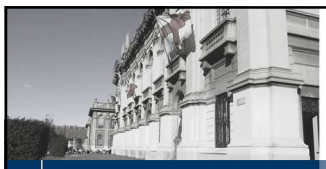

POLITECNICO DI MILANO

A REVIEW OF MUNICIPAL WASTE MANAGEMENT IN ITALY, AND INSIGHTS FROM RECENT RESEARCH

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and the "AWARE" research group

Department of Civil and Environmental Engineering
Environmental section

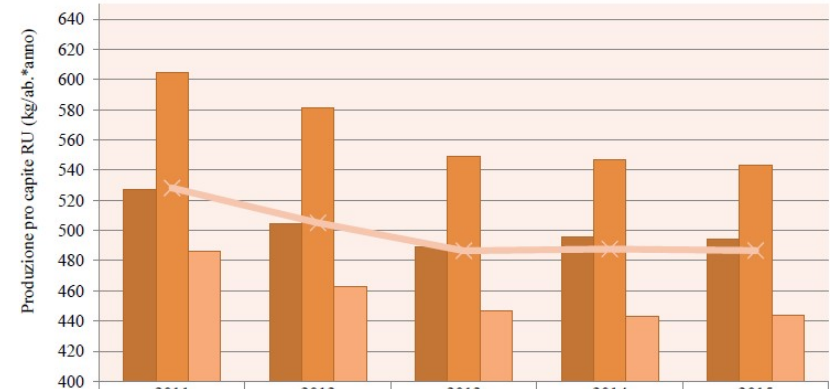
AGENDA

Recent trends on municipal waste management in Italy, with a focus on:

- Waste prevention
- Energy recovery
- Food waste recovery

MUNICIPAL WASTE GENERATION IN ITALY

Historical trend of municipal waste generation (kg/inhabitant*year)

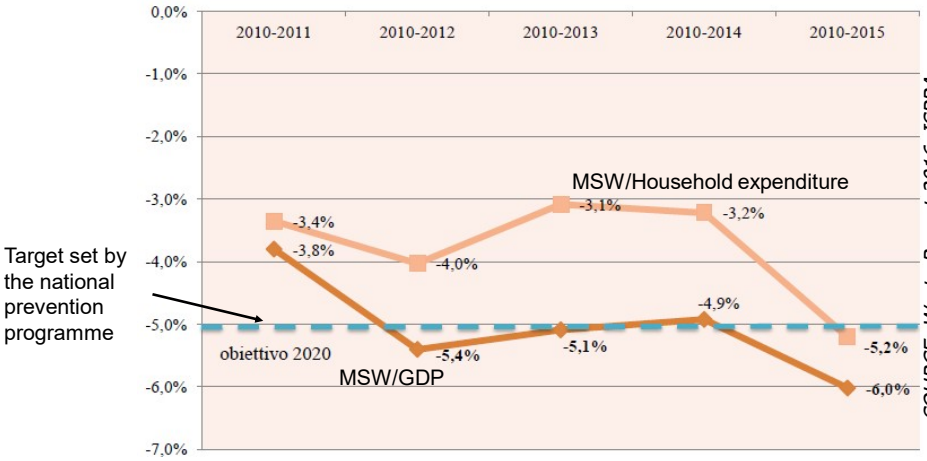


	2011	2012	2013	2014	2015
Nord	527	505	489	495	494
Centro	605	582	549	547	543
Sud	486	463	447	443	444
Italia	528	505	487	488	487

SOURCE: Waste Report 2015, ISPRA

MUNICIPAL WASTE GENERATION IN ITALY

1. Following the peaks of the late 2000's, MSW generation has decreased and stabilised at about 490 kg/in./y
2. First signs of decoupling from economic indicators are observed



