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URBAN WASTE TO ENERGY (WTE) PLANTS: A SOCIAL ANALYSIS

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Abstract

Wastes are resources and their prevention and recycling are sustainable pillars of any municipal solid waste (MSW) management scheme. However, in order to reduce their deposit into landfills, other treatment methods are needed. The technological development of waste to energy (WTE) plants goes into this direction, but a stakeholders' behavioural change is mandatory.

This paper proposes a social analysis, based on direct interviews, for the identification of the most critical elements determining the aversion towards a WTE plant construction in two Italian regions

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(Lombardia and Lazio). One thousand replies were collected and a great interest on these issues was evidenced. What emerged is that the Italian situation is critical and urgent action is required. This social framework provides quantitative and qualitative assessment that could support local and national policy makers' strategic actions.

1. Introduction

Municipal solid wastes (MSWs), together with Waste from electric and electronic equipments (WEEEs), are two of the most serious urban sources of pollution and their management has been identified as one of the global challenges that must be carefully evaluated in order to achieve sustainability goals. From one side, their recycling allows the reduction in the use of virgin resources for manufacturing, with relevant environmental advantages. From another side, these End-of-Life (EoL) strategies can generate interesting economic opportunities for all the involved actors. Furthermore, several directives were activated during the years concerning the EoL management of wastes [1-7].

Prevention and recycling measures are potentially able to reduce landfilled wastes (also according to Directive 2008/98/EC), but other technologies-like WTE facilities-are mandatory in order to reach significant goals in waste management [8]. In fact, WTE plants are very common in thickly populated cities [9], and grow in their relevance if coupled with renewable energy technologies [10, 11].

In EU-28, the MSW management is inhomogeneous. Even if there was an overall decrease in generated volumes during the last years (from 488 kg per capita in 2012 to 481 kg per capita in 2013), municipal wastes are treated in different ways: 28% are recycled, 15% are composted (Eurostat shows it as biological treatment), 26% are incinerated and 31% are landfilled (Table 1). In addition, treatment methods differ substantially among member states. In fact, Germany, The Netherlands, Sweden, Belgium, Austria and Denmark have a share of landfilled waste below 4%, while it is greater than 50% in other fourteen countries [12].

Table 1. Municipal waste treatment in 2013 in the EU 28 - Source [12]

	Generated (kg/inhabitant)	Treated (kg/inhabitant)	Recycled %	Composted %	Incinerated %	Landfilled %
EU28	481	470	28	15	26	31
Germany	617	617	47	17	35	0
The Netherlands	526	526	24	26	49	1
Sweden	458	458	33	16	50	1
Belgium	439	439	34	21	44	1
Austria	578	550	24	35	37	4
Denmark	747	747	28	17	54	2
Luxembourg	653	653	28	20	35	17
France	530	530	21	17	34	28
Finland	493	493	19	13	42	25
United Kingdom	482	476	28	16	21	35
Ireland	586	531	34	6	18	42
Italy	491	474	26	15	21	38
Estonia	293	253	14	6	64	16
Slovenia	414	287	55	7	1	38
Portugal	440	440	13	13	24	50
Czech Republic	307	307	21	3	20	56
Spain	449	449	20	10	10	60
Hungary	378	378	21	5		65
Poland	297	249	16	13	8	63
Bulgaria	432	428	25	3	2	70
Slovakia	304	278	4	8	12	77
Lithuania	433	421	21	8	7	64

Cyprus	624	624	12	9	0	79
Greece	506	506	16	4	0	81
Latvia	312	312	11	6	0	83
Croatia	404	396	14	2	0	85
Malta	570	526	6	5	0	88
Romania	272	220	3	0	0	97

The technological development allowed to construct modern WTE facilities with a significantly better environmental impact than those in the past [13] and their activity produce no more health risks for people living nearby [14]. Several typologies of wastes can be treated by these facilities: unsorted waste, dry fraction from mechanical biological treatment, refuse-derived fuels (RDF), and some special wastes (e.g. medical ones). However, in order to develop efficient WTE plants, the presence of adequate infrastructures for the distribution of thermal energy (district heating), facilitating the transition towards a low carbon energy system, are required [5, 15].

