Roma, 17 maggio 2016

IEA Workshop *"Towards a sustainable waste Management"*

MBT plants in Italy and their role in a sustainable waste management

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Data & analysis: sources

Data Source (2010-2014)

MUNICIPAL WASTE REPORT

ISPRA

The Italian National Institute for Environmental Protection and Research

Provides data concerning municipal waste generation, separate collection and management at national, regional and provincial level as well as data on import/export of municipal waste

Analysis (2010-2014)

The RSE research project 2015-2017 *BIOENERGY* *

RSE SpA - Ricerca sul Sistema Energetico, Milan

** PROJECT Financed by the* **Research Fund for the Italian Electrical System (RDS)** *under the Contract Agreement between RSE SpA and the Ministry of Economic Development - General Directorate for Energy and Mining*

Other Data source & Analysis (2014)

The AGCM "INVESTIGATION ON THE MARKET OF MUNICIPAL WASTE" (2016)

AGCM

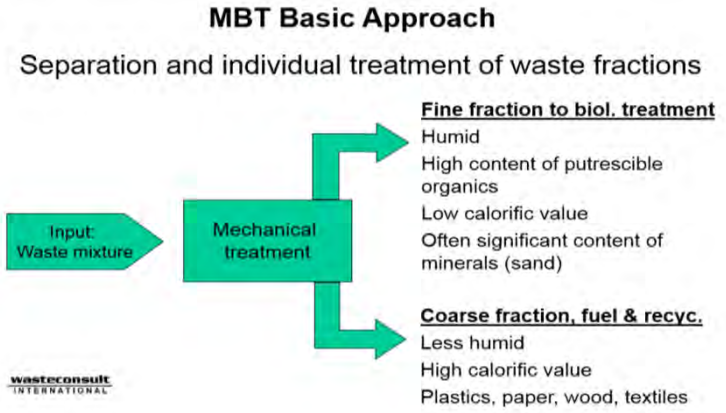
The Italian Competition Authority

MBT in the MSW management

MBT as

INTERMEDIATE STAGE

of waste management



before **landfilling (disposal: final stage of the waste cycle)**

improve the biological stability of waste, reduce moisture and volume to comply requirements of the law in charge (waste landfilling)

before **incineration (Disposal/E recovery: final stage of the waste cycle)**

increase the calorific value of the refusal input making it a more efficient fuel (SRF; other outgoing fractions)

to obtain a futher **material recovery** from waste **(M recycling: final stage of the waste cycle)**

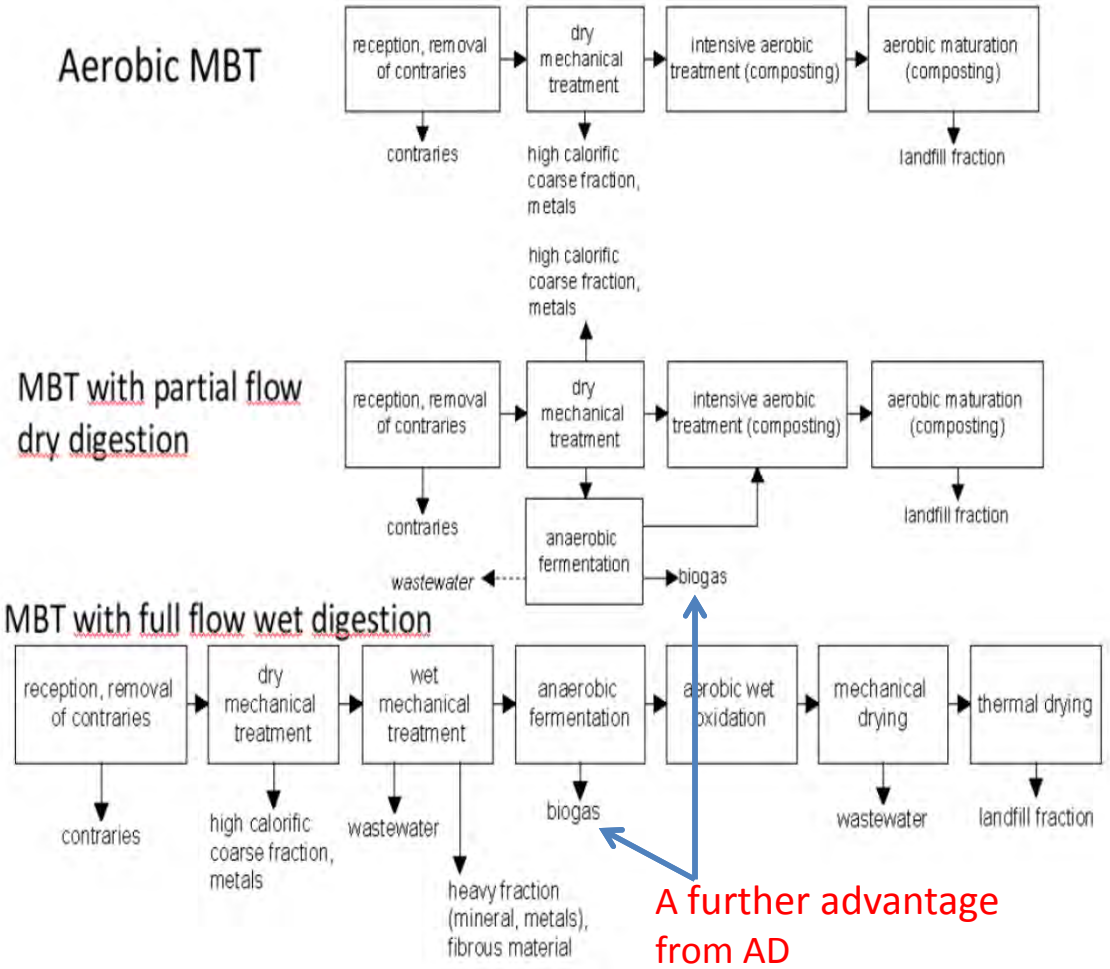
MBT plant may be configured and can incorporate a number of different processes (technologies) in a variety of combinations