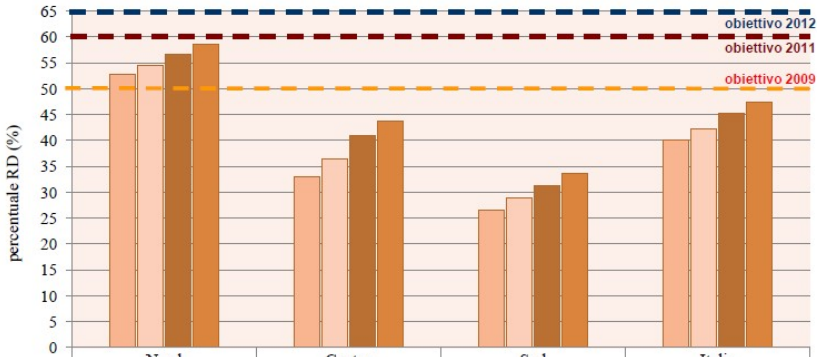
SOURCE: Waste Report 2016, ISPRA

MUNICIPAL WASTE MANAGEMENT IN ITALY

1. Separate collection (source separation of waste):
   - Paper
   - Organic waste (green and food waste)
   - Plastics
   - Glass and metals
   - Residual waste
2. Treatment of the different fractions:
   - Sorting and recycling of packaging materials
   - Treatment of organic waste (composting or anaerobic digestion)
   - Treatment of the residual waste

SOURCE SEPARATION OF MUNICIPAL WASTE IN ITALY

1. National target for Source Separation (65% @2012) far from being reached, but stable linear progression
2. A wide gap still exists between Northern and Southern regions

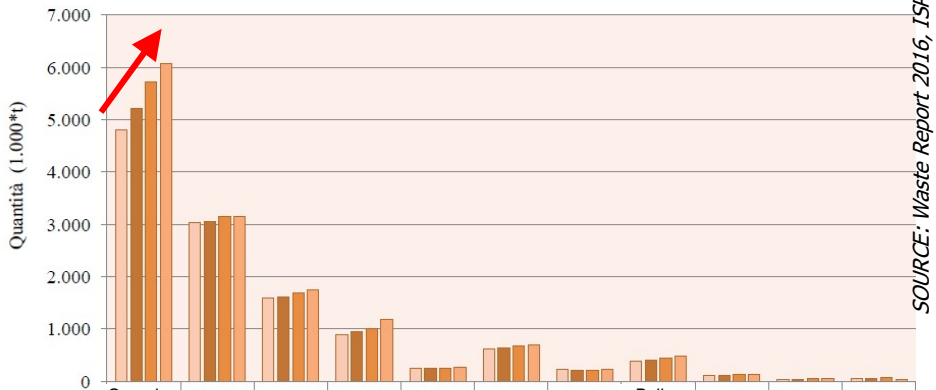


	Nord	Centro	Sud	Italia
2012	52,7	33,1	26,5	40,0
2013	54,4	36,4	28,8	42,3
2014	56,7	40,8	31,3	45,2
2015	58,6	43,8	33,6	47,5

