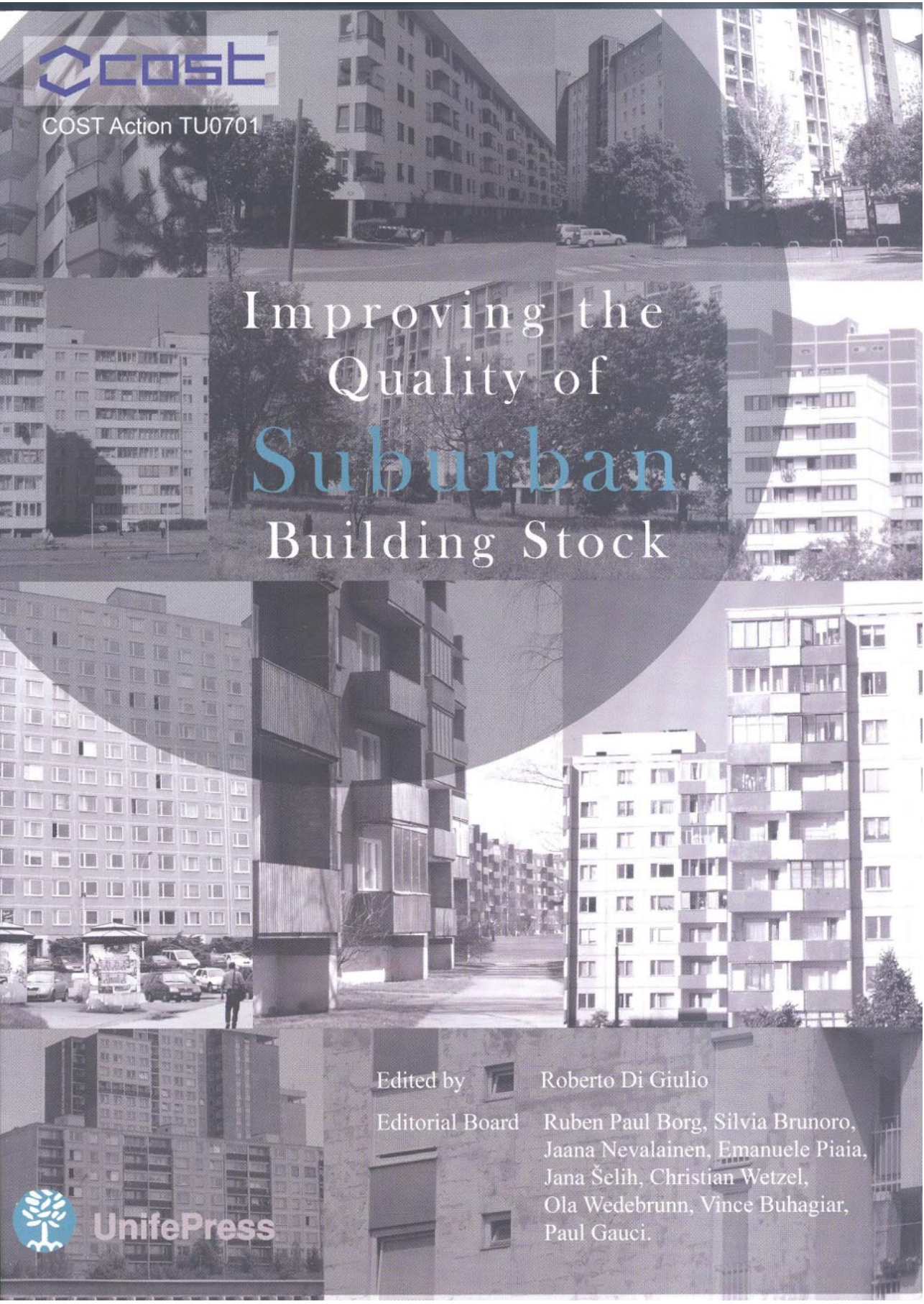

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COST Action TU0701

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COST Action TU0701
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Contents

Green small technology for neighbourhood regeneration: a southern case-study

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ABSTRACT: We can face the waste problem at *a neighborhood dimension* and make its loop closed inside a urban area. An innovative waste management can be furthermore a tool for making both a neighborhood more livable and services and infrastructure more efficient. The proposal was applied to an outskirt neighborhood in Palermo owning a large quantity of green spaces, but it can be replicated on other suburbs within the national territory owning similar features.