depending on the specific purpose for which it was made

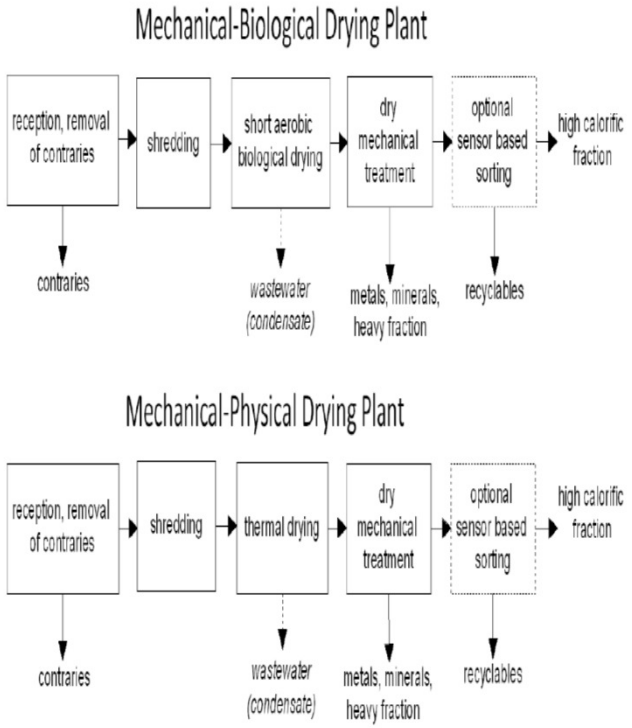
(i.e material recycling, energy recovery, biodegradable municipal waste diversion performance.

MBT : configuration and technologies

Simplified flow chart of conventional MBT processes



Simplified flow chart of biological and physical drying MBT processes



MBT : configuration and technologies

Technique	Principle
Hammer Mill	Material significantly reduced in size by swinging steel hammers.
Shredder	Rotating knives or hooks rotate at a slow speed with high torque. The shearing action tears or cuts most materials.
Rotating Drum	Material is lifted up the sides of a rotating drum and then dropped back into the centre. Uses gravity to tumble, mix, and homogenize the wastes. Dense, abrasive items such as glass or metal will help break down the softer materials, resulting in considerable size reduction of paper and other biodegradable materials.
Ball Mill	Rotating drum using heavy balls to break up or pulverise the waste.
Wet Rotating Drum with Knives	Waste is wetted, forming heavy lumps which break against the knives when tumbled in the drum.
Bag Splitter	A relatively gentle shredder used to split plastic bags whilst leaving the majority of the waste intact.

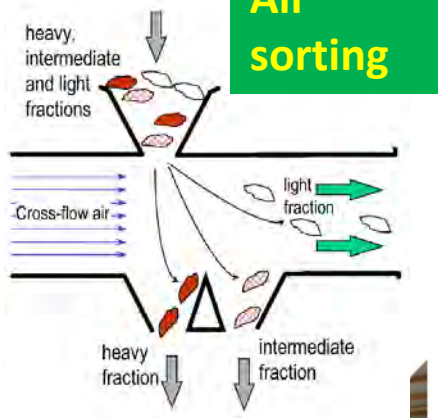
Waste Preparation Techniques

MBT : configuration and technologies

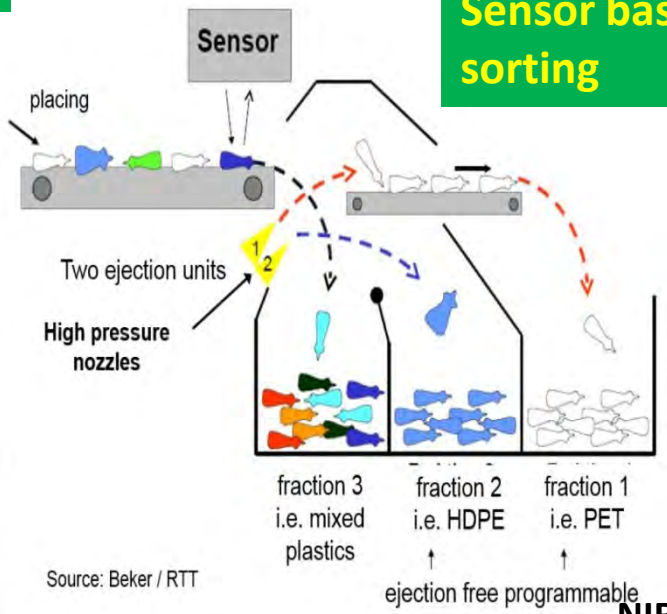
Waste Separation Techniques

Separation Technique	Separation Property	Materials targeted
Trommels and Screens	Size	Oversize – paper, plastic Small – organics, glass, fines
Manual Separation	Visual examination	Plastics, contaminants, oversize
Magnetic Separation	Magnetic Properties	Ferrous metals
Eddy Current Separation	Electrical Conductivity	Non-ferrous metals
Wet Separation Technology	Differential Densities	Plastics, organics will float Stones, glass will sink
Air Classification	Weight	Light – plastics, paper Heavy – stones, glass
Ballistic Separation	Density and Elasticity	Light – plastics, paper Heavy – stones, glass
Optical Separation	Diffraction	Specific plastic polymers

