, 2004. The revised definition adopted by the Zero Waste International Alliance on August 12, 2009 is posted above. This is intended to assist businesses and communities in defining their own goals for Zero Waste.

The Zero Waste Hierarchy according to ZWIA



Maximize materials recovery

Recover energy using only systems that operate at «Biological» Temperature and Pressure

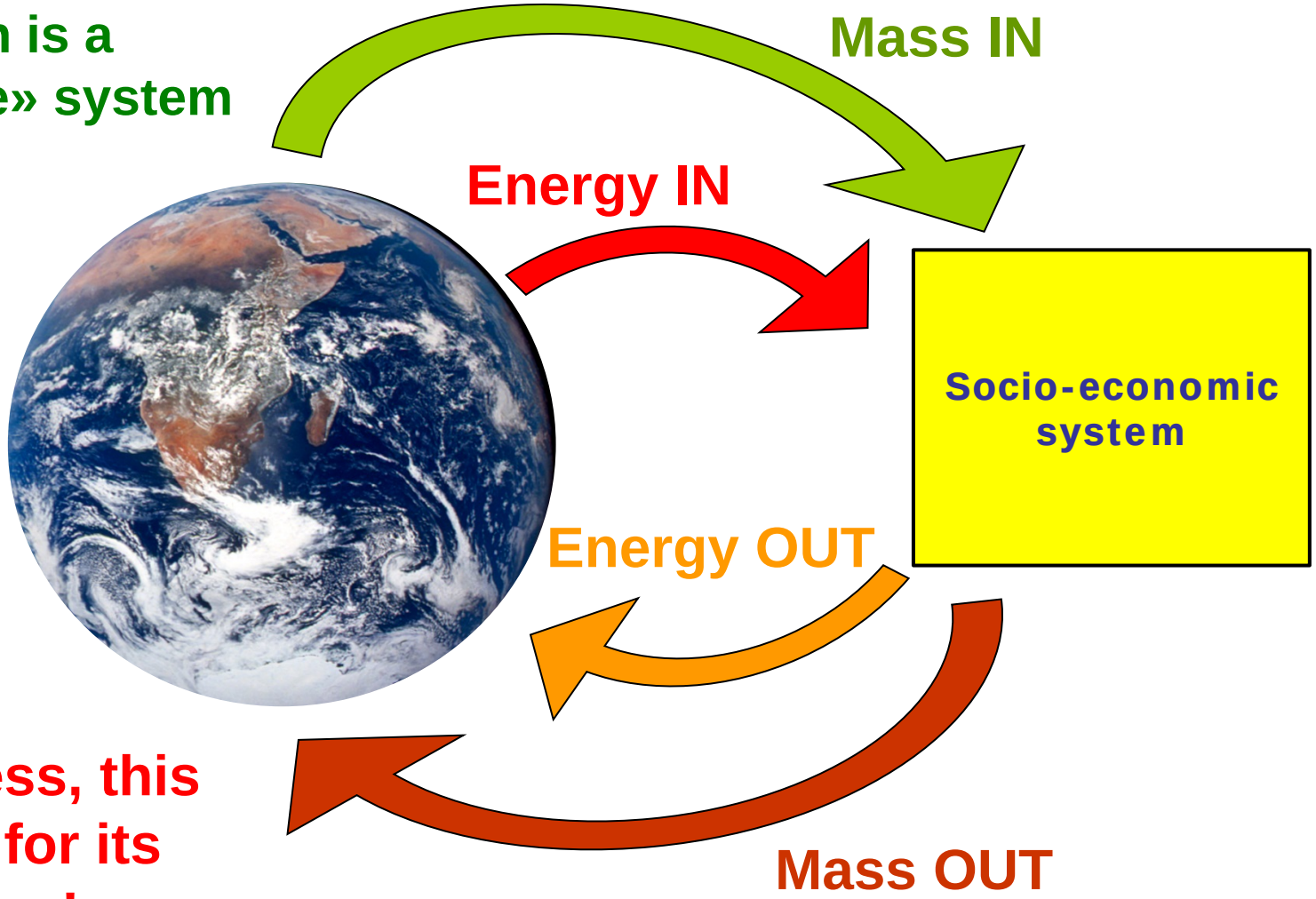
(the ambient temperature and pressure that occurs naturally without the use of added energy, or in any case not above 100°C to change it such as anaerobic digestion).

Disposal and Incineration are not allowed

Incineration = Distructive Disposal system

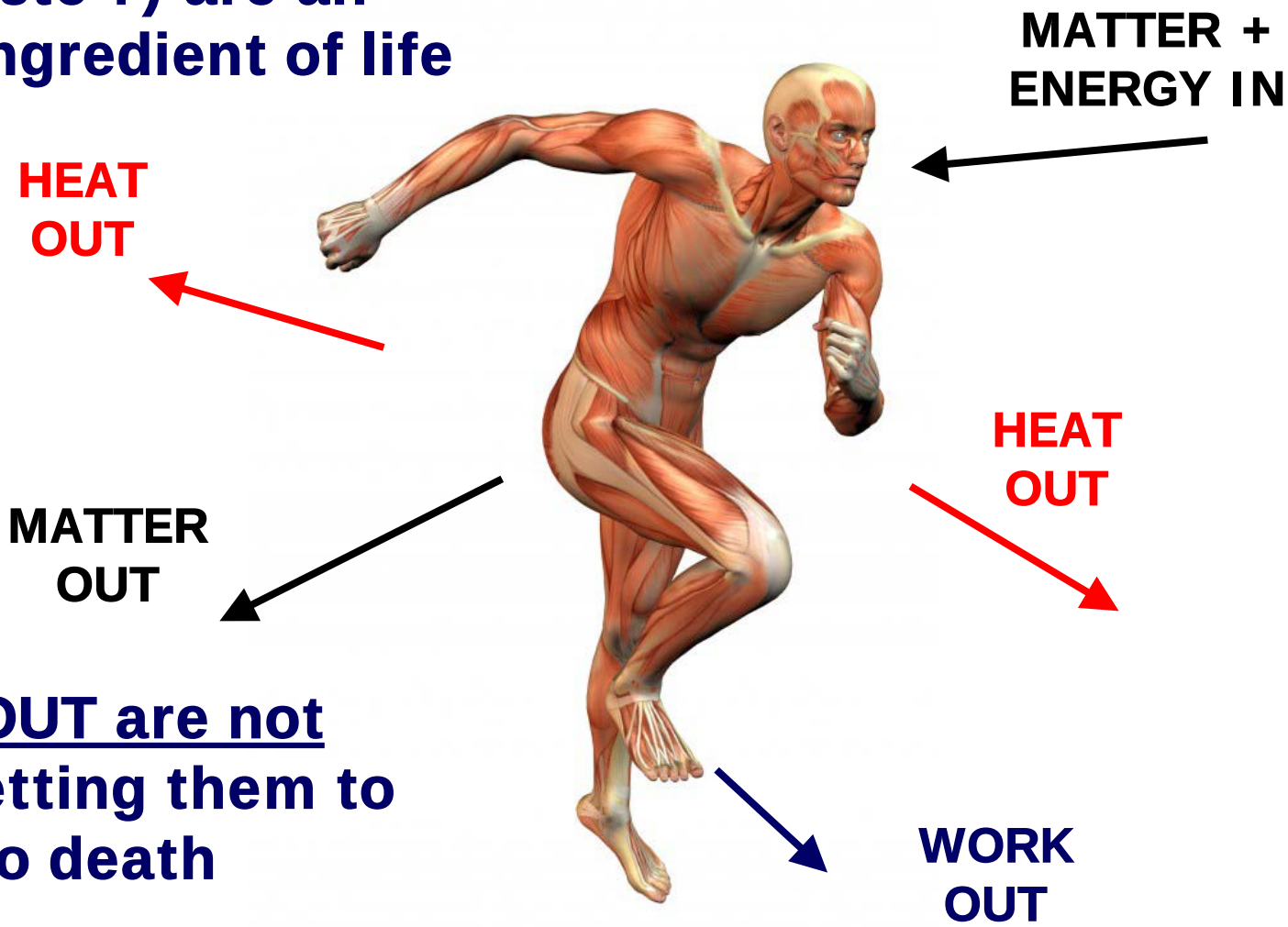
Is Zero Waste a sensible goal ?

Considered as a whole, Earth is a «Zero Waste» system



Nevertheless, this is not true for its sub-systems!

Fluxes of mass and energy IN and OUT (waste ?) are an ESSENTIAL ingredient of life



<u>Fluxes IN / OUT are not an option</u>: setting them to zero brings to death

San Francisco – California - USA

In 2010 claimed 80 % of diversion rate

Goal for 2020: 100 % of diversion

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San Francisco closer to turning zero-waste ambition into reality

US city's strict policies on recycling and composting are just some of the measures making a difference

Has the program been successful?