1 INTRODUCTION*

This research was born from the idea of combining a long-standing problem - like the municipal waste treatment - with the new development of urban suburbs. We thought that a more efficient waste management system can become a valid tool for the new development of a neighborhood. We can face the waste problem at *a neighborhood dimension* and make its loop closed inside a urban area. An innovative waste management can be furthermore a tool for making both a neighborhood more livable and services and infrastructure more efficient. The proposal was applied to an outskirt neighborhood in Palermo owning a large quantity of green spaces, but it can be replicated on other suburbs within the national territory owning similar features.

2 SUBURBS REGENERATION: FIGHTING ENERGY CRISIS AND WASTE EMERGENCY

Towns and metropolis are responsible for the greatest part of energy consumption and, at the same time, for the increase of municipal solid waste and greenhouse gas – also the disposal of landfills, still greatly widespread, contribute to it.

Instead, turning municipal waste into energy can contribute to reduce greenhouse gas (as a result of municipal waste landfills reduction) and increase renewable energy sources.

Concerning this, the European environmental policies on municipal solid waste issue are mainly based on the so-called *4R strategy*. This strategy establishes the hierarchical priority of actions in order to perform a correct municipal waste management (reduction, reuse, recycle, re-

* The present work has been developed by the Engineer Francesca Grisanti within the PHD course of "Building and Environmental Recovery" and by the two tutors Antonella Mamì and Giulia Bonafede of the University of Palermo, during the years 2010 and 2011. The administrative location of PHD course is the University of Federico II of Naples and the associated ones are the University of Palermo and University of Genoa.

covery of matter and energy); besides, it considers landfills as residual options. According to European directives, only the organic fraction of urban waste can be considered as a source of renewable energy.

Furthermore, the most recent European directive on municipal waste issue underlines the *Autonomy and Proximity* principle*;* it provides that the municipal waste management must be carried out by local communities within their territories in order to guarantee environmental protection and public health.

As far as energy is concerned, European and Italian policies solicit the integration of the territory-energy-environment trinomial resolutely through concrete actions. The reference to renewable energy sources and the rational use of the non-renewable ones appears as an obliged choice of strategic orientation for environment preservation and sustainable development. The inclusion of the energy issue into the process of urban planning and territorial governance is established by Italian laws, but, at the same time, it represents a significant opportunity to the change and development of cities within the framework of such national laws and directives and European funding.

The *20-20-20 European strategy* provides the 20% reduction of greenhouse emissions, in comparison with the levels assumed in 1990, and the increase of renewable energy use up to 20%, in comparison with the total energy consumption.

These goals are turned in Italy into: 1) reduction of 13% of the CO2 emissions; 2) covering the 17% of the gross domestic consumption for energy with renewable energy.

Cities and metropolis are called to plan their future intelligently in order to reach these goals improving the quality of their life and trying to benefit European financing.

The purpose of this paper is to contribute to outline an innovative approach to the municipal waste management in order to turn this problem into an opportunity. It implies the adoption of policies based on recycle of municipal waste and transformation of organic waste into compost and energy, optimizing the available resources.

Towns and urban agglomerations can be considered as large deposits of secondary raw materials that can be comparable to the natural deposits like forests (paper and wood), oilfields (plastic) and iron mines (aluminium and glass). In addition to natural deposits providing raw materials, daily the industrial sector could draw the secondary raw materials from *metropolitan deposits* separating collection and recycling. The effect of this model should reduce the municipal waste impact through the exploitation decrease of raw material and non-renewable energy, but also through the optimal use of material and energy at the end of the life goods. This plan implies a frame of coordinated actions by different actors according to the *cradle-to-cradle* principle.

In other words, inhabitants, institutions and productive forces should cooperate, firstly, to generate a virtuous circle within the productive processes (with any new employment opportunities) and then to improve the quality of urban life and preserve environment from unsustainable pollutant load in a harmony relation to the landscape features of places. Small towns are much more virtuous than largest cities or metropolitan areas. However, the challenging waste management of a complex metropolitan area can be more easily exemplified at the level of neighbourhoods. This planning level can be more suitable to involve local communities and regenerate urban environment.

This search paper arises these questions:

- Is it therefore possible to turn a neighbourhood as *consumer* of energy and matter into a *producer* of compost and bio energy?
- Is it possible to insert a small size technology in urban fabrics in order to turn municipal waste into clean energy?