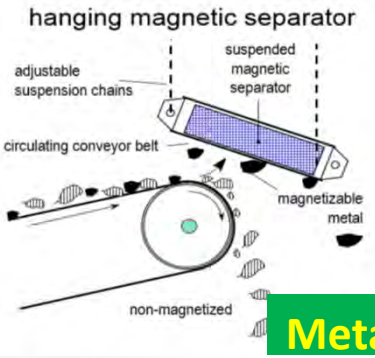
Air sorting

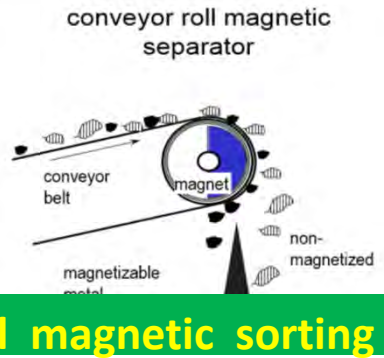


Sensor base sorting



NIR-Technology Near-InfraRed spectroscopy



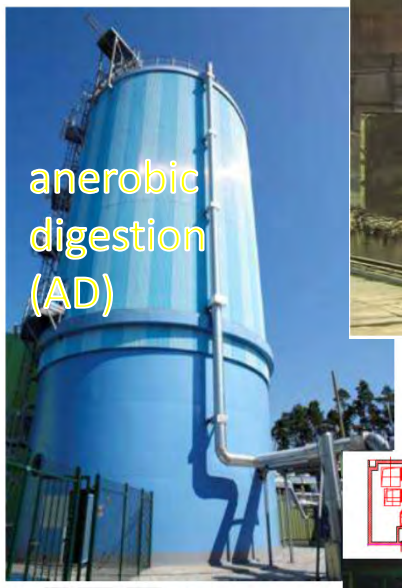


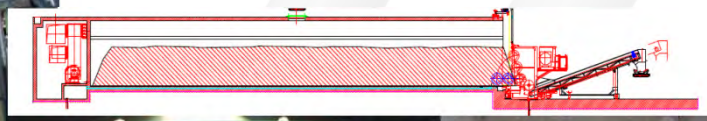
Metal magnetic sorting

MBT : configuration and technologies

Biological Techniques

Aerobic treatments - Anaerobic digestion (AD)





MBT vs Market

the "market " of MSW (as detailed later)

demand **(as detailed later)** is from operators of the MSW collection service: they give the mixed waste to MBT plants upon payment of a gate fee (AGCM: IT 115 €/ton but regional differences (range: 28,4-210 €/ton)

an internal «no-free market» (the proximity and self-sufficiency criteria; gate fee: regional regulation impact +MBT as "capital intensive" activity)

the industrial and energy market
(electrical and thermal energy production)

demand is for fuel (RES) derived from waste (output of MBT: dry fraction and, mainly, SRF ESW 191210 and/or product SRF-EoW) from

internal market	existing	DF, SRF 191210	combustion plants, cement kilns, power plants, INC
	potential	product SRF EoW	cement kilns, power plants
external market	existing	DF, SRF 191210	cement kilns, other WtE plants

Regione	Corrispettivi medi euro/ton	N. impianti	Quantità autorizzata (ton)	Quantità rifiuti trattati (ton)	tasso di utilizzo medio (%)
Friuli Venezia Giulia		3	258.600	123.856	47,9%
Veneto	133	7	644.200	397.447	61,7%
Trentino A.A.		0			
Lombardia	97,3	7	829.000	553.999	66,8%
Piemonte	142, 6	11	764.614	475.365	62,2%
Valle d'Aosta		0			
Liguria	210	2	96.000	164.296	171,1%
Emilia Romagna	118,7	9	1.066.000	526.917	49,4%
NORD	**139,7**	**39**	**3.658.414,00**	**2.241.880,00**	**61,3%**
Toscana [1]		16	1.504.622	966.125	64,2%
Marche	108,9	3	244.100	159.928	65,5%
Umbria	112,1	4	559.000	229.931	41,1%
Lazio	87,6	9	1.849.373	1.636.616	88,5%
CENTRO	**102,9**	**32**	**4.157.095,00**	**2.992.600,00**	**72,0%**
Abruzzo		7	668.736	400.102	59,8%
Puglia	88,1	14	1.613.064	1.409.020	87,4%
Calabria	123,4	6	390.000	343.718	88,1%
Molise		3	132.400	93.216	70,4%
Campania		7	2.500.585	1.309.310	52,4%
Basilicata		1	49.920	17.367	34,8%
Sicilia [2]	28,4	3	ND	349.774	
Sardegna	142	7	310.509	206.592	66,5%
SUD	**95,5**	**46**	**5.665.214,00**	**4.129.099,00**	**72,9%**
Italia	**115 (112,3 escludendo Liguria e Sicilia)**	**119**	**13.480.723**	**9.363.579**	**69,5% (62,9% escl. Liguria)**

