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ENVIRONMENTAL ASSESSMENT OF INTRODUCING A PUBLIC DRINKING FOUNTAIN WITHIN SAN LEO TOWN

Extended abstract

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Background

A vast majority of the European population lives and works in cities, consuming an estimated 80% of the energy used in the EU. Local administrations, as the closest government level to citizens, are ideally placed to address climate issues in a comprehensive manner. In this field a most promising initiative is the Covenant of Mayors (EUMayors, 2013), a voluntary European movement involving local and regional committed to reduce CO_2 emissions through increased energy efficiency and development of renewable energy sources. The reference document is EU 2020 (COM, 2010), the European strategy for smart, sustainable and inclusive growth aimed at achieve substantial objectives by 2020, such as the reduction of greenhouse gas emissions by at least 20% compared to 1990 level; the increase to 20% of the share of renewable energy sources in the final energy consumption and a 20% increase in energy efficiency. As in general way, also for the accomplishment of the EU 2020 emission and energy targets, local authorities play a key role and Covenant of Mayor endorses and supports remarkably the efforts deployed by local authorities in the implementation of sustainable energy policies.

Currently, about 5000 signatories cities (EUMayors, 2013), with different size from small villages to major metropolitan areas are involved in the Covenant of Mayor. All the signatories are committed to implement sustainable energy policies to meet and exceed the EU 20% CO_2 reduction objective through increased energy efficiency and development of renewable energy sources. These actions serve as examples for others to follow and an increasing number of municipalities are showing the political will to sign up to the Covenant. Finally, movements such as Covenant of Mayors endorse local authorities to respond several sustainability issues such as the strong social demand for better health, softer modes of transport, more natural areas in the cities, shorter circuits for food supply, shorter distances between working, living and leisure areas, reduced vulnerability to global economic shocks, especially for the poorest populations, and the creation of local and sustainable jobs. In other words, the endorsement of local authorities is crucial to improve the quality of life of their citizens and to face the challenge of sustainability.

Another critical issue observed at urban level concerns the development of integrated solutions for drinking water usage and for water management. In fact, the 60% of all water is allocated to domestic human use (Toppeta, 2010) and by 2025 the water demand in municipal areas will increase by almost 80 billions cubic metres (Doobs, 2012). Worldwide, 44% of people are living in water stressed areas, and this number (o this rate) is expected to grow dramatically in the next future (Dirks and Keeling, 2009). Particularly, freshwater consumption is expected to rise of 25% by 2030, due largely to the increase in urban population (Washburn et al., 2010). There is the need to implement innovative solutions and at the same time to increase awareness among users, with the aim to locate distribution and to optimize usage of municipal drinking water.

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Objectives

Through a case study this paper investigates a successful story implemented in an Italian small-town, San Leo concerning the introduction of an innovative system: public drinking fountain. The main objective of this study is to evaluate the environmental benefits of the fountain introduction. For this reason an environmental assessment was carried out with a life cycle approach, performing a comparative analysis with bottle water. Definitely, the experience of San Leo public fountain aims to demonstrate that cities offer good opportunities for decisive local action and also local authorities can facilitate the address of sustainability challenges and real behavioral changes.

Outline of the work

In the first section the paper presents the successful experience implemented in the Italian small-town of San Leo. The paper describes the project launched in 2012 by the local administration and in particular by the Mayor who has favored the introduction of the public fountain in San Leo.

Section two illustrates the analysis performed with the aim to quantify the environmental advantages of this novel initiative. A cradle-to-cradle (McDonough and Braungart, 2002) approach was adopted and an environmental life-cycle analysis of the fountain system was carried out.

The last section shows the comparison of water fountain versus bottled water environmental performances. In this section several general remarks from the analysis of the fountain system of San Leo are highlighted. Finally an overview of the main results and the benefits useful to reach Covenant of Mayor commitment is provided.