This research tries to answer to these questions in order to:

- Make local communities autonomous from the point of view of waste management;
- Recover waste in order to produce secondary raw material and renewable energy;
- Acquaint and educate communities about energy question and the impact that the current development models (based on renewable energy or non renewable energy) have on environment and society;
- Create a model and a strategy that can be reproducible and/or adaptable.
- Verify whether the possibility to reduce greenhouse emissions and to increase renewable energy can help to achieve the planned objectives by Italian law within 2020 ac-

cording to the Kyoto protocol provisions and the climate-energy European strategy (also known as *20-20-20 strategy*).

- The outskirts neighbourhoods, often marked by urban degradation, become a fertile terrain to test innovative projects that, on the other hand, are hardly feasible in central areas with a higher urban density. The unfinished feature of many peripheries, often abandoned and without identity and owning large open areas, permits the insertion of clean technologies for turning municipal waste into energy; it is an opportunity to trigger the urban areas regeneration. In addition to this, the separate collection and the plants management could involve neighbourhood inhabitants obtaining a likely positive impact on employment in areas where, especially in the south of the world, the unemployment rate is generally high. It could improve the social aggregation and renew the public administration interests to the outskirts neighbourhoods' regeneration.

3 THE CASE-STUDY: THE BORGO ULIVIA NEIGHBOURHOOD IN PALERMO

In this research, the selected case-study is represented by Borgo Ulivia in Palermo, a neighbourhood where the need to face the municipal waste emergency (haunting the entire town) combines with the need to start innovative actions of urban regeneration. It is a suburban settlement of Public Housing with morphological and typological features that are so frequent in the national territory to make us believe that the proposed strategy could be replicable.

Borgo Ulivia is very similar to those suburbs of public housing that were built throughout the Italian territory between the Fifties and Sixties when the urban expansion began. These kinds of suburbs are mainly characterized by permeable housing typologies, low population density and flexible structures of green areas and open spaces where transitions of opened/closed and public/private spaces are frequent. Today these spaces are often abandoned or used as parking areas; on the contrary, they could become fundamental in order to efficiently localize the needed equipment for separate collection and plants of waste treatment with small size. Unlike neighbourhoods of historic centres, where separate collection is often inefficient due to a lack of open spaces, this suburb offers great potentialities.

Furthermore, Borgo Ulivia is close to the rural belt, near to the Oreto river valley that is planned to become a river park. These features make the case-study interesting in order to verify its applicability. Through information programs on environmental issue, inhabitants can learn to employ the compost produced by municipal waste as fertilizer, both for the green spaces (within the neighbourhood and the river park) and agricultural areas near to it. Besides, the same green spaces and rural areas generate additional organic materials (resulting by pruning cuttings) that can be supplied to the plant for processing compost and biogas. Thanks to its features, the neighbourhood can metabolize its own organic waste as resource. Within this virtuous circle, the produced energy, in addition to being sold, can be used on-site to power the district heating or the lighting systems of public spaces and buildings.

4 APPLIED METHODOLOGY AND CHOICE TECHNOLOGY

We examined directives and laws about this subject, starting with the European context and arriving at the Italian and local ones, in order to define the general framework in which the search scope moves. A survey on benefits (resulting by organic fraction treatment) and the available and innovative technologies range was conducted choosing a flexible technology of small size among these options in order to generate renewable energy.

Such technology is calibrated on the dimension of a neighbourhood and it is an anaerobic digester, a single stage, for wet fractions of urban waste, allowing to turn organic waste into clean energy and compost. It consists of metallic and modular containers (with function of digesters) assembled to facilitate the feasibility of small projects in the field of recycling of urban wet and retrieving energy purposes. Compared to realization of traditional facilities implying construction works (usually reinforced concrete tubs), this solution provides for the installation of modules that can be assembled and transportable like machines.

From an organic matrix of 1,500 tons/year incoming, it is assumed that the quantity of biogas produced is equal to 230 tons/year. With this amount of biogas it is assumed of getting an installed power of 53 kW electric.

Considering the functioning of 8,000 hours/year in cogeneration, it is assumed that the amount of electricity to be produced is equal to 430,000 kWh/year and amount of heat to be generated is equal to 550,000 kWh/year.

Concerning composting process, it was estimated that it is possible to supply a quantity of quality compost of approximately 800 tons/year with the previous organic waste input.

A system of data was examined to evaluate the efficiency of proposal to insert this modular and innovative technology within the case-study neighbourhood. Some data were collected from direct sources (population, quantity of waste produced per capita, analysis of urban fabric, etc.) while others data were elaborated from indirect sources (energy consumptions, waste management costs, environmental damages resulting by management waste systems, etc.) in order to create a qualitative and quantitative reference framework.