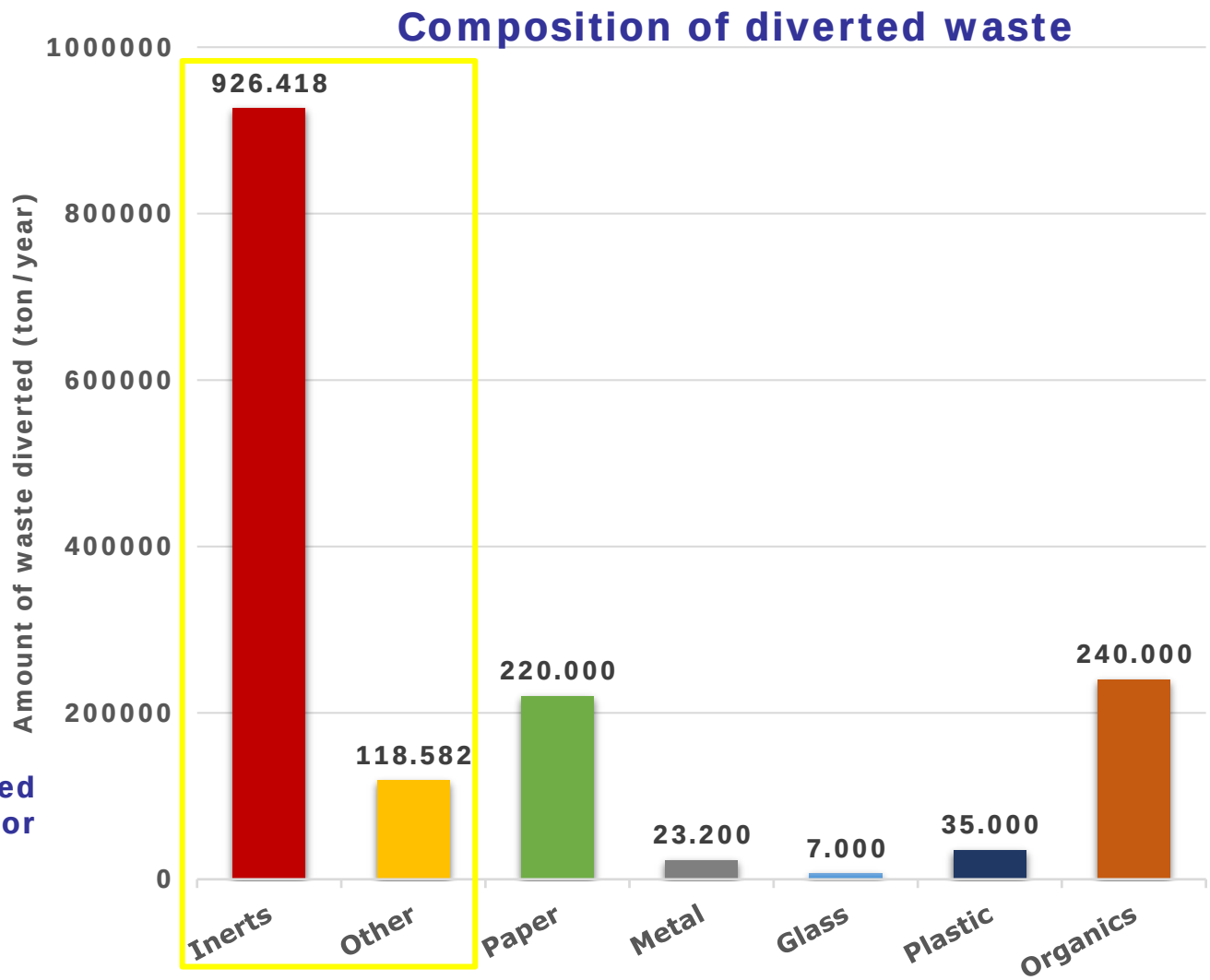
San Francisco has a world-class zero waste program. The City's 3 bin system, policies, financial incentives, and extensive outreach to residents and businesses, helped San Francisco achieve the highest diversion rate of any major city in North America. San Francisco diverts 80% (1,593,830 tons diverted in 2010) of its discards

SF Environment
Our home. Our city. Our planet.
A Department of the City and County of San Francisco

Data inconsistency - C&D waste included in MSW

AMOUNT OF WASTE (ton/year)	
Generated	1.962.750
Disposed	392.550
Diverted	1.570.200

Diversion Rate 80 %



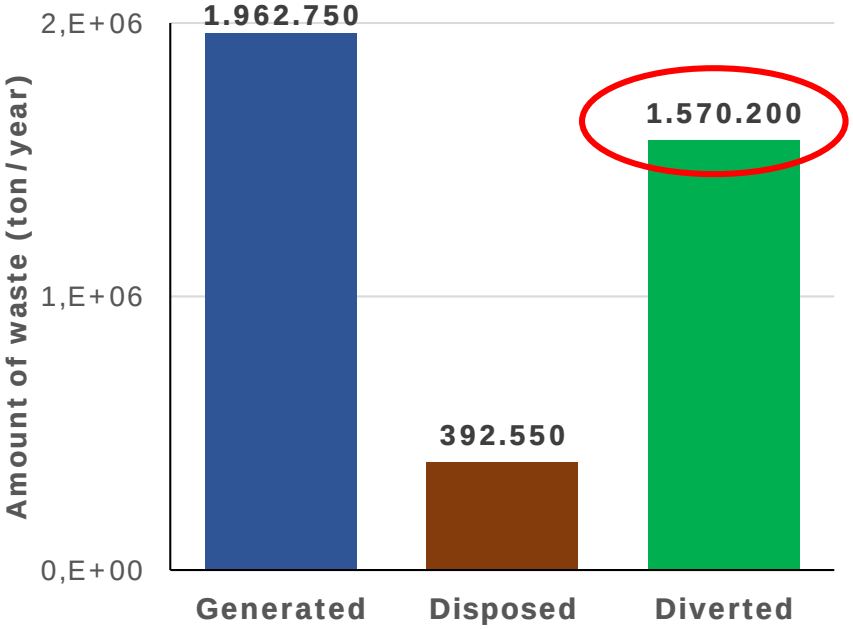
«Other» includes material used as «alterantive daily cover for landfills»: C&D, ash, sldudge…

Data referred to 2011

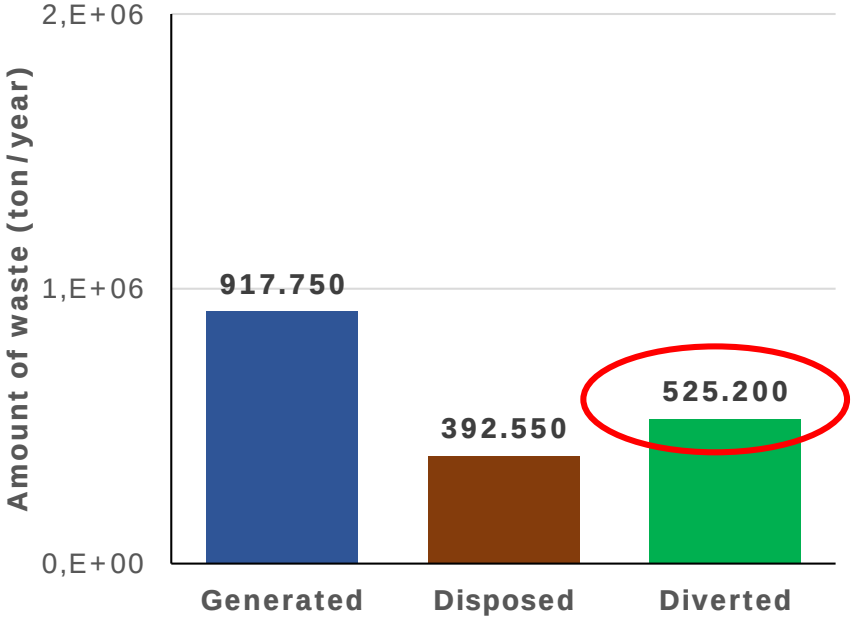
Source: MacBride S., 2013

Data inconsistency - C&D waste included in MSW

Waste flows including C&D in MSW



Waste flows excluding C&D from MSW



Diversion rate = 80% → **Diversion rate = 57%**

Data inconsistency – How is the diversion rate calculated?

The State of California calculation method

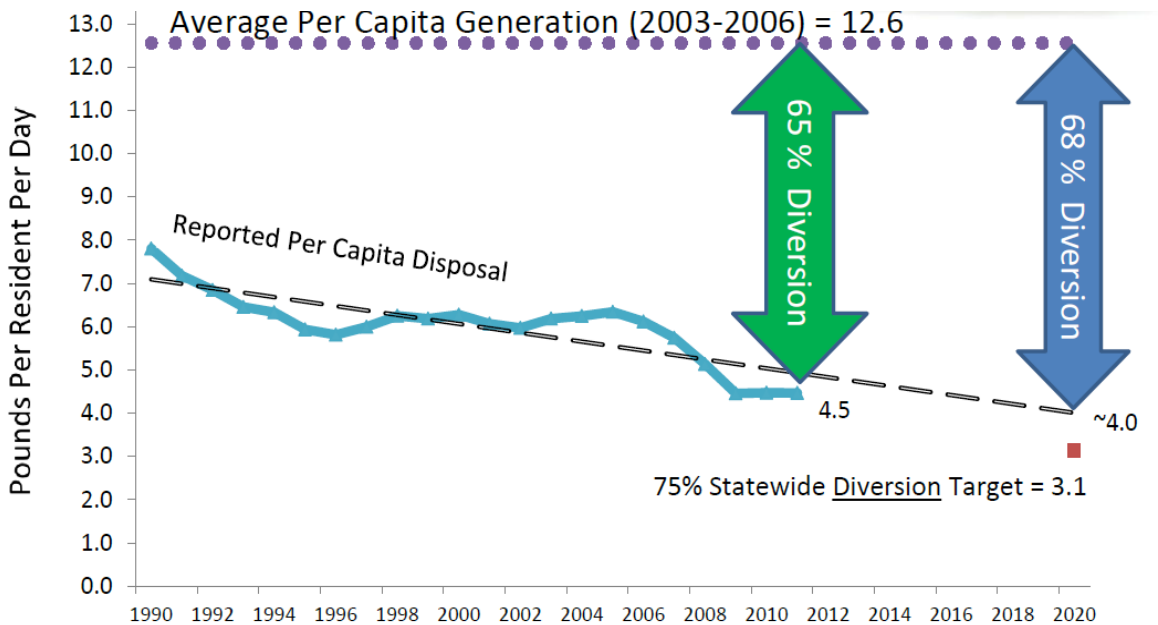
Diversion rate = Waste Generation - Disposal rate