Methods

This paper describes the local initiative promoted by the Municipality of the small town in Province of Rimini (Italy) San Leo, consisting in the installation of a public fountain in the fraction of San Leo, called Pietracuta. The village of Pietracuta has 993 residents and is located on a road with heavy traffic. Such as to be visible from the roadway, the public fountain is located in a strategic position, equipped with parking that facilitate the up and downloading of the bundles, and thus favors the access to people not resident in Pietracuta. This particular location is provided with the presence of an adjacent dispenser of fresh milk, two cafeterias and comfortable footpath that allows for a more safe accessibility by several kind of users. The choice of the location is certainly behind the success of the initiative that has dispensed 445.000 liters of drinking water during only the first year.

Fig. 1. Water fountain launch in 2012, San Leo, Rimini, Italy

The public drinking fountain of San Leo is branded Fonte Alma and produced by Celli spa. Celli is a leading Italian company in the field of systems and equipment for the beverage dispensing and one of the main landmarks in the world. Celli S.p.A. has always committed in innovation, technology and the company's product quality. Since the availability of safe drinking water has been becoming an increasingly heartfelt and urgent request, Celli S.p.A. has strengthened its Water Division, autonomously developing new solutions and products with the "Alma" brand name (Celli, 2010). The mission for Alma is to make water available directly from the water supply in a safe manner, and ensuring optimum quality standards. With this in mind, Alma water dispensers were the first to obtain TIFQ certification, guaranteeing the health and safety of the water dispensers for public use, also in outdoor environments. The growing awareness of pollution-related problems, and of the environmental damage caused by the transportation of water in glass or plastic containers, is leading to a swift revolution in consumers' habits, now more closely focused on safer, eco-friendly solutions. Accordingly, Fonte Alma drinking fountains are designed to make water readily available, always pure, at ambient temperature or even cooled, either still or sparkling.

In order to better understand the whole benefits in terms of sustainability from the installation of this kind of system, an assessment that evaluates the environmental advantages of the public fountain system in San Leo was carried out (Moschi, 2013). The environmental analysis has been performed adopting a life-cycle approach, in

compliance with the standards ISO (ISO 14040, 2006; 14044, 2006). The analysis has compared the consumption of drinking water from public fountains, refined at the municipal level instead of bottled water. The assessment has adopted a "from cradle to grave" approach, considering as functional unit the Italian pro capita water consumption per year (196 litres) referring to the 2011 data (IANOMI, 2012).

The life cycle of the service provided by the water public fountain has been divided in 5 different phases:

1.material consumption
2.maintenance operations
3.energy consumption
4.transports
5.end of life of materials substituted during the maintenance operations.

The materials consumption phase comprises the glass production for the packaging and the water consumption to fill in the bottle, i.e. pro capita water needed per year plus the losses in the distribution net (235,2 litres). The maintenance operation includes energy and water consumptions, the filters, the UV lamp, the pipes and the cleaning agents. The maintenance comprises also the end of life phase that consist landfilling or recycling in compliance with the current end of life scenarios for the Italian wastes. The energy consumption phase includes the overall energy request to run the machine (pumps, UV lamp, coolers).

Transports have been modeled with several mobility scenarios, in order to take into account all the effects of the distance modifications. Particularly, the analysis accounts 4 different scenarios:

- km 0 scenario: citizens have been supposed to reach the fountain on foot or by bike
- km 1-5 scenario: citizens reach the fountain by car covering an average distance of 6 km (including the return)
- km 5-15 scenario: citizens reach the fountain by car considering an average distance of 20 km (including the return)
- "real" scenario: citizens reach the fountain in compliance with the results of the interview analysis (walking, by bike, by car based on the declarations in the questionnaire).

The analysis of the travel to the water provision covers the average supply for each provision in order to establish the number of travel done to get the pro capita water amount. Allocation factors have also been applied in order to consider the real car fleet in compliance with the interview answers (51% diesel, 33% gasoline, 8% natural gas, 8% LPG). These percentages are consistent with the Italian national framework.