In order to evaluate costs and benefits resulting by an innovative waste management system, three sets were described. The first one describes the actual condition, that is to say, without separate collection and with waste disposals in landfill. The second ones considers the implementation of the separate collection with the decrease of waste disposal in landfills, similarly to a model already applied in other parts of the town. Finally, the third set in which, in addition to separate collection, the treatment of waste organic is directly done in situ, by building a small plant for the biogas production and of compost making. The last two sets were evaluated from the point of view of costs and benefits and compared to the state of fact, paying attention to greenhouse gas reduction and increase of renewable energy, in addition to considering the alternatives for waste management.

5 FINDING AND RESULTS

The research shows the opportunity to implement - in an outskirt neighbourhood - a system of municipal waste management based on separate collection and on treatment of waste organic availing of a small plant of anaerobic digestion aimed at producing compost and biogas.

This hypothesis confirms several advantages within various dimensions and a concrete feasibility. The results demonstrate, compared to the state of fact, that, although the costs for waste management increase, it is possible to obtain earnings for selling compost and renewable energy.

Referring to greenhouse gas, the research demonstrates (the third set) that CO_2 emissions, compared to the state of fact, decrease considerably and precisely of 98,84%, almost totally.

This drastic reduction is due to several reasons such as: the waste separate collection that allows recycling; the use in situ of biogas emitted by organic waste to produce energy and finally the use of compost as fertilizer. The methane, when left free, generates greenhouse gas; on the contrary, if it is opportunely picked up it can be used to produce renewable energy, with the additional advantage of reducing the exploitation of fossil sources. In addition to this, the use of compost reduces the use of chemical fertilizers that are also responsible of greenhouse gas increase.

Comparing to the total of 3.000.000 kg of CO_2 emitted by the neighbourhood, we obtain interesting data: the reduction of 895.000 kg is the effect of waste recycling; the reduction of 1.500.000 kg is the effect of anaerobic digestion of organic waste in situ; the reduction of 480.000 kg is the effect of substitution of the fossil energy source; the reduction of 95.000 kg is the effect of utilizing quality compost as fertilizer.

Furthermore, considering that among the economic sectors (energy, industry, transportation, etc.) the waste one is responsible for the 4% of the total CO2 emissions, this hypothesis contributes substantially in order to reach the goal of CO2 emission cutback established by the Italian climate-energy strategy. In other words, about 4% of total 13% of CO2 cutback, to be achieved within 2020, could be assured by this solution. The following diagram shows the decreases of emissions (in percentage) due to the new waste management.

Concerning the renewable energy, the quantity to be obtained with this hypothesis is equal to 6% of energy consumption for final use within the neighbourhood case-study. This result is

very appreciable making a reference to the goal of 17% set by climate-energy strategy to be achieved within 2020. The following diagram displays the renewable energy to be obtained within the neighbourhood case-study and referring to the goal of the *climate-energy 2020 strategy*.

6 CONCLUSIONS AND FORWARDS WORK

The proposal has definitely positive effects both in economic terms - because of reducing waste management costs – and in environmental ones - because of the minor use of landfills and greenhouse gas reduction.

The outskirt neighbourhood can be turned from a simple consumer of energy into a producer of renewable energy with the advantage to autonomously manage organic waste (harmful whether piled in landfill) by closing the loop inside. The electric energy manufactured by the small technological plant can be sold or used for public lighting or public buildings; the thermal energy can be used in situ for district heating.

Leaving many aspects to be deepened, this research demonstrates that the problem of waste management and retrieving energy may be faced also within limited areas. Complex urban conditions like the metropolitan areas can be studied simply at the level of neighbourhood where relocation processes of renewable energy sources are rewarding in terms of efficiency and flexibility.

Starting from the discretization of waste management problem and the instances of urban services redevelopment and energetic retrofit, through the use of existing innovative technologies, the research proposes concrete actions that are connoted by economic, technical and administrative feasibility. Such actions may materialize works - like sustainable and innovative projects of redevelopment for public buildings, open spaces and residence - and opportunities for social participation. The small size technological plants offer benefits compensating investment costs. The hypothesis can lead to the realization of a pilot project.

Moreover, the innovative organic waste management linked to small size and flexible technology can be widely applied also in small towns. These can be compared to outskirts neighbourhood of a great city for number of inhabitants, settled areas, quantity of waste production and very close relationship between inhabitants and their urban area. Besides, small towns and outskirts neighbourhoods are similarly equipped with green space and rural zones.

Some problems concerning the identification of a site, according to the analysis of location suitability, and the implementation of processes for sharing choices with inhabitants are still open.

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