Waste Generation: **Estimated**

Disposal rate: **Data from plants**

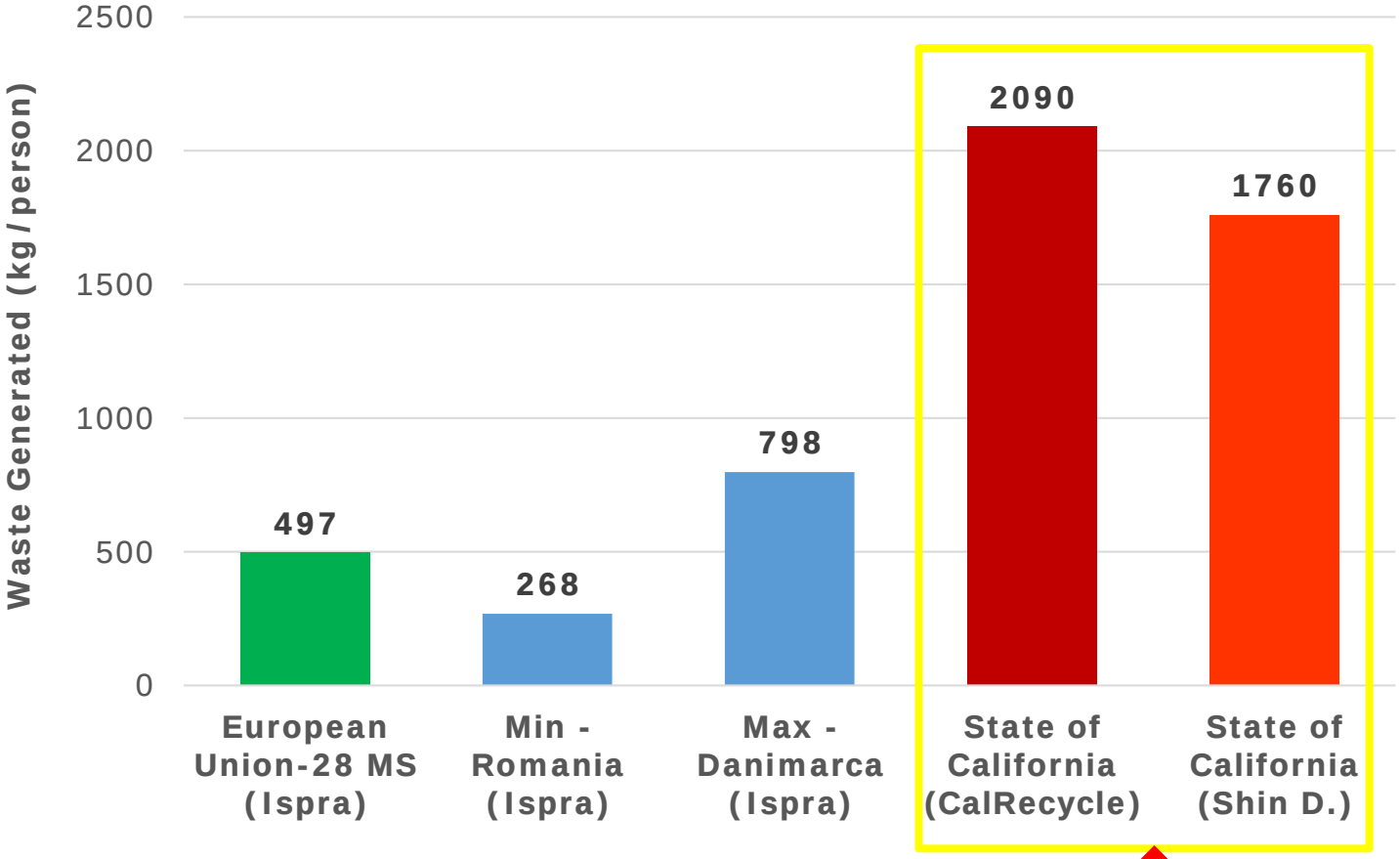
Waste generation is not calculated or measured, but estimated.

Calculation of Diversion rate for California State



The amount of waste generated is considered costant: equal to the average per capita generation between 2003 and 2006.