Source

AGCM 2016
INVESTIGATION ON THE MARKET OF MUNICIPAL WASTE

MSW MANAGEMENT : energy recovery 2014

	2010	2011	2012	2013	2014
	ton/y (Source: AITEC)				
SRF *	**180.361**	**181.732**	**172.001**	**180.267**	**190.481**
Plastics	10.919	21.557	39.591	63.197	40.572
ELT	47.019	42.652	32.855	19.985	50.818
Sewage sludge	10.976	13.211	15.615	8.044	13.667
Oils	32.468	29.480	10.814	6.945	626
Non-chlorinated solvents	15.399	11.000	6.342	3.272	136
Other Liquid wastes	4.082	3.000	10.000	13.369	...
Animal flour and fat	11.317	12.545	18.109	6.378	835
Total waste treated	**312.541**	**315.177**	**305.327**	**301.457**	**297.135**

Pre-treated unsorted MSW *

(SRF: EWC 191210)

sent to

Cement kilns

	2010	2011	2012	2013	2014
	ton/y (Source: ENEL)				
SRF	nd	56.106	58.398	62.617	nd

Pre-treated unsorted MSW

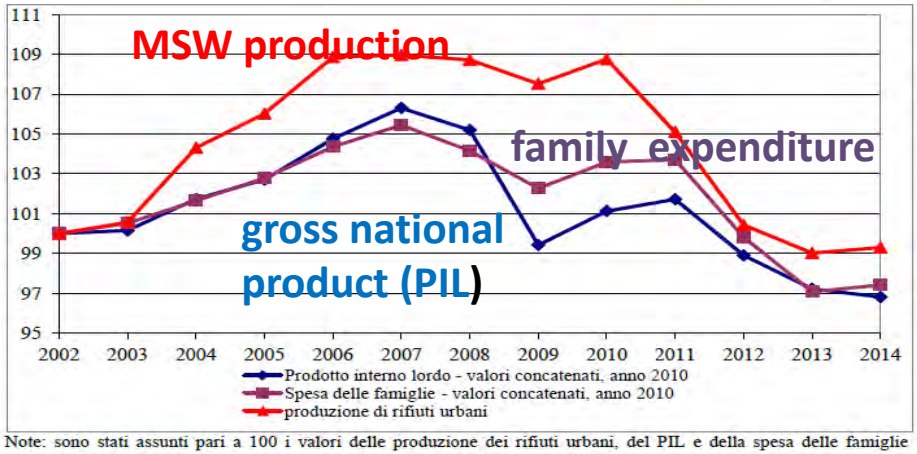
SRF: EWC 191210 sent to

Power plants

MSW : a quick overview of production and overall management

MSW total production ton/y

	2010	2011	2012	2013	2014
Piemonte	2.251.370	2.159.922	2.027.359	2.003.584	2.050.631
Valle d'Aosta	79.910	78.418	76.595	72.591	72.431
Lombardia	4.957.884	4.824.172	4.625.032	4.594.687	4.642.315
Trentino A.A	508.787	521.503	505.325	495.427	495.425
Veneto	2.408.598	2.305.401	2.213.653	2.212.653	2.240.454
Friuli V.G.	610.287	575.467	550.749	546.119	553.433
Liguria	991.453	961.690	918.744	889.894	899.438
Emilia R.	2.999.959	2.918.957	2.763.260	2.780.295	2.829.543
Toscana	2.513.312	2.372.799	2.252.697	2.234.082	2.253.908
Umbria	540.958	507.006	488.092	469.773	476.375
Marche	838.196	822.237	801.053	764.139	796.142
Lazio	3.430.631	3.315.942	3.201.691	3.160.325	3.082.372
Abruzzo	681.021	661.820	626.435	600.016	593.080
Molise	132.153	132.754	126.592	124.075	121.123
Campania	2.786.097	2.639.586	2.556.249	2.545.445	2.560.486
Puglia	2.149.870	2.095.402	1.980.385	1.928.081	1.909.748
Basilicata	221.372	220.241	214.236	207.477	201.130
Calabria	941.825	898.196	864.945	832.908	809.974
Sicilia	2.610.304	2.579.754	2.422.831	2.391.124	2.342.219
Sardegna	825.126	794.953	746.174	741.972	725.024
Total	32.479.112	31.386.220	29.962.096	29.594.665	29.655.250



Note: sono stati assunti pari a 100 i valori delle produzione dei rifiuti urbani, del PIL e della spesa delle famiglie dell'anno 2002.
Fonte: ISPRA; dati degli indicatori socio economici: ISTAT