SOURCE: Waste Report 2016, ISPRA

SOURCE SEPARATION OF MUNICIPAL WASTE IN ITALY

Organic fraction (mainly food waste) is driving the SS increase

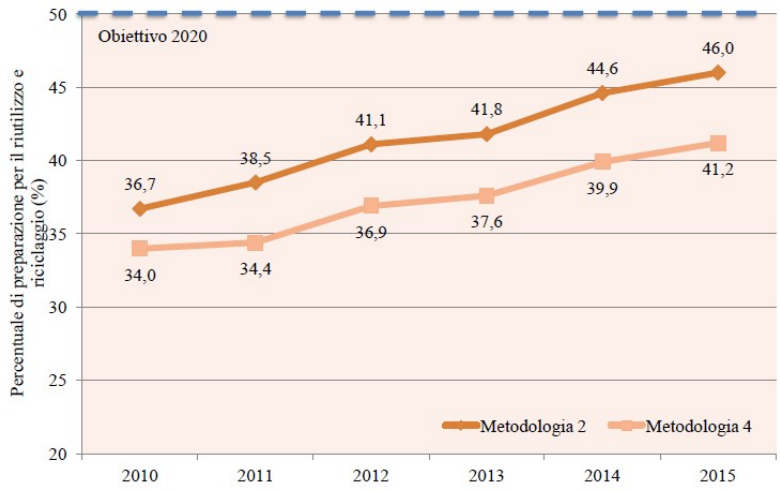


	Organic fraction	Paper	Glass	Plastic	Metals	Wood	WEEE	Bulky waste	Textile	Selective	Other
2012	4.813,4	3.037,6	1.598,1	889,8	248,9	614,1	219,7	377,3	101,1	38,6	53,7
2013	5.216,9	3.051,4	1.608,1	945,2	241,0	635,2	209,2	398,5	110,9	39,9	52,2
2014	5.720,0	3.153,9	1.691,3	1.012,5	249,6	676,0	213,7	447,3	124,4	40,6	72,2
2015	6.071,5	3.149,9	1.747,8	1.178,0	261,1	695,3	222,9	484,3	129,0	42,4	38,6

SOURCE: Waste Report 2016, ISPRA

SOURCE SEPARATION OF MUNICIPAL WASTE IN ITALY

Italy as a whole is on the right track towards the EU targets on preparation for re-use and recycling set for 2020



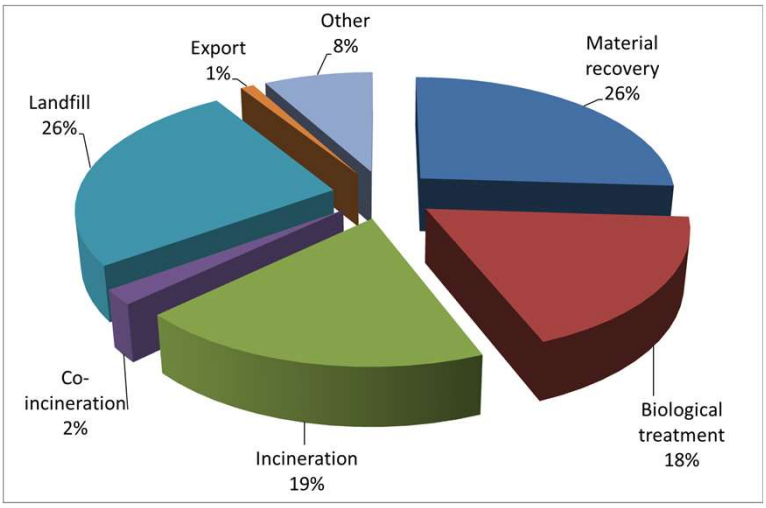
SOURCE: Waste Report 2016, ISPRA

TREATMENT OPTIONS FOR THE RESIDUAL WASTE

- Incineration with energy recovery
  - → Electric energy production
  - → Combined heat and power (CHP)
- Mechanical-Biological pre-treatment (MBT) for:
  - → Treatment prior to landfilling
  - → Solid recovered fuel (SRF) production for subsequent energy recovery:
    - SRF co-incineration in industrial plants (mainly cement kilns)
    - SRF incineration in dedicated plants
- Landfill (even if banned by D.Lgs. n. 36/2003)

MUNICIPAL WASTE MANAGEMENT IN ITALY (YEAR 2015)