However, even with high technological innovation and stakeholders' behavioural change, the effects are null if the education level in waste management topics is very low [16]. This happens in Italy, where the idea that WTE plants are more pollutant than landfills is widely present in the public opinion [17]. A survey demonstrated that local populations are, generally, against these projects, especially when public authorities and companies are seen as not playing in a fair way [18]. Again, the same authors define as the social acceptance for the development of a WTE plant is a topic little analyzed in the literature. Instead, environmental and economic aspects are widely discussed by the literature [15].

In order to solve some Italian needs in terms of waste management, the Government proposed in November 2014 a decree denominated "Unlock Italy", in which it evidenced the need to develop an integrated system of WTE facilities, aiming to restore the balance between landfill areas and waste volumes coming from other regions. A National Waste Management

Plan (NWMP) was also proposed by [19] in order to minimize wastes conferred into landfills through the realization of several WTE plants. The authors defined that a NWMP requires a direct consultation of citizens through questionnaires and seminars in order to give clear indications of the presence or absence of any effects and benefits for all the inhabitants, especially for those living close to WTE facilities. Previous research projects [19, 20] defined the sustainable framework of WTE plants and this paper aims to complete the picture through a social analysis, by investigating the critical elements that determine (or not) the aversion toward WTE plants construction in Italy.

The paper is organised as follows. The role of WTE plants is described in Section 2, where several perspectives are considered (e.g. methodological, political, environmental, technological, economic, supply chain and social ones). The main results coming from a case study on NWMP, both in terms of sustainability analysis and methodology used, are proposed in Section 3. The overall results are presented and discussed in Section 4. Some concluding remarks are presented in Section 5.

2. Literature Review

An overview of the current state of the art highlighted that the WTE topic can be analysed according to several perspectives:

- Methodological perspective. Recycling and energy recovery are two complementary waste treatment methods. Materials such as paper, metal, plastics, and glass are currently recycled and recovered. However, even with high levels of recycling, an unsorted fraction of waste will remain. Furthermore, different WTE strategies can be adopted in function of the share of wastes deposited into landfills [20].

- Political perspective. National and local governments can choose several policies and regulations to encourage the expansion of WTE plants. WTE facilities generate clean energy and determine several benefits, such as the improvement of energy security, the reduction of greenhouse gas (GHG) emissions, the creation of job and economic opportunities [21].

- Environmental perspective. WTE plants avoid the creation of methane into landfills. However, the ash produced by boilers is considered a hazardous waste, requiring a proper management. The dedicated management of individual ash fractions seems to do not provide relevant benefits. Weekly and monthly measurements are required for each existing plant. In fact, significant variations between fractions of biogenic CO_2 emitted not only over time, but also between several plants in function of their technology and their operative conditions can be observed [22].

- Technological perspective. Some authors propose a review of technologies and performances of thermal treatment systems for energy recovery from waste [23] and other authors analyse advanced solutions in combustion-based WTE technologies, concerning radiant superheaters, Syncom Plus, low NOX processes and dry discharge [24].

- Economic perspective. The size of a WTE plant has a relevant role. The economic benefits of WTE plants are always positive also for small-size facilities, while the financial benefits are positive only for medium-large ones. Furthermore, the evaluation of some critical variables, such as lower heating value, investment cost, selling price of the electricity, heat selling price and interest rates are needed [25].

- Supply chain perspective. Optimal locations of processing hubs and facilities are determined in order to optimize economic (logistic costs are not value-added) and environmental (smaller distances mean lower emissions) results. Decisions about the size of facilities are based on some assumptions, such as the waste amount to be treated and the current MSW management system [26].

- Social perspective. WTE facilities cause intense debates among social and political groups. During the last decade, Not-In-My-Back-Yard (NIMBY) and Not-In-My-Term-of-Office (NIMTO) behaviours have hindered their realization. Hence, before starting to think about the realization of a WTE plant, a social analysis (through interviews) is required in order to define what are the most critical elements determining the aversion of people living there [19].