Waste generation – Comparison with EU

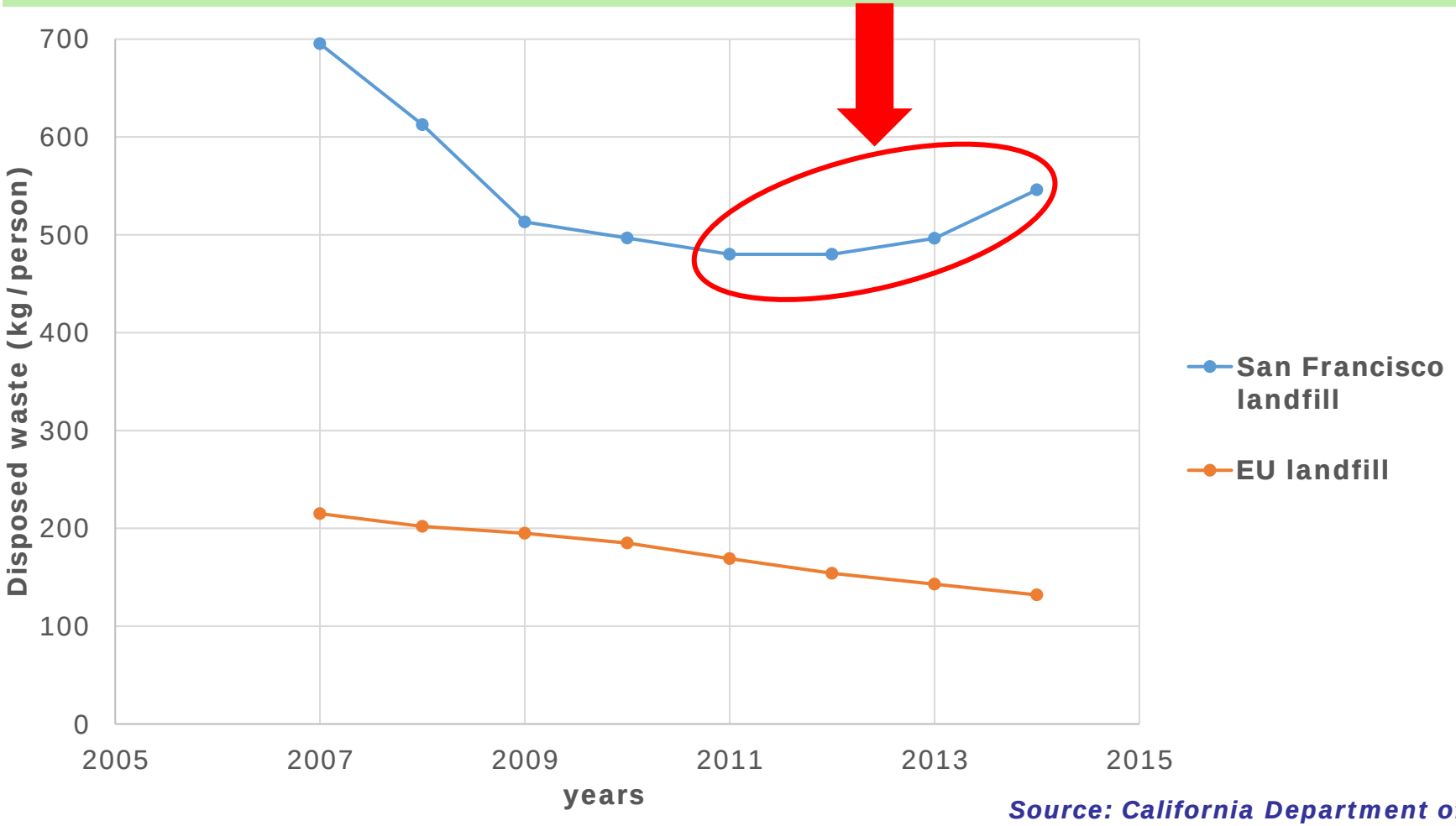


Data referred to year 2011
Sources: ISPRA 2015
Shin D., 2014

Recognized problems of inconsistency and lack of data

The disposal trend

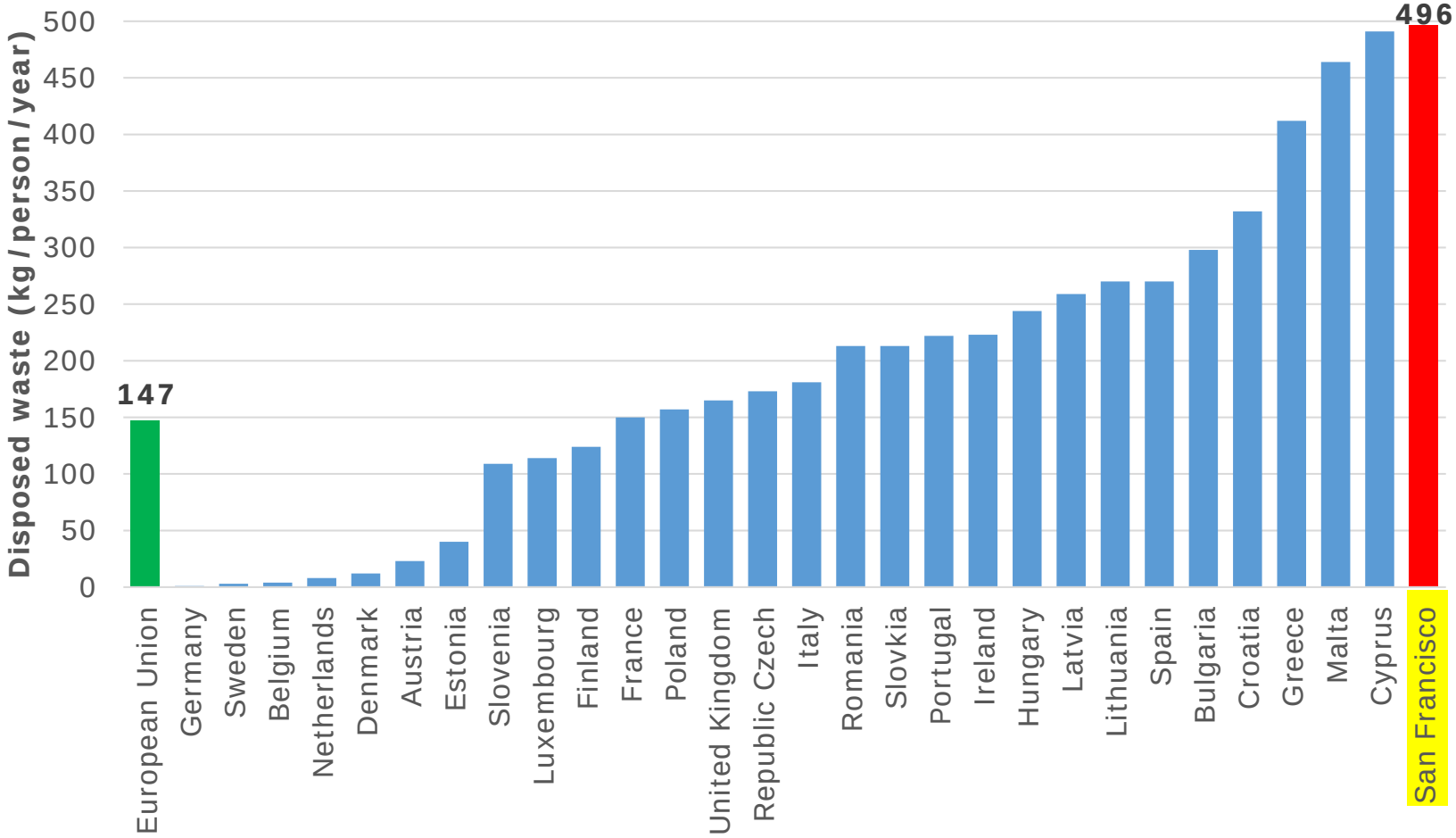
Disposal trend in San Francisco stopped its decrease in 2012 and began to increase in the last years.



Source: California Department of Resources Recycling ad Recovery (CalRecycle); Eurostat 2016

Zero Waste Cases – San Francisco vs EU

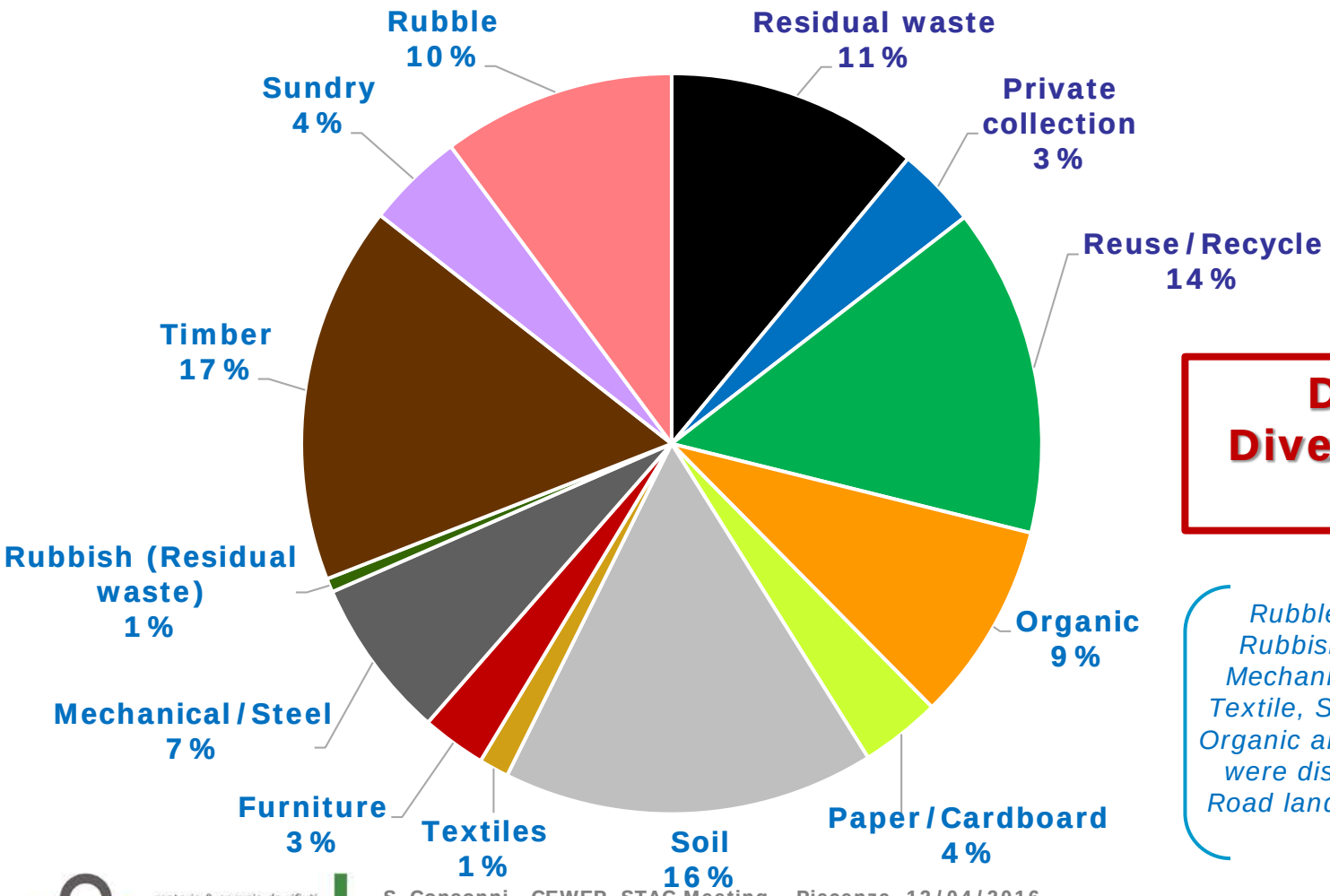
San Francisco landfills much more than in the EU



Data referred to 2013
Source: Ispra, 2015; CalRecycle

Opotiki Distric – New Zeland

Waste Source and Composition (ref. Opotiki Distric Council Waste Management and Minimisation Plan 2012)

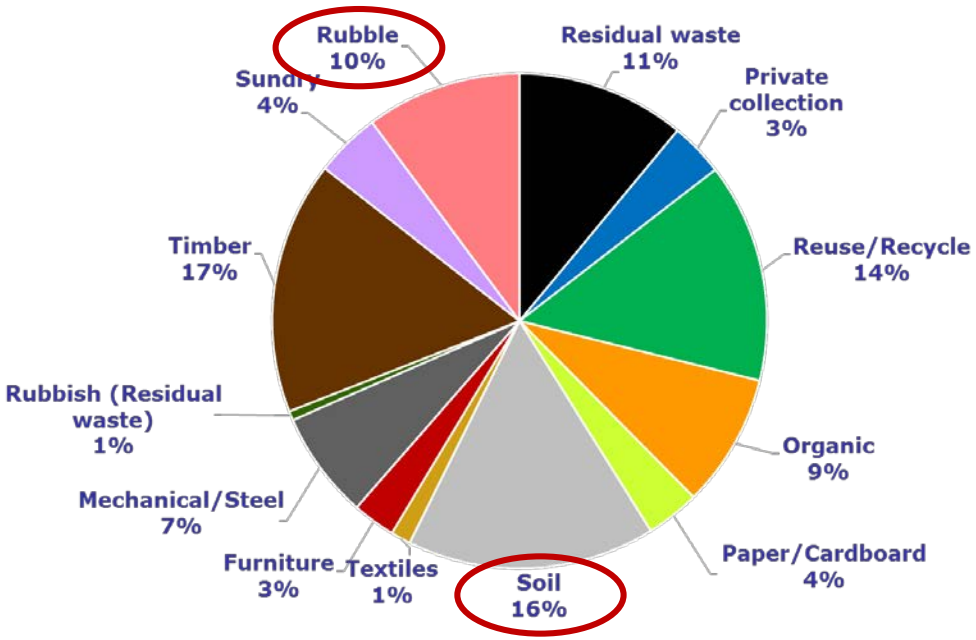


Declared Diversion Rate: 89 %

Rubble, Sundry, Timber, Rubbish (Residual waste), Mechanical/Steel, Furniture, Textile, Soil, Paper/Cardboard, Organic are waste fractions that were disposed at Woodlands Road landfill, before its closure in 2004.

What's wrong with Diversion Rate calculus?