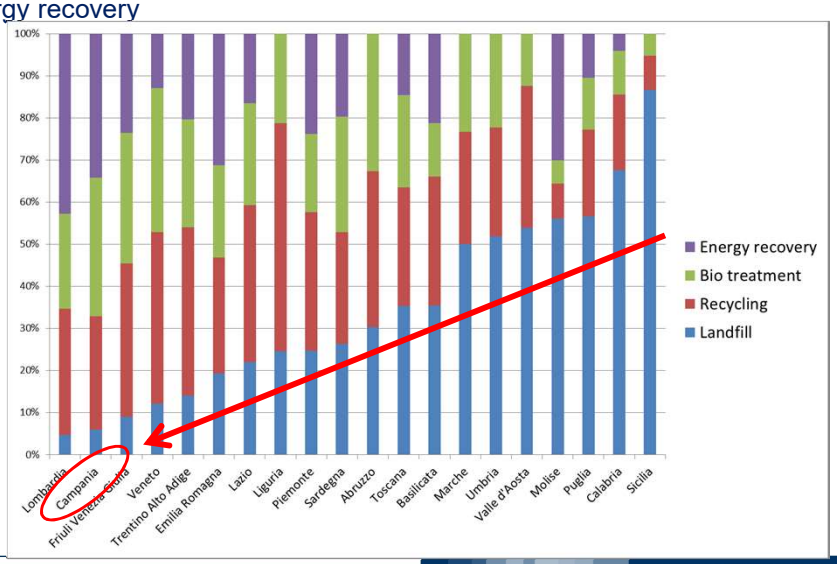
- ✓ Decrease of landfilling, but 1.1 Mt still disposed without any pretreatment
- ✓ MBT as an intermediate treatment accounts for 10.5 Mt



SOURCE: Waste Report 2016, ISPRA

MUNICIPAL WASTE MANAGEMENT IN ITALY (YEAR 2015)

The regional breakdown confirms the complementary role of recycling and energy recovery

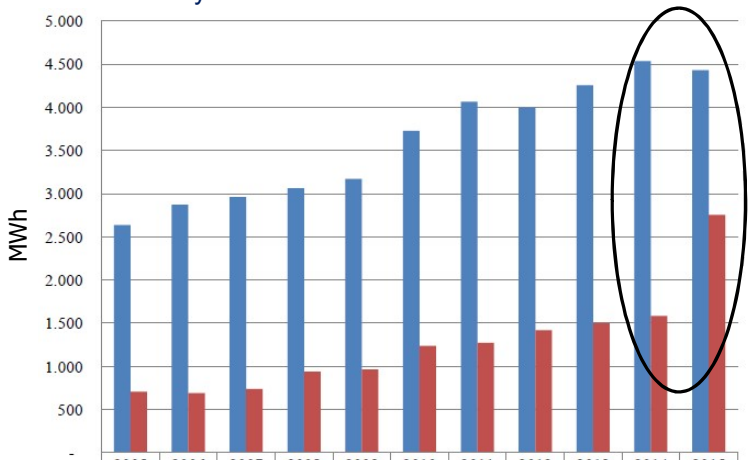


SOURCE: Waste Report 2016, ISPRA

MUNICIPAL WASTE MANAGEMENT IN ITALY

Electric and thermal energy from WTE plants

A clear shift from electricity to heat is observed



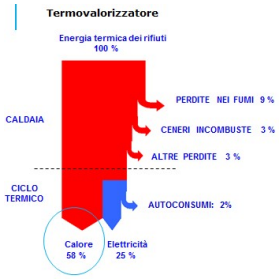
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Electric energy	2.637	2.873	2.959	3.064	3.172	3.727	4.063	3.996	4.255	4.535	4.430
Thermal energy	706	689	739	937	965	1.235	1.270	1.418	1.503	1.585	2.754

SOURCE: Waste Report 2016, ISPRA

MUNICIPAL WASTE MANAGEMENT IN ITALY

Source: A2A Ambiente

MUNICIPAL WASTE MANAGEMENT IN ITALY



	2008	2009	2010	2011	2012	2013	2014	final
Recovered heat (GWh)	76	88	108	145	206	218	198	> 400

In the near future more than 1/3 of the heat **distributed in Milan and surrounding municipalities** will be produced by the Silla 2 WTE plant