A prerequisite for the effectiveness of integrated MSW management is the acceptance by the local community. In fact, there are numerous examples showing that the objections of the public opinion towards these projects have led to major delays or also to their withdrawal [27, 28]. In this case, a quantification of the losses (in terms of time delays and additional costs) is required to guarantee the profitability of investments [29]. The following section describes the case study analysed in this paper.

3. Case Study and Methodology

The WTE topic is multidisciplinary and the literature analysis highlighted as the social dimension often is considered as secondary. WTE plants are an attractive technological option in MSW management. However, they are the subject of intense debates [18, 30]. The sustainable management framework defined within this paper derives from previous analyses related to:

- A NWMP for energy recovery in Italy [20].
- A sustainability analysis of this NWMP [19].

A bottom-up approach was applied, where several scenarios, based on different level of landfill use, have been evaluated. The considered alternatives are: (i) share of wastes conferred no more into landfills, but recovered through WTE plants equal to 75% ($WtoE^{75\%}$), (ii) share of wastes sent to energy recovery equal to 75%, but with a constraint related to a maximum level of WTE size equal to 500 kt/y ($WtoE^{\delta(75\%)}$) and, finally, (iii) share of wastes sent to WTE plants equal to 50% ($WtoE^{50\%}$) and 25% ($WtoE^{25\%}$), respectively. A sustainability analysis for each of these scenarios is proposed in Table 2.

Table 2. Sustainability analysis-source [19, 20]

Indicators	$WtoE^{75\%}$	$WtoE^{\delta(75\%)}$	$WtoE^{50\%}$	$WtoE^{25\%}$
Number of WTE plants	19	22	11	3
Waste valorization amount (kt/y)	11,200	10,550	6200	1750

Reduction of waste conferred into landfill (%)	34%	32%	19%	5.5%
Reduction of GHG (ktCO2eq)	5600	5275	3100	875
Financial Net Present Value (k€)	761,927	389,213	383,778	108,759
Economic Net Present Value (M€)	4449	3987	2439	689
Do nothing cost-Delay of 1 year (M€)	36	19	18	5
New jobs generated	2688	2532	1488	420

The Italian situation requires urgent actions because 38% of MSW was conferred into landfills in 2013 (Table 1). However, it is important to clarify that:

- There are improvements in comparison to 2010, when the percentage of landfill use was equal to 49%.
- A significant contribution was given by the separated collection rate, equal to 40% in 2012 (+4.9% than 2010), but this value is very far from the European target of 65%.
- The NWMP proposed is actual, because it was developed by considering dynamic values of wastes, and quantities of MSW conferred into landfills were equal to 10,914kt in 2013.
- The inputs of WTE plants in 2013 were: unsorted wastes (43%), dry fraction from mechanical biological treatment (31%), RDF (19%) and special wastes (7%)-[31].
- Torino (421kt), Parma (130kt), and Bolzano (130kt) were the three new WTE facilities inaugurated in 2013, while Mergozzo (17kt), Reggio Emilia (21kt), and Bolzano (67kt) were decommissioned-[31].

In order to complete NWMP, a social analysis is proposed within this paper, with the aim to define the social acceptance of WTE plants construction in Italy. Telephone interviews, in-person (face-toface) interviews, mailed questionnaires and web-based questionnaires were the selected procedures [32]. Face-to-face interviews with the use of a simple questionnaire were preferred among the other methods, according to [18].

They were managed by exploiting the knowledge and experience gained by the authors in previous research projects [19, 20]. The questionnaire included all the critical parameters characterizing the choice of a decision-maker towards the acceptance (or not) of a WTE facility. Emphasis was given on the clarity of questions, but maintaining their technical nature. The questionnaire was submitted to people of all ages and levels of education. One thousand valid replies were collected by using the stratified sampling method. Interviews were conducted into two regions: Lombardia and Lazio. The first region manages its wastes with a sustainable approach; both recycling and energy recovery are used to reduce landfilling. Lombardia presents the lowest landfill use rate among all the others Italian regions. The second region manages its waste with a non-sustainable approach. In fact, the landfill is the most adopted solution. Lazio and Sicilia are responsible for a third of the amount of the Italian wastes disposed of into landfills. The number of interviews was equally divided between the two regions (Table 3).