Declared Diversion Rate = 100% - Residual Waste (11%) = 89%

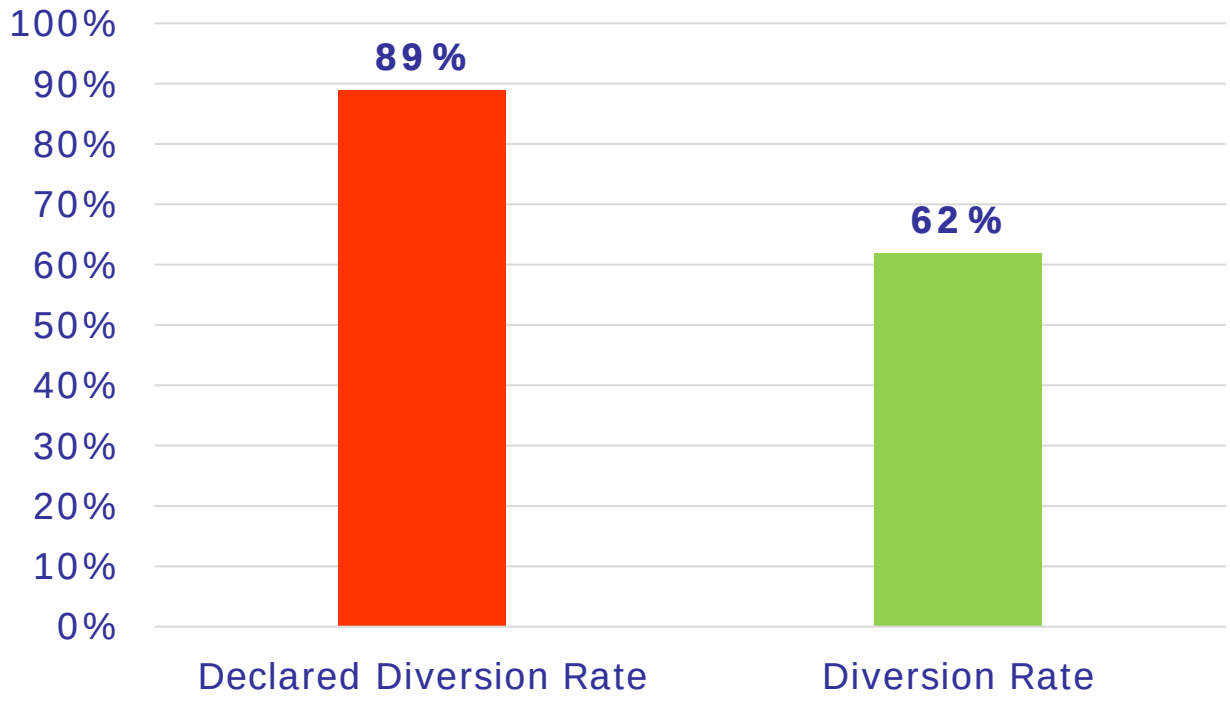


89% includes:

- Private collection
- Reuse/Recycle
- Organic
- Paper/Cardboard
- Textiles
- Furniture
- Mechanical/Steel
- Rubbish (Residual waste)
- Timber
- Sundry
- Rubble
- Soil

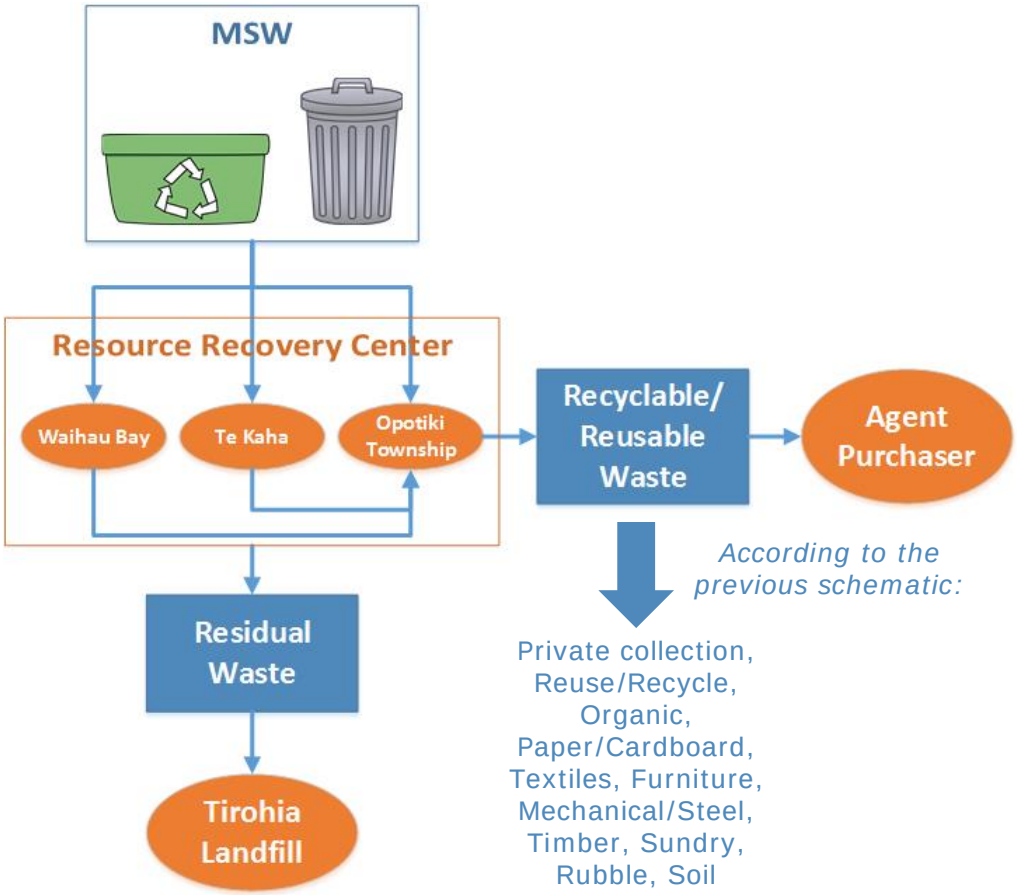
→ **C&D WASTE**

What's wrong with Diversion Rate calculus?



The Diversion Rate, re-calculated excluding «Soil» and «Rubble» (but cautiously considering «Private collection» and «Sundry» because no information was found about their destination and treatement), is reduced by 27%.

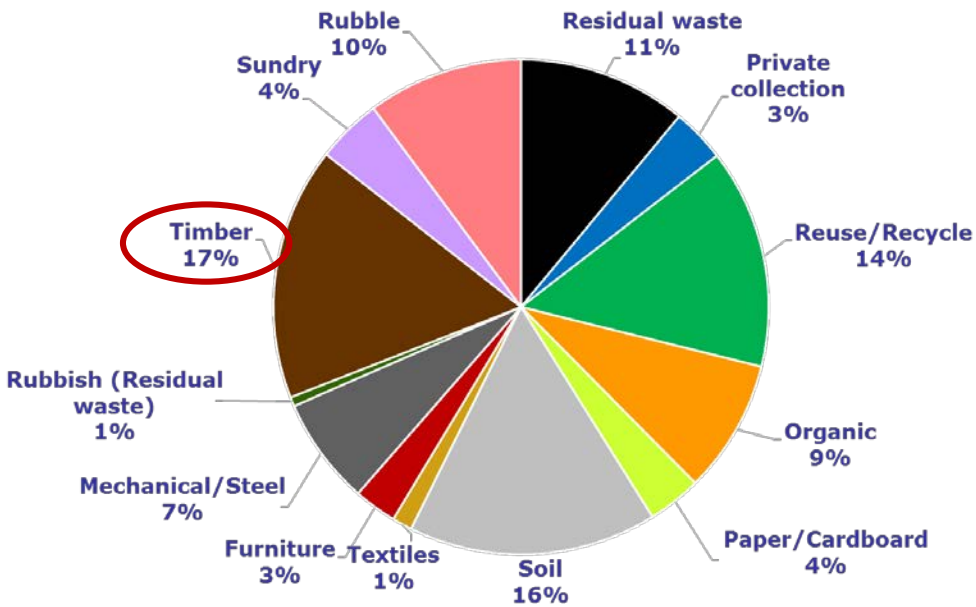
What's wrong with Diversion Rate calculus?



The declared Diversion Rate excludes all wastes produced by processes downstream of recyclable / reusable refuses' trade to agent purchasers or recycling plants.

The definition of the Control Volume is a significant issue in order to have comparable Diversion Rate

What's wrong with Diversion Rate calculus?



"Since the closure of the landfill* these materials have either been reused or composted, and in respect of the timber a portion burnt on site."

Ref. Opotiki Distric Council Waste Management and Minimisation Plan 2012

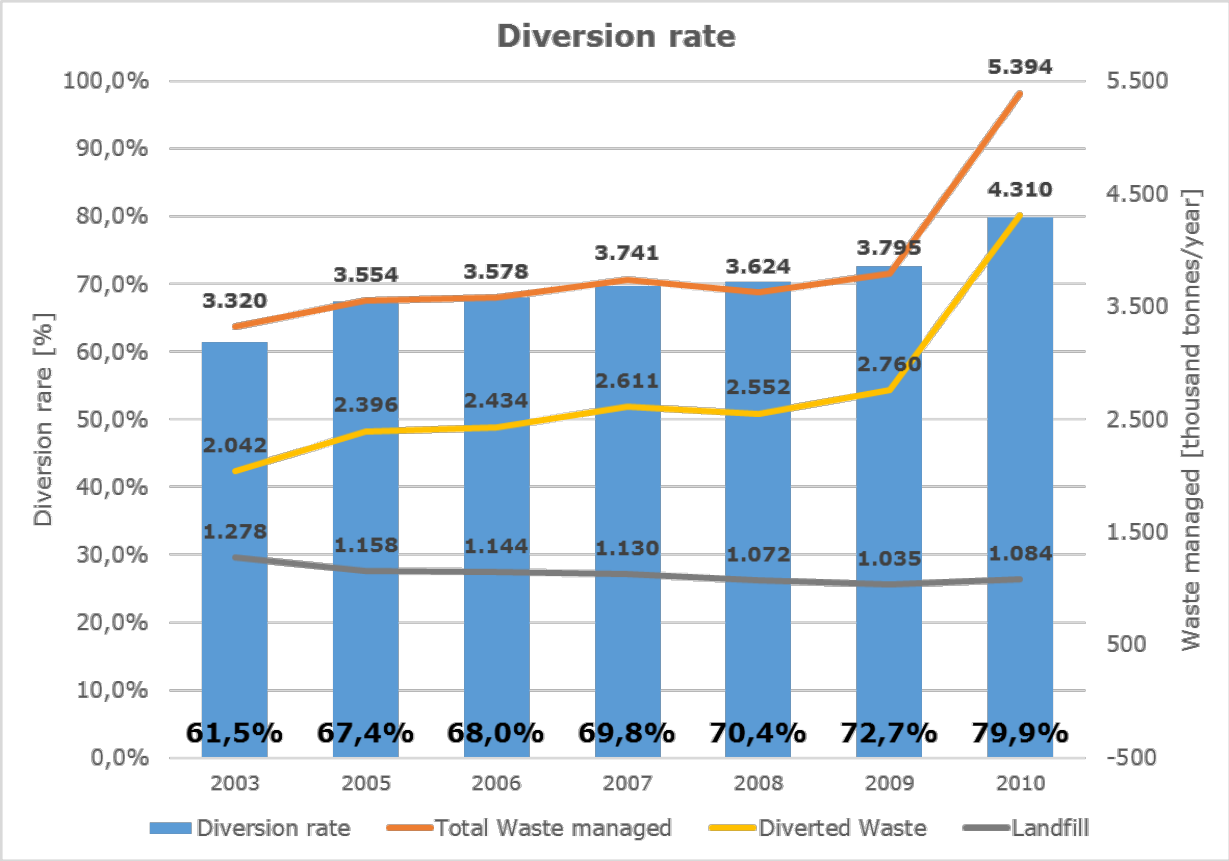
* Woodlands Road landfill, closed in 2004