Separate collection (RD) of the MSW

2014: Total = ton 13.406.451 = %RD 45,2

RD increase over time but :

still << national target 2012 = 65%

wide variability between regions

MSW : a quick overview of production and overall management

	2010	2011	2012	2013	2014
Piemonte	1.1				937.746
Valle d'Aosta	47.				41.364
Lombardia	2.5				2.026.980
Trentino A.A	214				163.500
Veneto	994				725.718
Friuli V.G.	309				219.355
Liguria	737				588.522
Emilia R.	1.5				1.267.762
Toscana	1.5				1.256.058
Umbria	368				243.234
Marche	509				337.785
Lazio	2.8				2.073.770
Abruzzo	489				319.546
Molise	115				94.137
Campania	1.8				1.342.175
Puglia	1.8				1.416.007
Basilicata	191				145.683
Calabria	824				659.432
Sicilia	2.3				2.049.247
Sardegna	454				340.778
total	21.020.304	19.556.261	17.997.273	17.075.253	16.248.800

2014 :

Total Unsorted MSW produced

16.248.800 ton

of which :

Urban unsorted residual (after RD)

ton

15.855.677

bulky urban waste for disposal

ton 393.122

MSW Management routes

- **MBT**
- **Landfilling**
- **Material recovery**
- **Incineration**
- **Composting An. Digestion**
- **Energy Rec.**
- **Export**

MBT system : all facilities in operation

Plant Total Number

	2010	2011	2012	2013	2014
Piemonte	12	12		11	11
Lombardia	9	8		7	8
Liguria	2	2		2	2
Veneto	8	7		7	7
Trentino A.A	0	0		0	0
Friuli V.G.	3	3		3	3
Emilia R.	12	11		9	7
Toscana	13	15		16	16
Umbria	5	4		4	4
Marche	3	3		3	4
Lazio					8
Abruzzo					7
Molise					3
Campania					7
Puglia	15	15		14	13
Basilicata	4	2		1	1
Calabria	7	7		6	7
Sicilia	1	1		1	2
Sardegna	7	7		7	7
Italy	**130**	**123**		**117**	**117**

mainly in **Southern and Central Italy**

Treatment Capacity (CA), ton/y

	2010	2011	2012	2013	2014
Piemonte	753.250	876.250		764.614	764.614
Lombardia	999.000	803.000		719.000	829.000
Liguria	96.000	129.000		96.000	96.000
Veneto	723.800	607.200		644.200	644.200
Trentino A.A					
Friuli V.G.	246.600	246.600		258.600	258.600
Emilia R.	1.473.000	1.416.000		1.191.000	1.066.000
Toscana	1.371.750	1.491.750		1.459.622	1.504.622
Umbria	664.000	559.000		559.000	559.000
Marche					244.100
Lazio					1.849.373
Abruzzo					668.736
Molise					132.400
Campania					2.500.585
Puglia	1.552.644	1.552.644		1.709.564	1.613.064
Basilicata	84.000	22.000		49.920	49.920
Calabria	458.650	483.000		390.000	390.000
Sicilia	60.000	60.000		60.000	na
Sardegna	364.109	365.509		365.509	310.509
Italy	**14.202.114**	**13.991.379**		**13.753.023**	**13.480.723**

mainly in **Southern and Central Italy**

MBT system : facilities in operation with SRF production

Plant Total Number

	2010	2011	2012	2013	Author. 2014	SRF Prod. 2014
Piemonte	6	6		6	6	5
Lombardia	7	7		6	7	4
Liguria	1	1		1	1	1
Veneto						4
Trentino						0
Friuli V.G						2
Emilia R						2
Toscana						5
Umbria	0	0		0	0	0
Marche	1	1		1	1	0
Lazio	8	9	na	9	8	8
Abruzzo	1	1		1	1	1
Molise	1	1		1	1	1
Campania	0	0		0	1	(0)
Puglia	2	2		3	3	2
Basilicata	0	0		0	0	0
Calabria	6	5		5	6	5
Sicilia	1	1		0	1	1
Sardegna	1	1		0	0	0
Italy	52	52		52	55	42

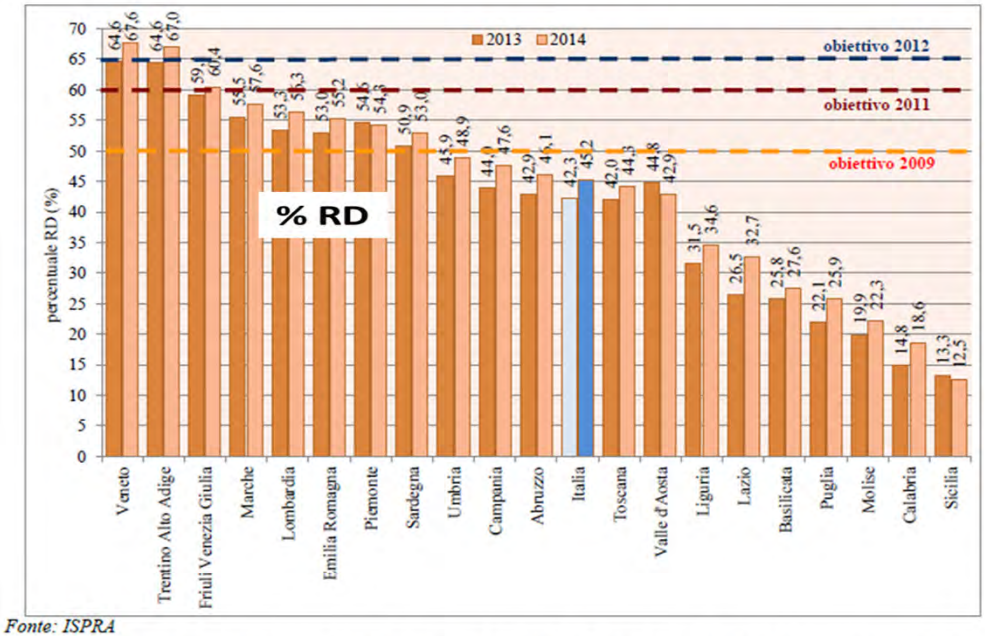
mainly in **Northern and Central Italy**