Table 3. Survey's demographical characteristics

		Lombardia (%)	Lazio (%)
Age	Under 24	26	28
	25-39	34	31
	40-64	29	26
	Over 65	11	15
Education level	Post-graduate studies	18	13
	Higher education	50	48
	Secondary education	28	33
	Elementary education	4	6

4. Results

The questionnaire was composed by twenty questions and divided into several thematic areas. They were related to MSW management (Table 4)

and various perspectives of WTE facilities: general information (Table 5), environmental (Table 6), economic (Table 7), and social (Table 8) ones. A great interest towards these issues was highlighted. Universities, public parks, squares and shopping centres were the places where interviews have been conducted.

Table 4. Questionnaire "MSW management"

	Lombardia (%)	Lazio (%)
1. Are you aware of the advantages and disadvantages of MSW?		
I am fully aware and I have a clear view	40	20
I am aware but I do not have a clear view	35	20
I have heard about, but I don not have a clear view	20	50
I do not know about	5	10
2. Which of these treatment method is correct?		
Recycling	17	16
Recycling + Waste to energy	55	34
Recycling + landfill	18	30
Waste to energy	6	5
Landfill	3	8
Indifferent	1	5
3. Do you prefer a WTE plant or a landfill in your town?		
WTE plant	65	41
Landfill	35	59
4. Do you prefer a WTE plant or a landfill in your region?		
WTE plant	98	67
Landfill	2	33

The interviews results evidenced that, even if advantages coming from a correct management of urban wastes are well known by common people, reaching sustainable targets requires a higher level of detail in information, especially when the concept of "waste to value" is not already a common practice (question 1). To this aim, a series of elements could support the learning process:

- Thematic seminars, where politicians, entrepreneurs, environmentalists and researchers could meet together, exchanging their ideas and involving the local population.

- Online free access periodic reports, about results obtained by different treatment methods (e.g. the plastic quantitative obtained by the differentiated collection, or the electric energy produced by a WTE plant).

Furthermore, it is clear that recycling alone cannot be the unique waste treatment method (question 2). There is always the presence of a waste fraction that has to be treated into another way. This assumption is confirmed by the experience of different European nations, involved by many years in these topics. They became aware that WTE plants are not an alternative to recycling, but a complementary method. From one hand, the Waste Hierarchy assumes that recycling is preferable to incineration. From the opposite hand, it explains that landfilling must be minimized. Lombardia respondents agreed with this approach. Instead, Lazio respondents were equally distributed between WTE plants supporters and landfills supporters, as MSW choice to be coupled with recycling activities. The NIMBY phenomena finds confirms even in this analysis, but with distinctive features (question 3, 4). To this aim, it can be observed that:

- In Lombardia, almost all the respondents prefer WTE plants in comparison to landfills, with a 30% of consensus reduction if this choice is adopted in their city.

- In Lazio, the great part of respondents prefer to construct a landfill in their city instead of a WTE plant.

Table 5. Questionnaire "waste to energy plant-general perspective"

	Lombardia (%)	Lazio (%)
5. What is a WTE plant?		
A combustion process of waste with energy recovery	80	47
A combustion process of waste	18	43
I do not know about	2	10
6. What is type of responsibility body for the operation of a WTE plant?		
Public body	17	28
Private company	21	20
Public-private partnership	62	52
7. What factors do you consider most critical in the original design of a WTE plant?		
Ability to manage more waste	28	27
Ability to produce more energy	21	18
Emissions of air pollutants	42	47
Aesthetic of plant	4	3
Local traffic burden	3	3
Job creation	2	2
8. What are the input of a WTE plant? You can choose one or more answers.		
Unsorted waste	98	95
Dry fraction from mechanical biological treatment	60	40
RDF	80	70
Special waste (e.g. medical)	30	18

Going into details on WTE plants, it can be evidenced as in Lazio there is already a not so clear perception about WTE technologies, given that modern plants are frequently confused with the old ones, designed only for the combustion of wastes. Instead, in Lombardia is re-known that the result of this process is the joined production of electric and thermal energy (question 5). The lack of public capitals and the market liberalization pushed

private investors to enter into the market. The public-private partnership is in continuous diffusion in many sectors, even in the waste management one (question 6).