Timber flux is considered as «diverted material» but it is declared to be burnt on site, with no information on technologies used.

According to Zero Waste principles, no waste has to be thermally treated.

Adelaide – Australia

Ref. ZWSA, 2011a. South Australia's Waste Strategy 2011 – 2015



"If a significant amount of C&D is recycled and diverted and recorded as a fraction of municipal solid waste this is a misleading figure for municipal waste diversion from landfill."

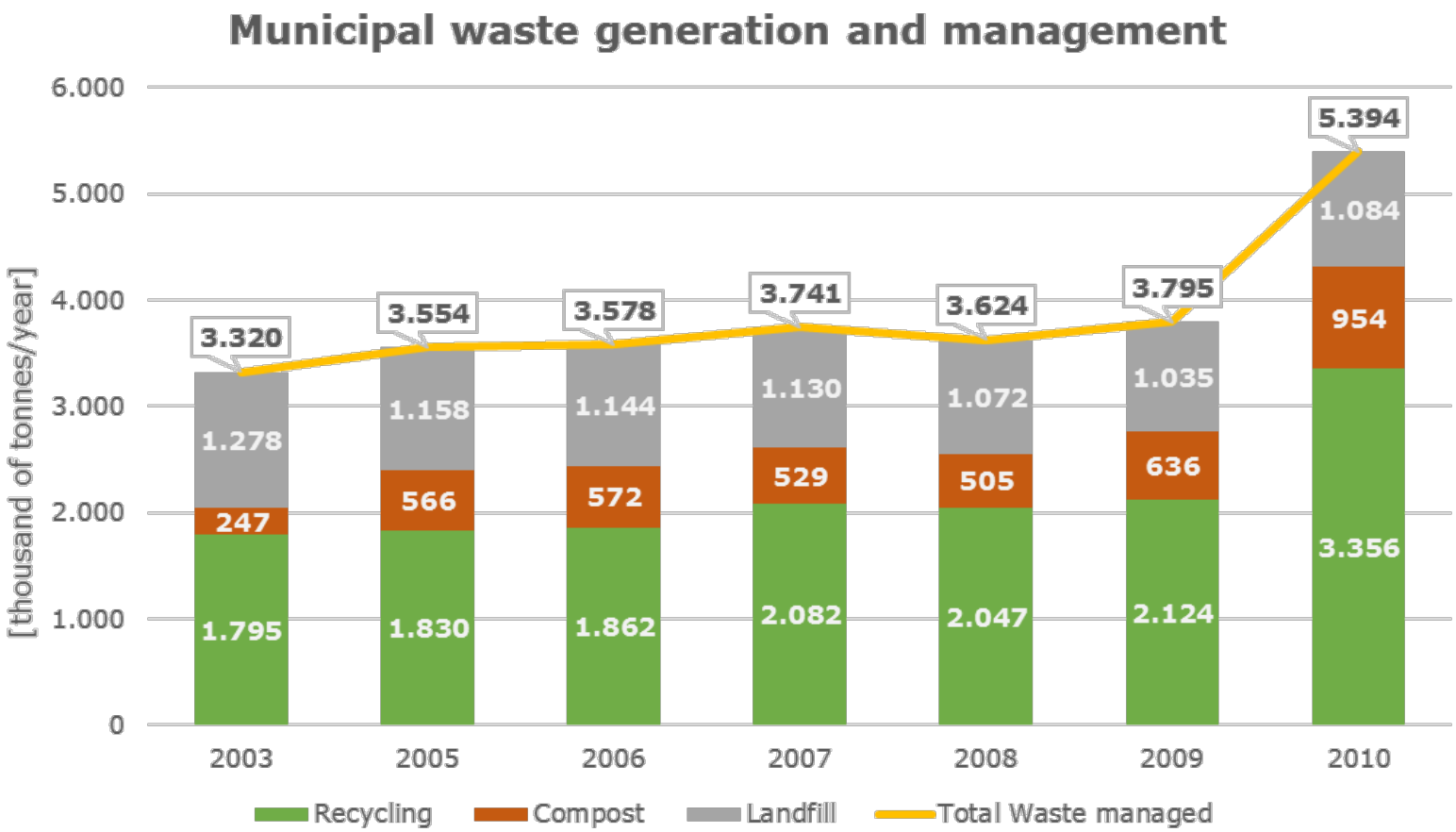
A. Zaman, "Measuring waste management performance using the "Zero Waste Index": the case of Adelaide, Australia," Journal of Cleaner Production, vol. 66, pp. 407 - 419, 2014.

Adelaide has been rebuked for non-compliance relative to MSW composition as it has been verified that C&D wastes were included

(Ref. "UN-HABITAT", 2010; CSIRO, "Australian Waste Database", 2004)

Data ref. ZWSA, 2011a. South Australia's Waste Strategy 2011 – 2015

Adelaide – Australia



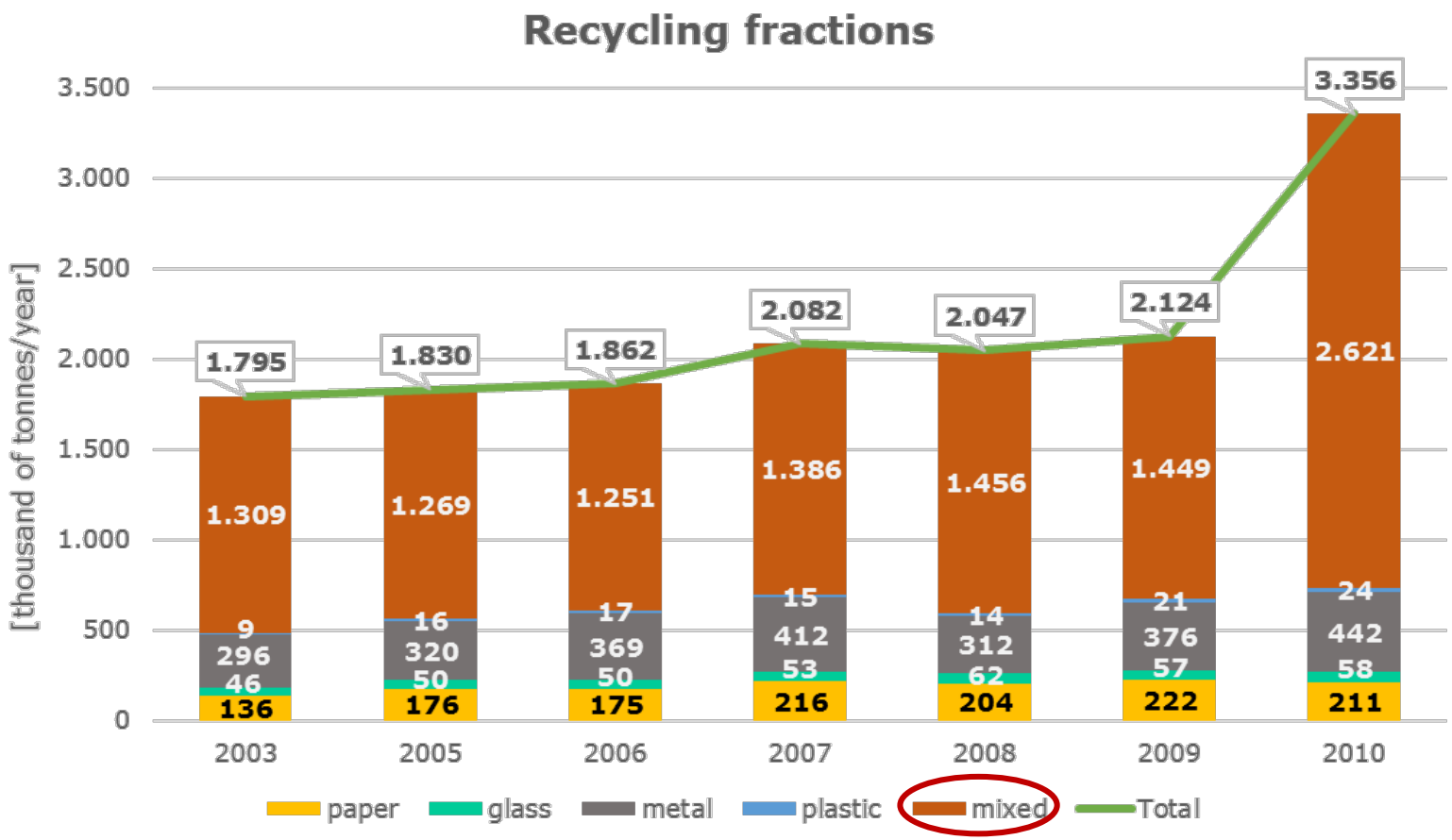
The waste generation rate incresed 42 % in 2010 compared to previous year, mainly due to:

1. compost;

2. recycling materials.