Treatment Capacity (CA), ton/y

	2010	2011	2012	2013	2014
Piemonte	262.500	505.500		419.000	419.000
Lombardia	523.000	523.000		379.000	414.000
Liguria					96.000
Veneto					546.200
Trentino A.A					
Friuli V.G.					165.000
Emilia R.					238.000
Toscana					553.672
Umbria					
Marche					
Lazio	1.494.000	1.896.000		1.969.373	1.849.373
Abruzzo	270.000	270.000		270.000	270.000
Molise	36.500	36.500		36.500	36.500
Campania					116.100
Puglia	385.739	574.444		337.289	337.289
Basilicata					
Calabria	324.650	349.000		229.000	229.000
Sicilia					nd
Sardegna					
Italy	5.235.789	6.067.044		5.181.034	5.270.134

mainly in **Northern and Central Italy**

MBT system: mainly in Southern and Central Italy - Why?



Fonte: ISPRA

A separate collection of MSW (RD) still low =
more unsorted waste to manage

A «market» not free (proximity and self-sufficiency criteria)

Shortcomings of WtE plants to close otherwise the cycle of the unsorted MSW

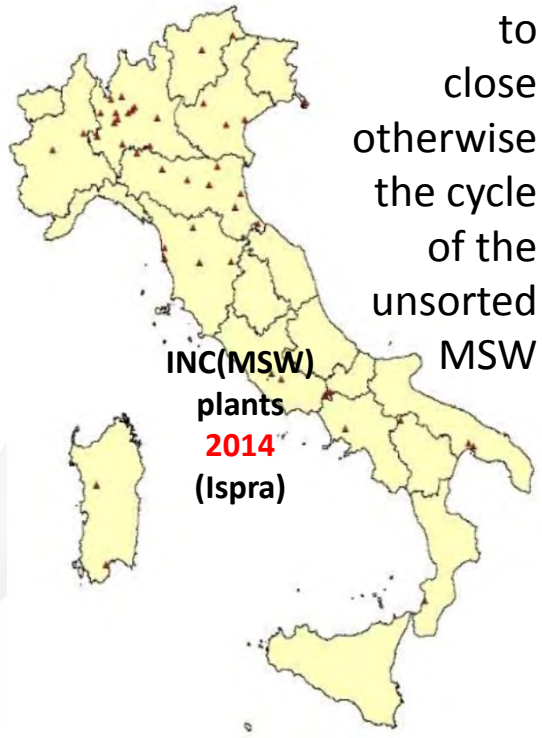
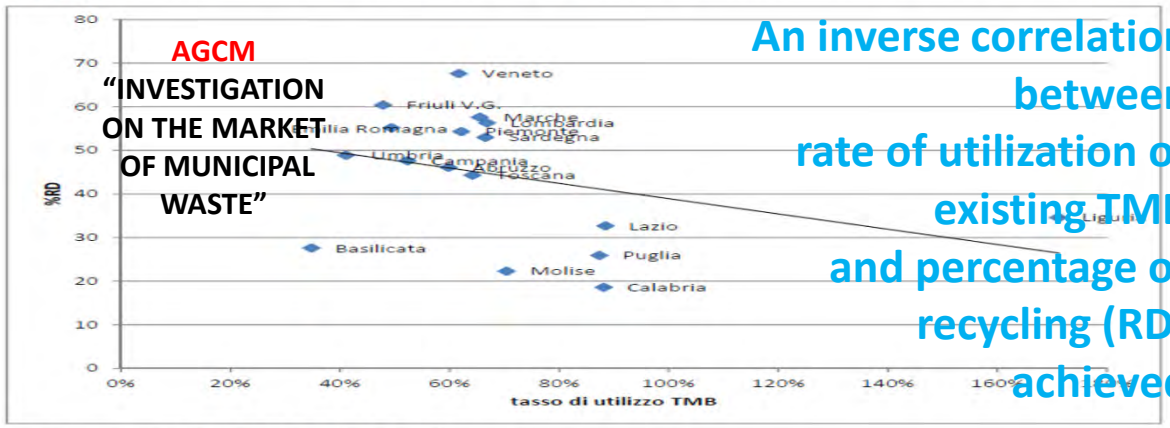


GRAFICO 7. RELAZIONE TRA PERCENTUALI DI RACCOLTA DIFFERENZIATA E TASSO DI UTILIZZO DEI TMB



AGCM "INVESTIGATION ON THE MARKET OF MUNICIPAL WASTE"

An inverse correlation between rate of utilization of existing TMB and percentage of recycling (RD) achieved