During the design phase, all the respondents are in accord in saying that the reduction of the emissions is the most critical and incisive factor in choices. However, a plant must assure other requirements, in addition to the environmental ones. From one side, it must be prepared for the management of a different mix of wastes in input. From another side, it must be prepared for the optimization in the energy produced (question 7). In fact, it is a common opinion that WTE plants are able to treat only unsorted wastes and RDF. Instead, it is possible to recover energy even from the combustion of other substances. This is of outmost importance for plants managers, focused on wastes with a high calorific power, and public decision-makers focused on the minimization in the use of landfills (question 8).

Table 6. Questionnaire "waste to energy plant-environmental perspective"

	Lombardia (%)	Lazio (%)
9. You think that the WTE plant is …		
Safe for public health	20	5
Safe for public health only in specially designed units	62	37
Harmful to public health due to pollutants emitted	18	58
10. How safe do you feel with the technological development of a WTE plant?		
Not at all, since controls will be weak	8	25
Not at all, since technologies will be not adequate	2	4
Not at all, for reasons of corruption in the control phase	12	28
Enough, if monitoring will be intense	35	18
Enough, if heavy fines will be imposed	32	21
I feel very safe	11	4

11. If waste are treated in another region, the emissions associated to their transportation …		
Are low	4	65
Are high	38	10
Are not interesting assessments	2	2
Are justified, if the cost of my bill is greater	12	10
Are not justified	44	13
12. The emissions released by a WTE facility affect …		
Present generations	15	10
Present and future generations	52	20
Local population	31	68
National population	2	2

By focusing the attention on the environmental perspective, it is evident the following situation (question 9):

- 80% of Lombardia respondents believe in the safety of WTE plants. In the region there is the presence of both new generation and old WTE plants. Hence, it determines a common understanding of the safety of new generation plants respect to the old ones.

- Almost the 60% of Lazio respondents believe in the dangerousness of WTE plants.

With the aim to overcome these cultural barriers against the construction of new WTE plants, a decisive role can be played by the technological progress (question 10). As previously evidenced, these plants are well-considered in Lombardia, even if a series of periodic monitoring controls on emissions levels is mandatory for guaranteeing the correct respect of regulations. Instead, in Lazio, the negative perception derives both from the scarce level of controls (the great part of which are executed not in the right way), and by corruption phenomena related to control processes.

About the reception (or not) of a WTE plant near their houses, it can be observed as in Lombardia it is not justified the choice of treating wastes

outside regional borders and one of the motivations is given by higher emissions caused by transports of wastes. Instead, Lazio respondents agree in saying that emissions related to transports could be marginal and only a limited part of respondents could be available to pay a higher cost in their waste management bills (question 11). An additional relevant information comes from the concept of sustainability, or the guarantee of the same chances of life both to present and future generations. This idea is present in the 50% of Lombardia respondents, and only in 20% of Lazio respondents, where WTE plants emissions are believed to influence only the local population (question 12).

Table 7. Questionnaire "waste to energy plant-economic perspective"

	Lombardia (%)	Lazio (%)
13. Do you think that the amount you pay for waste management is …		
Certainly more than it should	25	27
Probably more than it should	52	60
Just as it should	16	10
Probably less than it should	5	2
Certainly less than it should	2	1
14. What is the effect of waste treatment (separate collection, recycling, WTE) on bill's cost?		
Substantial reduction	2	2
Minimum reduction	6	3
Unchanged	11	7
Minimum increase	40	30
Substantial increase	41	58
15. In your opinion a WTE plant must be realized if …		
It is profitable	29	39
It is green and also profitable	62	52
It is green, but is not profitable	6	2
Its benefits are greater than its costs	3	7