Data ref. ZWSA, 2011a. South Australia's Waste Strategy 2011 – 2015

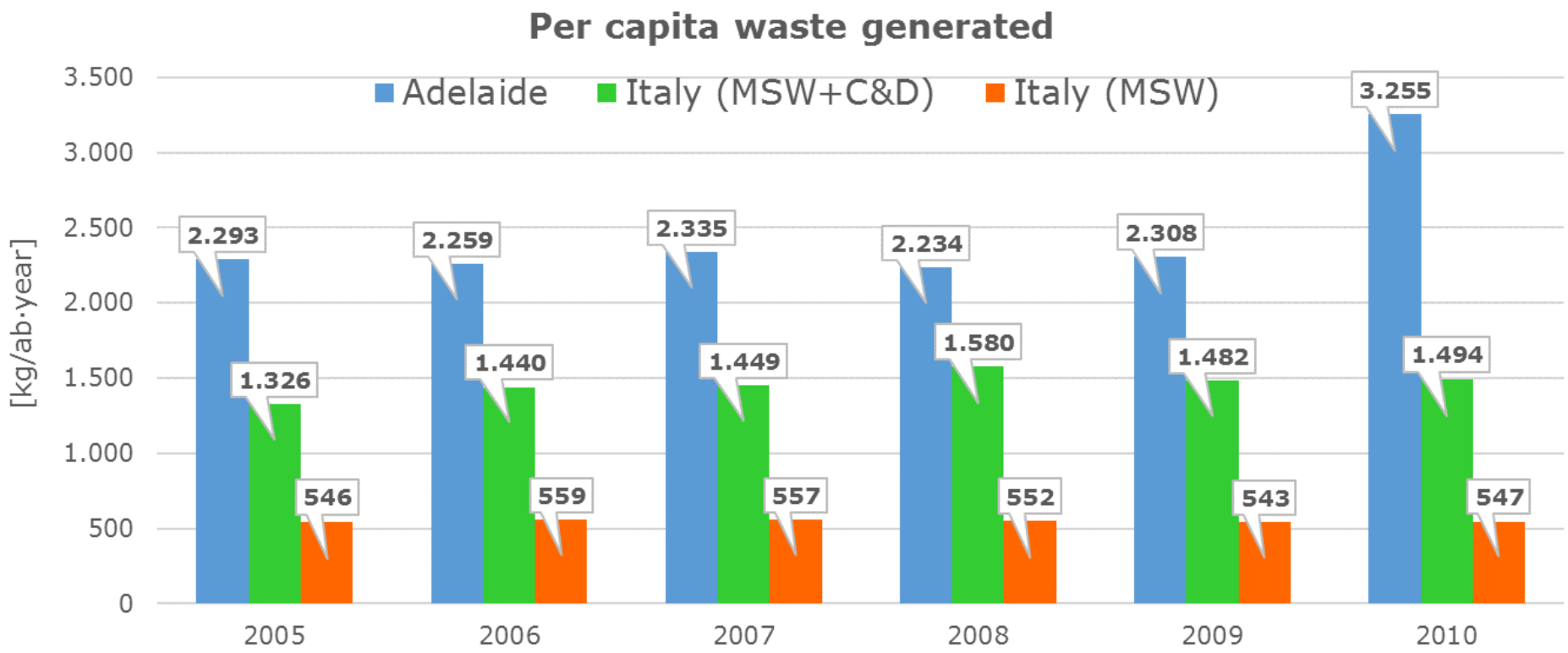
Adelaide – Australia



Among «mixed» entry of recycling fractions, a considerable quantity is composed of C&D waste and, as a massive infrastructure development project has started in Adelaide in 2010, it can be considered the main reason of waste genearation increase.

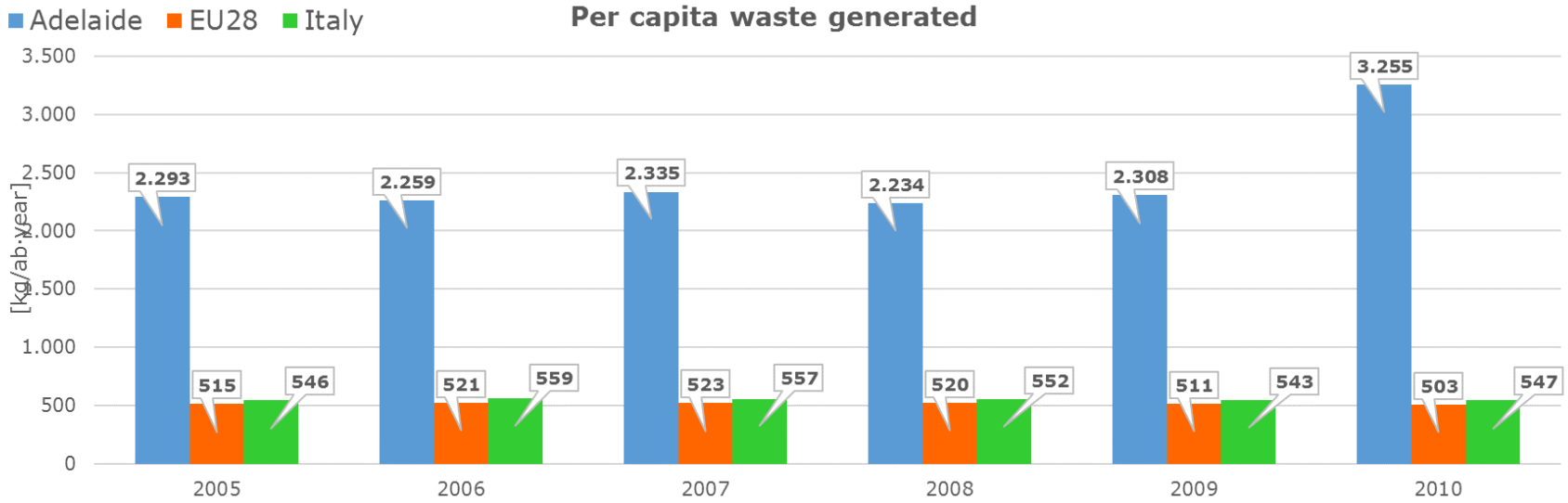
Adelaide – Australia

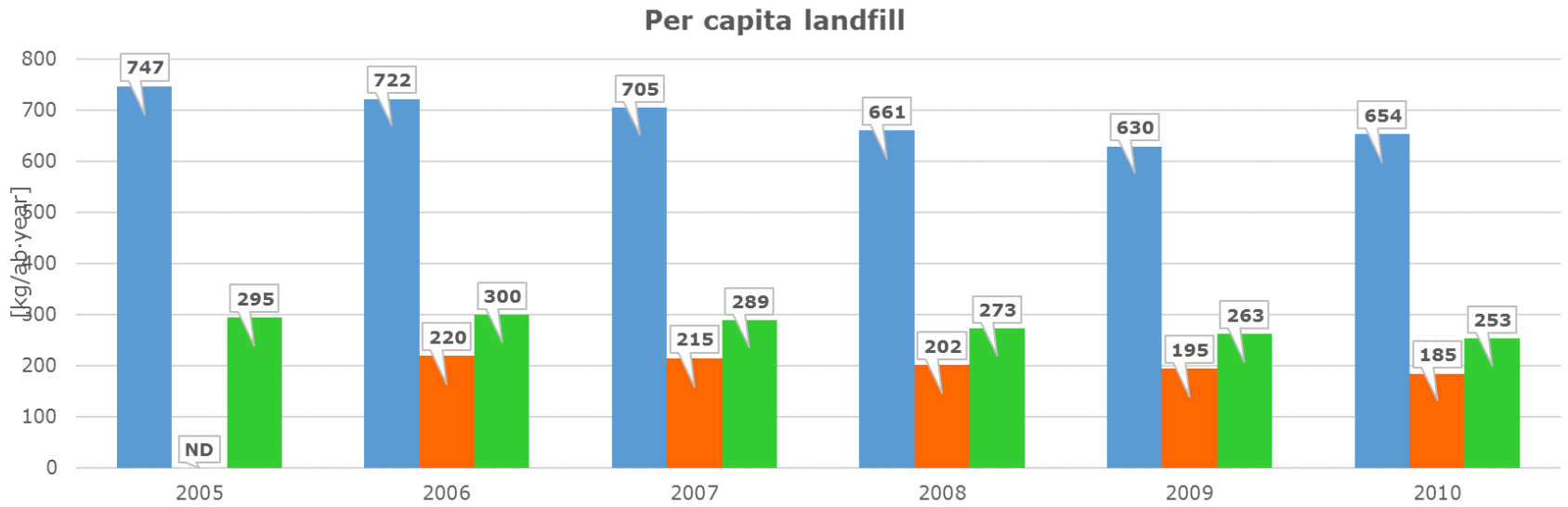
Data ref. ZWSA, 2011a. South Australia's Waste Strategy 2011 – 2015
Eurostat Database 2004 - 2010



Adelaide – Australia

Data ref. ZWSA, 2011a. South Australia's Waste Strategy 2011 – 2015
Eurostat Database 2004 - 2010





Zero Waste Cases – Adelaide

As reported in RAWTEC, "Analysis of Resource Recovery Activities Servicing Metropolitan Adelaide“, 2011:

“Of particular note is the emergence of waste-to-energy technologies for situations when materials recovery is no longer commercially viable, which enables extraction of value from waste material with a significant reduction in volume to landfill.”