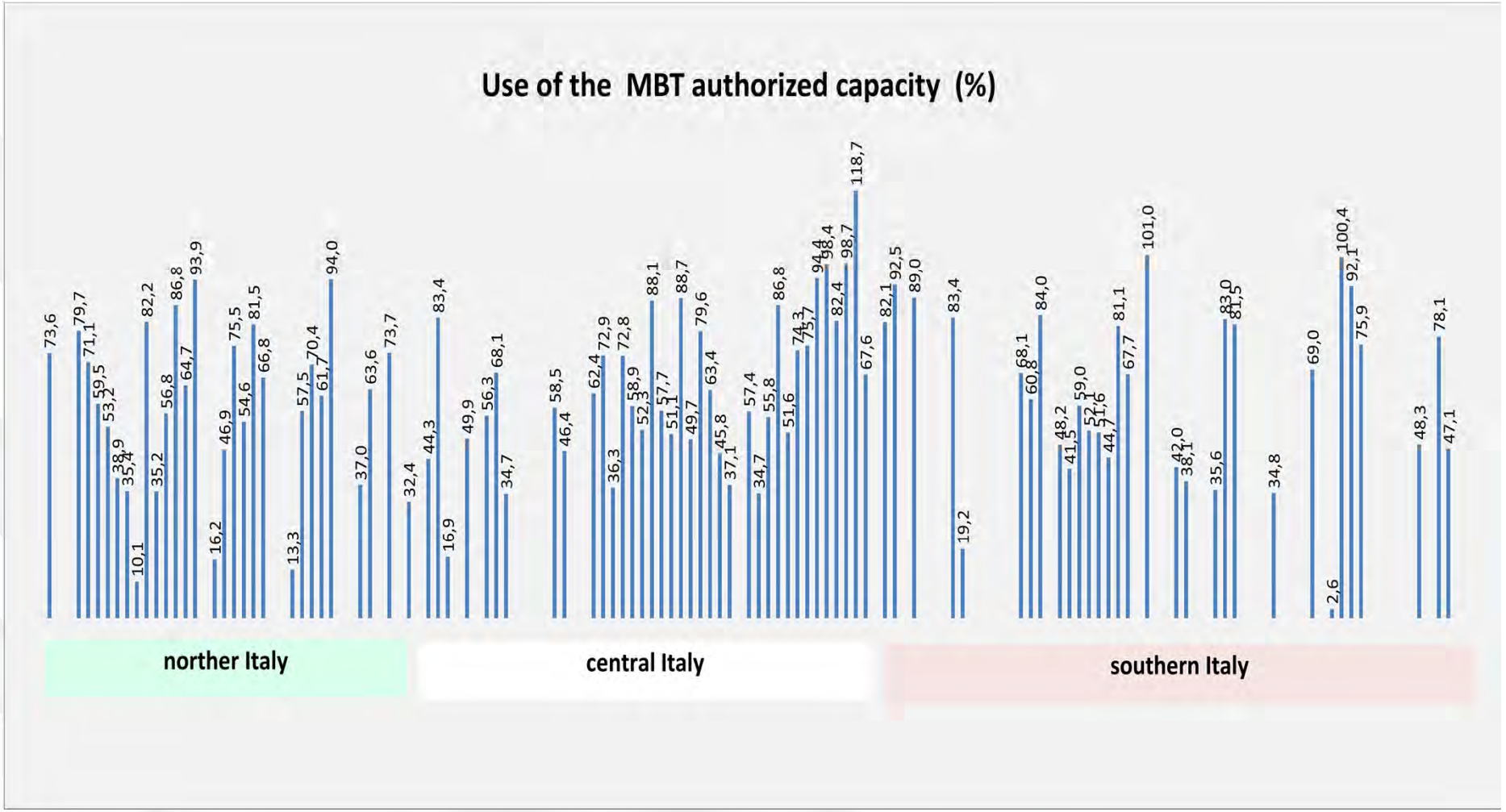
Fonte: elaborazioni AGCM su dati ISPRA (2015).

MBT system 2014 : total INPUT – use of MBT

	TOTAL INPUT, ton	Uns.MSW, ton	Uns.MSW treated as % of produced	Use of MBT (as % of the total regional CA)
Piemonte	475.367	475.358	50,7	62,2
Lombardia	553.998	547.232	29,8	66,8
Liguria	164.296	164.296	28,6	171,1
Veneto	397.447	394.387	55,6	61,7
Trentino A.A				
Friuli V.G.	123.856	107.132	50,6	47,9
Emilia R.	526.917	505.351	41,6	49,4
Toscana	966.125	965.674	79,4	64,2
Umbria	229.931	227.079	96,2	41,1
Marche	159.928	159.928	48,6	65,5
Lazio	1.636.616	1.636.467	79,3	88,5
Abruzzo	400.102	400.102	125,3	59,8
Molise	93.215	92.004	98,5	70,4
Campania	1.309.310	1.309.310	98,0	52,4
Puglia	1.409.020	1.409.020	99,9	87,4
Basilicata	17.367	17.367	11,9	34,8
Calabria	343.718	343.718	52,5	88,1
Sicilia	349.774	349.739	17,1	na
Sardegna	206.592	202.947	61,3	66,5
Italy	9.363.579			69,5

Even if at a plant level.....