16. If a medium-large WTE plant is profitable unlike the small one, you choose a …		
Medium-large size	36	44
Medium-large size, only if waste are generated in my region	61	50
Small size	1	2
Small size, only if waste are generated in my region	2	4

The questionnaire analysis, from a purely economic point of view, evidences some important information related to costs sustained by users in their waste management bills (questions 13, 14):

- More than 50% of respondents believe to pay probably more than expected, and 25% of them believe to pay (without doubts) more than expected. There are frequent complaints from users about the required taxes, but a so high number of complaints evidences a common idea about the non-correspondence between waste management costs and perceived service quality level.

- Citizens, from one side, are responsible for the production of wastes, but, from the opposite side, are the ones that strongly support the waste management activities, for example through differentiation. To this aim, it is preoccupant as it is not associated to these maneuvers any type of benefit trackable in waste management bills. Again, the 80% of respondents believe that there was an increment of costs in these last years, and the great part agrees in saying that this augment was even substantial.

Furthermore, the sustainability concept previously described affirms that a WTE plant must be constructed not only for environmental reasons, but also for financial ones. This concept is shared by the great part of respondents (question 15). Previous studies evidenced as the plants profitability increases if plants dimensions increase, as direct effect of economies of scale. It is possible to say that (question 16):

- If small-scale plants are not profitable, it is correct to do not construct them.

- Where wastes are generated within the region, 60% and 50% of respondents (in Lombardia and Lazio, respectively) are available towards the construction of big scale plants.

In this phase, it can be observed as where cultural barriers against the construction of WTE plants are overtook, big scale plants are preferred to small ones. The fear to have higher emissions (as direct consequences of the increase of treated volumes) assumes a secondary role respect to a higher profitability.

Table 8. Questionnaire "waste to energy plant-social perspective"

	Lombardia (%)	Lazio (%)
17. Are you agree or disagree, if a WTE plant is built in your town?		
I agree since electricity and heating costs are reduced	46	30
I agree because it is a sustainable choice	8	5
I disagree because it degrades aesthetically the area	10	18
I disagree because it is dangerous to local public health	34	41
I disagree because there are other sustainable strategies	2	6
18. Are you agree or disagree, if a WTE plant is built in your region?		
I agree since electricity and heating costs are reduced	56	45
I agree because it is a sustainable choice	14	10
I disagree because it degrades aesthetically the area	7	17
I disagree because it is dangerous to local public health	23	24
I disagree because there are other sustainable strategies	0	4
19. What are the main reasons for delays in the development of WTE plants? You can choose more answers.		
Incomplete legal framework	5	4
Political reluctance	24	25
Lack of information	25	20
Local authorities strong	17	19

Opposition of public opinion	10	6
Increased costs	2	3
Increased environmental burden	16	21
Technological constraints	1	2
20. What are the main factors of a NWMP, that reduces waste conferred into landfill?		
Reduction of emissions	27	39
Reduction of bill's cost	44	51
Each Region must treated its waste	24	6
Sustainability	5	4

Finally, the questionnaire evaluated more typical aspects about social behaviours, by comparing the attitude to accept (or not) a WTE plant in a city. Findings say that (questions 17, 18):

- More than 50% of Lombardia respondents are available towards the construction of a WTE plant, reaching the 70% if the plant will not be constructed in their city.

- In Lazio there is the opposite situation. In fact, if constructed in their region, the 55% of respondents is available to accept it. However, this percentage goes down to 35% when the plant will be constructed in their city.

- A limited number of respondents (about 10%) believe that a WTE plant is a sustainable solution. At the same time, the identification of more sustainable waste treatment alternatives does not represent the cause of disagreement about the construction of these plants.

- The main cause of disagreement about the construction of these plants has to be identified in fears about an increase in local emissions, with negative consequences on human health conditions. However, it has to be taken into account as cause of disagreement also the aesthetic deterioration and, so, it is mandatory that the construction of WTE plants could follow eco-friendly principles, and could well match with the local landscape.