- **Some «Zero Waste» institutions (such as Sero Waste SA, a South Australian state government organization that has the task to define a waste strategy with the aim to reduce landfill disposal) are aware of the need of WtE treatment in order to reach “zero waste” goal.**

Mixed low-value C&D waste is processed in a Material Recovery Facilities (MRF) to produce a substitute fuel for alternative energy; part of recovered material (plastics, glass, C&D, dry C&I) is processed in Recovered Recyclable Waste Processor (RR WP) into a usable fuel source.

- **Energy recovery from waste is disguised as material recover.**

Conclusions

1

Zero Waste goes beyond developement of waste management strategies and best practices. As it is also outlined in the definition of ZWIA, "*Zero Waste is a goal that is ethical, economical, efficient and visionary*".

Therefore, talking of Zero Waste mainly concerns with a sort of **«ideology»**, rather than with proposals of practices.

2

Waste is believed to be a failure, according to Zero Waste movements. This thought doesn't consider the **necessity of waste as a sink of even closed loops**. Effectively, waste is at least needed in order to concentrate and eliminate pollutants that otherwise would remain in the systems.

3

Comparison of situations is rather weak, due to **data inconsistency**. The main identified problem is the definition of Municipal Solid Waste, which is not unique and universal.

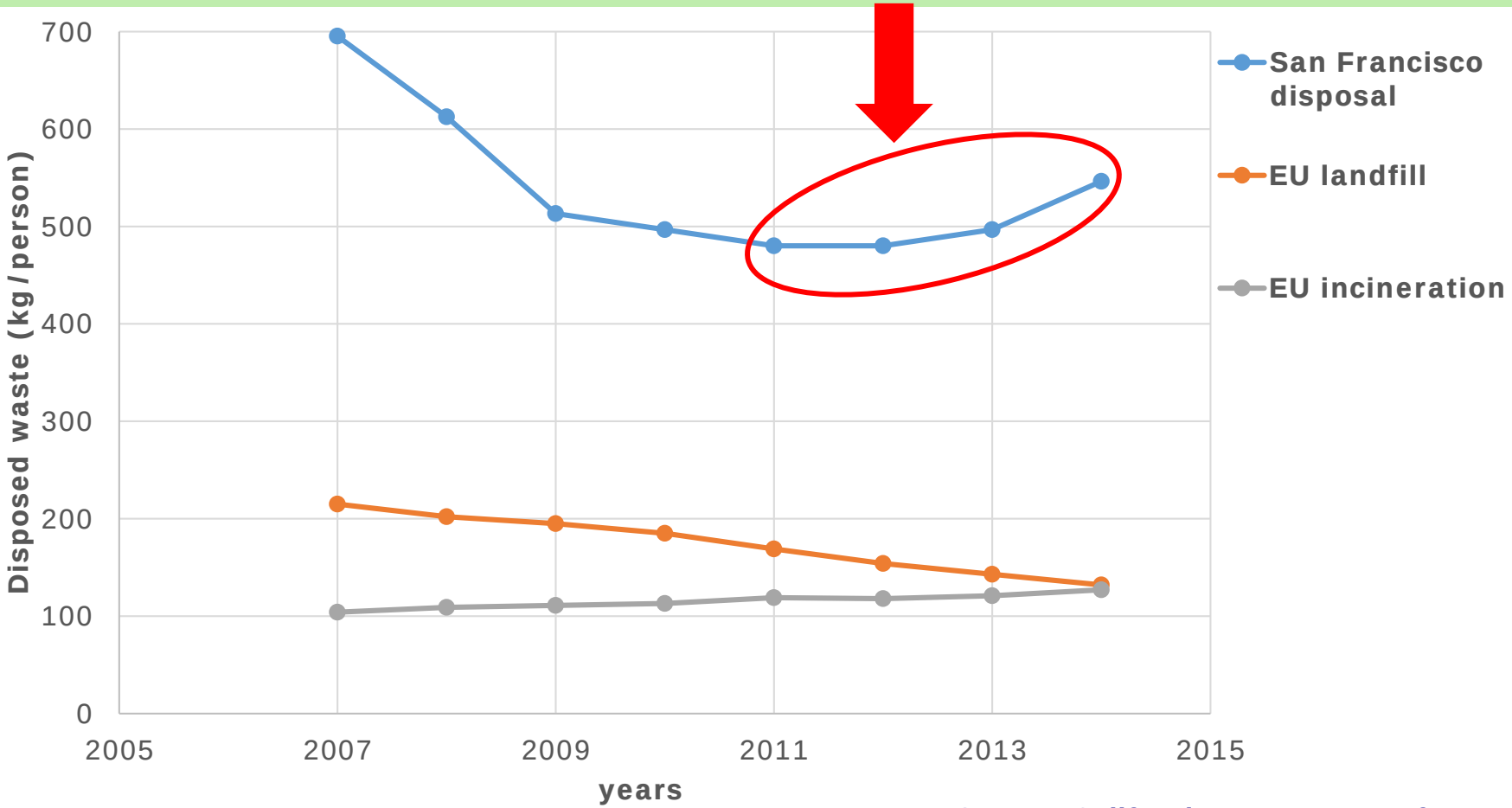
4

Furter developement should include **theorical/technical demostrations of non-feasibility** of «Zero Waste» industrial processes and **critical assessment** of ZW principles and values.

Backup slides

The disposal trend

Disposal trend in San Francisco stopped its decrease in 2012 and began to increase in the last years.



Source: California Department of Resources Recycling ad Recovery (CalRecycle); Eurostat 2016

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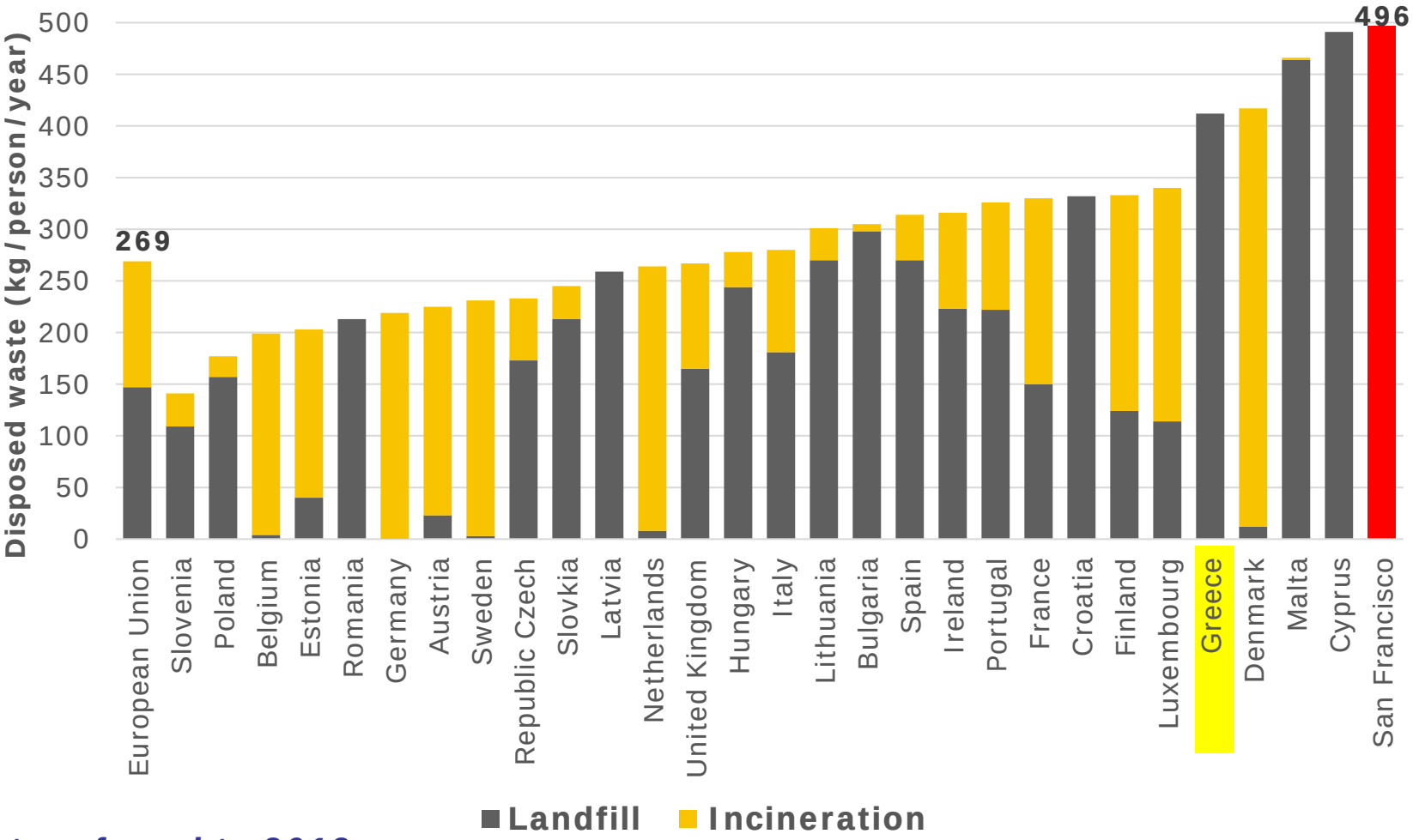
San Francisco disposes much more than in the EU



Data referred to 2013

Source: Ispra, 2015; CalRecycle