Source: A2A Ambiente

MUNICIPAL WASTE MANAGEMENT IN ITALY

Two new WTE plants operating on CHP mode

TURIN

421,000 t/y

50 MWel.

PARMA

130,000 t/y

18 MWel.

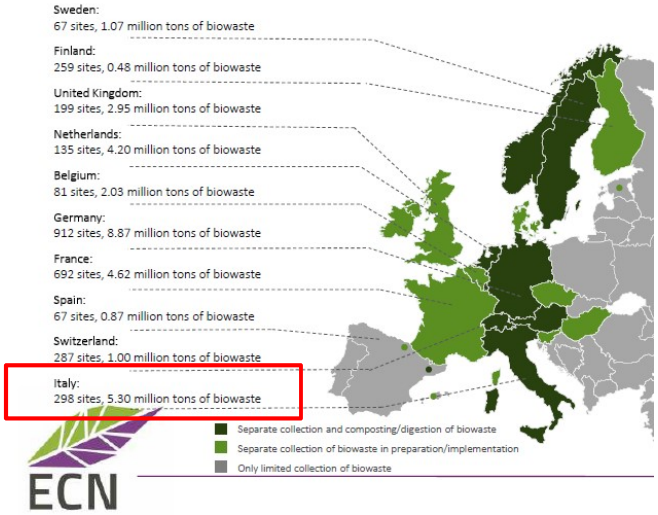
MUNICIPAL WASTE MANAGEMENT IN ITALY

HOT SPOTS IN THE DEBATE

1. According to a recent Decree (August 2016) 1,800,000 t/y of additional WTE capacity is needed → 8 new plants mainly in the Center and South of Italy
2. The Campania waste crisis was solved thanks to WTE and increased source separation. Still large shipment of recyclables and organic fraction takes place due to the lack of treatments plants
3. Emergency has moved to Rome, because of the closure of the Malagrotta monster landfill and of the inadequacy of existing MBT plants → huge shipment to Northern Italy and Austria
4. Steady and strong opposition to new WTE facilities (currently only the Florence plant is in the pipeline)
5. Some overcapacity issues are observed in Northern Italy (Lombardia), leading to the discussion of possible shut-down of old WTE plants

FOCUS ON FOOD WASTE MANAGEMENT IN ITALY

✓ Italy among the EU countries with highest yield of food waste separated collection



SOURCE: European Compost Network

FOCUS ON FOOD WASTE MANAGEMENT IN ITALY

A clear trend is already observed towards <u>anaerobic digestion</u> vs. composting, due to:

- ✓ Economic incentives
- ✓ Better economic and energy balances
- ✓ Easier control of odour emissions
- ✓ Possibility to upgrade existing composting plants, by increasing their capacity

FOCUS ON FOOD WASTE MANAGEMENT IN ITALY

As of year 2015,

✓ 1.9 Mt of food waste treated in 261 composting plants

✓ 1.6 Mt of food waste treated in 47 pure AD or combined AD + post-composting plants

AD to catch up and overtake composting very shortly

Fewer large scale AD plants compared to smaller and more scattered composting ones