Italy, if compared with other European countries, presents a deficitary urban waste management system. However, there is not the volition to adopt a long-term action plan to solve the problem. Delays are related to two factors (question 19):

- Political reluctance, NIMBY phenomena, and a scarce trust towards politicians decisions.
- Lack of information, related to the idea to see a landfill as a less sustainable solution than WTE plants.

At the same time, other relevant factors are the ecosystems defence and the ability of local authorities to make prioritary local needs than national welfare. NWMP is a sustainable solution able to reduce waste flows directed into landfills, whatever the beliefs of respondents. Again, interviewees see the waste management costs reduction as an expected output more than the reduction of emissions. Furthermore, it is needed to evidence as Lombardia respondents, in comparison to Lazio ones, believe that each region should manage their wastes by itself (question 20). The discussion points emerged from the interviews are many, and the one that seems to be most relevant is that the disagree about the construction of these plants could reduce if:

- Benefits coming from WTE technologies will be adequately explained.
- More rigid emission controls would be adopted.
- Waste management costs could be really reduced in bills.

In this optics, the consultation with local authorities and population becomes prior, and a sustainable increase is mandatory as remedy to stop the economic crisis. In fact, sustainability requires the integration of economic prosperity with social fair.

5. Conclusions

The climate changes determine a modification of current eco-systems with negative consequences on both human health and production activities. Wastehas always been seen as a problem, but in the last decades the

awareness towards the concept of "waste to value" raised strongly. In fact, reuse, recycling and recovery techniques allow the recovery of raw materials, the reduction of atmospheric/terrestrial/water pollution, the production of clean energy, the development of new job positions and the chance to undertake projects characterized by high economic profitability.

This work is linked to some previous research projects. In an unequivocal way, with the support of quantitative evaluations, it is possible to say that WTE plants represent a sustainable solution if compared to landfills. Italy must follow waste management politics adopted by other European countries and couple them to recycling activities. In fact, even by considering the current economic crisis, costs related to non-adoption decisions are no more justifiable.

One of the most common motivations explaining this choice is the common disagreement of different actors (e.g. public opinion, environmental associations and local politicians) based on three assumptions that both the literature and real local experiences demonstrated to be without foundation. The first assumption is related to WTE plants' combustion process. It is believed that the process is highly pollutant (more than landfills). The second one is that WTE is an alternative to recycling. The third is that WTE plants do not allow the energy production. Furthermore, a general disagreement in setting a WTE plant near a city is a common belief, even if their utility is wellknown. Given that, a regional responsibility allocation is needed to reach common targets (where not already done) and the "Unlock Italy" decree has the chance to do that. In this waste management context focused on sustainability, the participation of the public opinion is of utmost importance. In fact, by exploiting these synergies, from one side, citizens tend to differentiate wastes in a correct way and, from the opposite side, politicians can identify the optimal treatment methods.

The proposed questionnaire aims to be exhaustive and simple. In fact, it is oriented to the entire citizenship, distinct by age and instruction level, by evidencing that participation is favoured if the topic has a common interest and if the filling procedure requires less time. The selected question set

allows to define a framework easily replicable in other locations identified as promising for the construction of a WTE plant. Together with NWMP, it seems to be a support for politic decisions. In general terms, the following considerations on obtained results can be taken into account:

- Public does not have a clear idea of how an MSW management is structured.

- Locations where WTE plants are present show a higher agreement level if compared to locations presenting a landfill. This means that the experience collected during the years by these locations was positive.

- The disclosure process of information must expand faster than present. Different technological solutions are needed to solve specific needs and the sustainability concept must represent a common target.

- Each region must become auto-sufficient, or being able to select a treatment method that manages the whole amount of wastes generated within the region, by avoiding the transfer of wastes (and related emissions).

- A WTE plant, as other productive processes, expels into the atmosphere dangerous substances. Hence, the monitoring process must be objective, periodic, and demands strong economic penalties in case of exceeding of threshold limits established by current regulations.

- Politicians must define tariffs systems to be applied to users waste management bills. This way, virtuous behaviours could be correctly rewarded, with a concrete reduction in charges.

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