MBT system 2014 : use of MBT at a plant level



MBT system 2014 : total OUTPUT

Output, ton

Italy 8.264.204

of which (ton) :

SRF	❑ 1.498.235
Dry fraction	❑ 3.887.766
Biostabilised fraction	❑ 877.135
Biodried fraction	❑ 176.843
Wet fraction	❑ 425.066
Non-composted organic fraction	❑ 959.124
Residue&Swaste	❑ 245.390
Wood	❑ 8.894
Paper	❑ 2.999
Glass	❑ 0
Plastic	❑ 6.929
Metals	❑ 75.377

of which sent to final destination (ton, total) :

Incineration	❑ 2.088.322
Energy Rec.	❑ 558.503
SRF Prod/Ref	❑ 296.234
Biostabilization	❑ 370.289
Landfilling	❑ 4.611.076
Material Recovery	❑ 158.123
Storage	❑ 90.398

MBT 2014 : SRF (EWC 191210)

Total SRF (ton)

Italy 1.498.235

Regional Average SFR Yield (%) *

	2010	2011	2012	2013	2014
Piemonte	43,1	35,0		46,6	**44,4**
Lombardia	26,5	16,7		26,7	**23,4**
Liguria	35,2	39,8		7,2	**7,2**
Veneto	32,1	31,3		25,1	**25,9**
Friuli V.G.	14,1	14,0		30,1	**34,2**
Emilia					**21,3**
Toscar					**16,2**
Lazio					**27,3**
Abruz					**39,8**
Molis					**31,9**
Puglia	57,3	45,0		65,5	**65,9**
Calabria	32,6	20,4		26,9	**27,1**
Sicilia					**79,5**
Sardegna					
Italy	**32,5**	**27,2**		**30,8**	**30,1**

Only a **coarse assessment** : Total SFR plant output *vs* Total Plant INPUT

of which sent to final destination (ton) :

- **Incineration** ❑ **706.201**
- **Energy Rec.** ❑ **442.123**
- **SRF Prod/Ref** ❑ **66.310**
- **Biostabilization** ❑ **0**
- **Landfilling** ❑ **225.224**
- **Material Rec.** ❑ **11.938**
- **Storage** ❑ **46.439**

MSW MANAGEMENT : incineration 2014

Pre-treated (unsorted) MSW sent to INC(MSW) plants → **EWC 191210 (SRF)**

	Total 191210	191210 from MSW
Piemonte	5.977	*5.977*
Lombardia	436.391	*275.442*
Trentino A.A.	0	*0*
Veneto	310	*27*
Friuli V.G.	0	*0*
Emilia R.	76.656	*72.875*
Toscana	8.847	*8.847*
Umbria	0	*0*
Marche	0	*1*
Lazio	362.443	*362.443*
Molise	92.494	*63.036*
Campania	0	*0*
Puglia	76.811	*76.811*
Basilicata	0	*0*
Calabria	72.850	*46.932*
Sicilia	0	*0*
Sardegna	51	*51*
total	**1.132.831**	***912.441***

MBT 2014 : Dry fraction

Total DF (ton)

Italy	3.887.766

of which sent to final destination (ton) :

Incineration	❑ 1.273.187
Energy Rec.	❑ 108.533
SRF Prod/Ref	❑ 226.916
Biostabilization	❑ 0
Landfilling	❑ 2.205.547
Material Recovery	❑ 29.642
Storage	❑ 43.941

MSW MANAGEMENT : incineration 2014

Pre-treated (unsorted) MSW sent to INC(MSW) plants → **EWC 191212**

ton	Total 191212	191212 from MSW
Piemonte	49.184	*48.934*
Lombardia	545.599	*358.463*
Trentino A.A.	17.823	*348*
Veneto	60.659	*41.357*
Friuli V.G.	39.593	*30.385*
Emilia R.	385.350	*309.443*
Toscana	147.395	*147.221*
Umbria	0	*0*
Marche	0	*0*
Lazio	0	*0*
Molise	0	*0*
Campania	692.267	*687.480*
Puglia	0	*0*
Basilicata	29.886	*23.310*
Calabria	0	*0*
Sicilia	0	*0*
Sardegna	45.076	*43.797*
ITALIA	**2.012.832**	***1.690.736***

MTB current & future sustainability: some items

MARKET - Waste management : what if

Separate collection of MSW: a future, general, growth of the %RD towards and over 65% ?
More restritive choises for landfilling : towards a low /zero waste landfilling ?
Policy : choises, rules and «degree of freedom» (priority, local regulation), …… ?
The so-called «unlocks Italy» decree : towards a saturation of thermal load of WtE-INC(MSW) overcoming constraints of proximity and self-sufficiency in MSW management ? **……**

MARKET - Industrial sector: what if

Demand change (i.e: SRF, materials, energy): industrial trends; number of plants authorized to use of MBT-fuels; supporting mechanism for RES from waste; « product « quality; …..**……**

MBT system items

Plant perfomances : aging; capability (process & tecnologies) to increase yield production and quality of derived fuels (SRF) and/or the material recovery, to minimize waste/residues of the process to landifilling); to minimize environmental impacts of processes;
Economical aspects : investment costs; time cost for authorization; O&M costs; gate fee (TMB) and gate fee (INC) too and how they are regulated (free/not free market) **……**

Society items

Social acceptability : ie: if MBT including a «waste derived fuel» production