→ Montello AD plant, aut. capacity 350,000 t/y

→ Este AD plant, aut. capacity 450,000 t/y

A wide range of AD technologies is applied

FOCUS ON FOOD WASTE MANAGEMENT IN ITALY

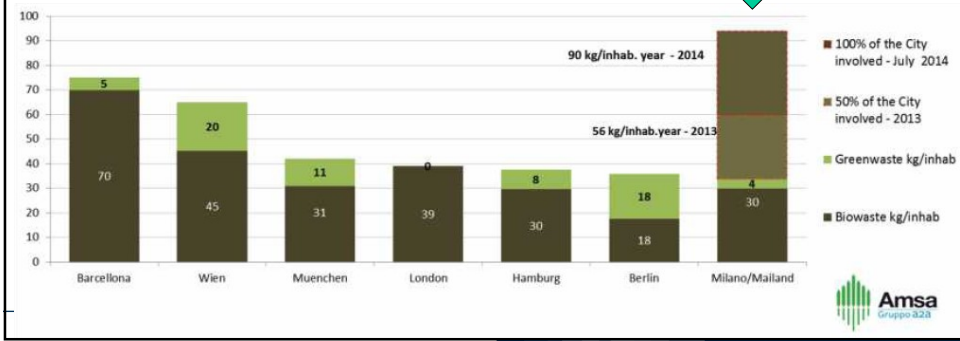
The city of Milan (1.3 millions inhabitants), a success story…

Food waste collection started from scratch on early 2013

All the city is covered since July 2014

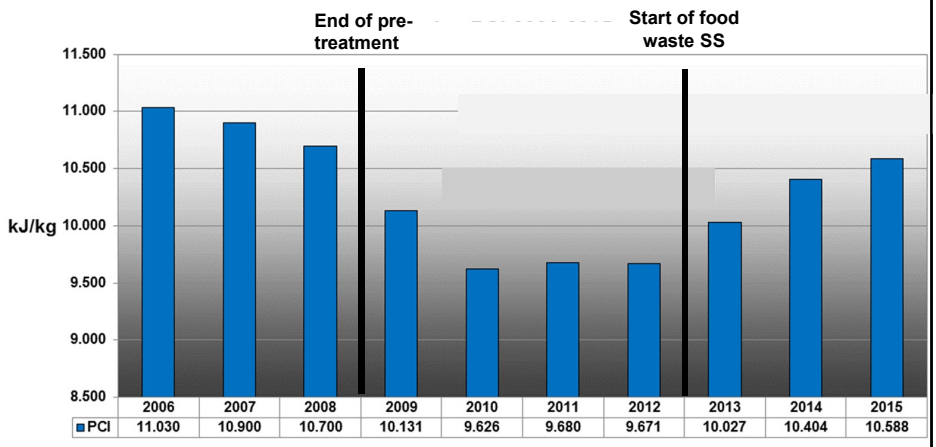
Results achieved so far are encouraging:

- High yield (up to 90 kg/inh./y)
- Low impurities (< 5% in weight)
- Positive attitude by the citizens



FOCUS ON FOOD WASTE MANAGEMENT IN ITALY

Trend of LHV of the residual waste fed to the Milano WTE, as a consequence of food waste SS



Source: A2A Ambiente

FOCUS ON FOOD WASTE MANAGEMENT IN ITALY

A predictable trend towards <u>biomethane production</u> is expected, because of:

- ✓ Public subsidies shifting from electric energy to biomethane
- ✓ Widespread use of methane in Italy because of historical reasons → biomethane to become "the Italian biofuel"
- ✓ A potential maximum annual production of 450 Gm^3 of biomethane is estimated, allowing to fuel 80% of the waste collection vehicles (estimates by the Italian Composting Consortium)
- ✓ Main challenge: to find possible uses of the removed CO_2, so to <u>achieve negative GHG emissions</u>!

THE "AWARE" RESEARCH GROUP AT DICA – POLITECNICO DI MILANO

Assessment on **WA**ste and **RE**sources

1 associate professor: M. Grosso

1 senior researcher (and lecturer): L. Rigamonti

3 post-doc researchers: L. Biganzoli, S. Nessi, S. Pantini

4 research collaborators: G. Dolci, C. Tua, F. Villa, G. Borghi

AWARE

Assessment on WAste and REsources

www.aware.polimi.it

RESEARCH ACTIVITY ON WASTE AT DICA

Activities are carried out at the Department and at the LEAP laboratory (Piacenza), within the MatER Research Centre (www.mater.polimi.it), founded in 2011

A strict connection with colleagues from Energy Engineering is established

mater
materia & energia da rifiuti
materials & energy from refuse