Results and discussion

With the aim to make a comparison between San Leo public fountain and the current scenario where citizens use bottled water, a study of Environmental Product Declaration (EPD) of an Italian bottled water brand has been considered as data source (Breedveld, 2009). The environmental profile outlined by the EPD has been adapted to make real the comparison, specifically the transport phase has been ri-calculated in order to be consistent with the fountain water scenario previous described. The impacts related to the infrastructure construction (both for the public fountain and for the bottling plant) has not been included in the analysis. Table 1 shows the results of the characterization phase for the fountain water *real scenario*.

Table 1. Life Cycle Impact Assessment of fountain water *real scenario*

Impact category	***Unit***	***Material+Mainten.***	***Transport***	***Energy***	***EOL***
Global warming (GWP100)	kg CO_2 eq	0.451465481	4.69194542	1.362837983	3.11191E-06
Ozone layer depletion (ODP)	kg CFC-11 eq	4.66932E-08	6.31003E-07	1.61566E-07	3.59309E-13
Photochemical oxidation	kg C_2H_4 eq	0.000233837	0.004930262	0.000603086	3.24955E-09
Acidification	kg SO_2 eq	0.001686663	0.008218353	0.00545548	1.50778E-08
Eutrophication	kg PO_4^{3-} eq	0.000622215	0.001536452	0.001168138	5.08521E-09
Non renewable, fossil	MJ eq	7.530028049	67.8764107	18.88197333	5.74009E-05

Focusing on global warming potential, the transport phase accounts for more than 70% of the total impact and the energy phase contributes for a 20%. Starting from the previous results, the comparison of the fountain water and the bottled water environmental profile shows a clear reduction (>70%) for all the impact categories. This result is confirmed for all the assumed transport scenarios. Another important results concerns the plastic and waste reduction. The water fountain service allows to reduce the amount of plastic utilized for the water bottles (0.019 kg/L), for a total amount of 5748 kg of packaging waste per year and 4200 kg of PET per year. As listed below, succeeding the waste management system of San Leo Municipality, a consequent reduction in waste derived from the avoided use of plastic bottles for one year is achieved:

- 765 kg separate collection
- 861 kg incinerator
- 2583 kg landfill

The assessment carried out with a life cycle approach has identified the transport as the most critical phase. Starting from these results, it is possible to set the best transport scenario for the water provision area able to satisfy the CO_2 reduction (20%) that is one of the principal Covenant of Mayor targets. As final results, Fig. 2 shows two transport scenarios where the distances are connected to the accomplishment of two CO_2 reduction targets. A 20% of CO_2 reduction would be achieved, if all the users came from Area B (15 km radius). Then Area B (9 km) attains the most ambitious target of 50% of CO_2 reduction.

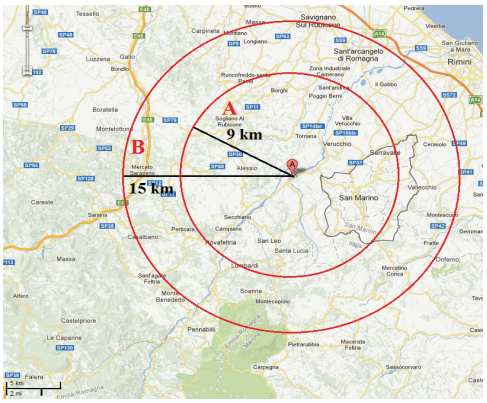

Fig. 2. Extension of water provision areas for CO_2 reduction targets

Concludig remarks

The water fountain in San Leo is a valid experience to address the impacts of climate change. As the analysis has demonstrated, the public fountain system meets the growing need for the consumption of drinking water from the mains, with ready-to-use dispensers for fresh water. It also offers considerable benefits for the environment: a reduction in waste disposal (bottles in PET or other materials) and in urban pollution from transport, deliveries, etc. As a result, the environmental benefits provided by the fountain system help to respond to environmental issues, such as CO_2 emission and waste reduction. Finally the experience of San Leo contributes to establish a new role of local authorities, away from a regulatory role towards a new one that enables others to act. The result is the facilitation to realize a behavioral change and to put in practice sustainable society.

Keywords: climate change, drinking water, life cycle assessment, urban sustainability, waste reduction.

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