

FINAL VERSION OF ACTION PLAN FOR ENVIRONMENTAL IMPROVEMENTS

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Project Partners



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1. The HealingPlaces project

The “*HealingPlaces - Enhancing environmental management capacities for sustainable use of the natural heritage of Central European SPA towns and regions as the driver for local and regional development*” project, is run by 10 partners, led by the Central Mining Institute (Katowice, Poland) and it is funded by the EU Interreg Central Europe Programme. It started in April 2019 and will end in June 2022.

Its main aim is to improve the current management practices of mineral and hot water and valuable natural resources of SPAs. Indeed, SPA heritage and related natural resources are assumed to be subject to environmental and economic pressures and usage conflicts, so one of the main challenges for the future will be to protect them in a way that allows their further sustainable development.

The project consists of three different but close related work packages (WPs). The thematic WP1 “Environmental Mapping and Assessment” aims to develop common tools for an integrated assessment of current and expected threats and pressures on mineral and thermal water resources in SPAs.

The WP2 “Pilot actions in project regions”, closely connected to WP1, experiments with the practical implementation of the sustainable use of water resources in the SPAs, throughout the implementation of pilot actions located in the various regional territories of project partners (PPs). These pilot actions implemented on the local scale will provide the practical elements for the development of the Integrated Strategy of the Central Europe regions on a project scale.

Finally, the WP3 “Management strategy and guidance: Integrated Strategy for Sustainable Development”, starts from the involvement of the most relevant stakeholders through the Regional Working Groups (RWGs) and from the lessons learned from best practices on the management of environmental and socio-economic pressures in the partner regions, establishes an Integrated Strategy for the Sustainable Management of the SPA system, as one of the main results of the project.

2. The purpose of the report

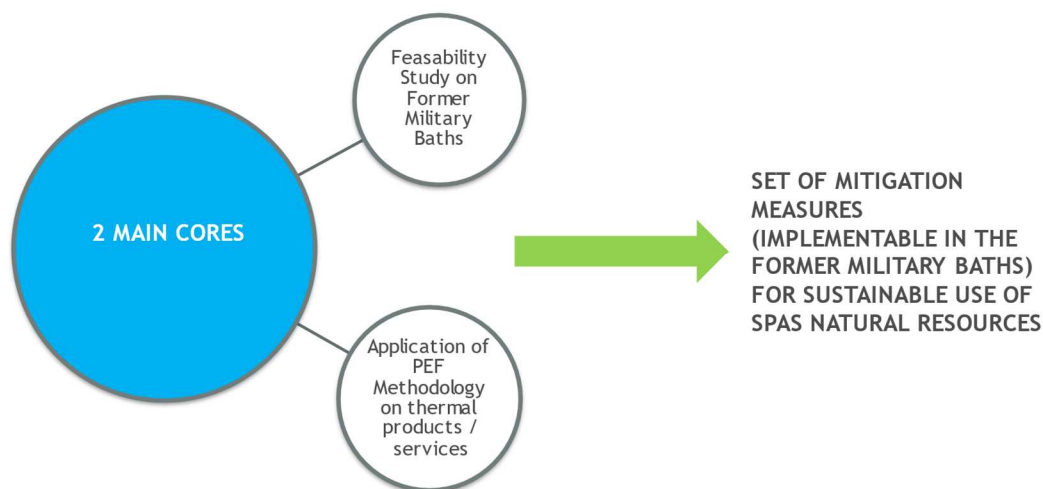
The following report represents the Final version of the Action Plan for environmental improvements, one of the main deliverables of the Pilot Action number 7 carried out within Work Package 2.

The Action Plan aims to promote a set of integrated and combined actions capable of promoting the thermal water resource as the main driver of a broader territorial development path towards sustainability, inspired by the concept of Green City.

In this sense, the report is intended as a sort of feasibility study which, starting from the assumptions contained in Report D.T2.7.4 (first draft of the Action Plan) and focusing on the potential recovery and reuse actions of the Former Military Baths, considers different environmental impact scenarios of spa services/products and identifies the most promising mitigation solutions, for the SPA facilities but also for the whole territory.

In addition to the feasibility study, another key point of the Action Plan is to present the PEF methodology as an efficient environmental assessment approach which will be used with the aim of highlighting and quantifying the potential environmental impacts of products/services that use the thermal water in the Thermal District Acqui Terme.

Fig. 1: Action Plan structure



Source: HealingPlaces project, Pilot Action 7

Crucial for the elaboration of this document has been the contributions from the Regional Working Group and the main territorial stakeholders, that allowed to create a shared vision not only on SPA facility recovery but also on the relaunch of sustainability of the area in a broad sense, able to:



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- assess the environmental impact of products and services that use thermal water in the Thermal District of Acqui Terme;
 - sensitize public and private stakeholders to a more conscious and respectful use of thermal resources, from the point of view of environmental sustainability;
 - raise awareness about the environmental impacts of services and products and about the importance of managing the complexity of the supply chain of the water resource, upstream and downstream of the production / supply process;
 - introduce environmental assessment methodologies, such as the PEF methodology.



3. Reference framework: Acqui Terme and the Former Military Baths

The history of Acqui Terme has always been strongly linked to its thermalism. The thermal waters of Acqui Terme have been known and used therapeutically since Roman times. This is testified by the remnants of the monumental aqueduct, which was built during the empire of Augustus (27 B.C.-14 A.D.) to bring cold water to the SPAs. In the eighteenth and nineteenth centuries, the SPAs were expanded with the construction of the complex of the Military Baths. In the early 1900s, the SPAs were grandiose and were a source of pride for the city.

Unfortunately, even if thermal tourism has always been recognized as a strategic asset for the regional economy, the splendor of the early 1900s has never been reached and various events have marked the conflictual relationship between the city and the managing body of the thermal district.

Today, Acqui Terme spa cluster is passing through a profound crisis, specifically connected with the Covid-19 health emergency and its strong economic repercussions on the SPA and tourism system, that have led to a temporary closure of the main thermal facilities.

Originally designed to direct involve the managerial authority of Acqui Terme Spas, which, however, was forced to decline the invitation due to the severe period of crisis it is facing, the Pilot Action has been re-designed taking into account this complex framework. The new focus of the activities has been the “Former Military Baths” of which the Municipality of Acqui Terme has become the owner in attempting a real relaunch of the spa sector.

In 2017, the Municipality of Acqui Terme acquired from the State Property the ownership of the “Former Military Baths” of which it now has full availability. The Former Military Baths are a unique heritage for the city. The complex of the Military Baths was built in 1700 and strengthened in the second half of the 1800s. This SPA, one of the few plants of this kind in Italy, was used for two centuries by soldiers for SPA treatments and was definitively closed in 1997. With the acquisition of the SPA by the Municipality, the possibility of a complete recovery of the thermal vocation of the area becomes concrete.

The Former Military Baths consist of a covered area of about 9,000 square meters and 1,000 square meters of external and internal courtyards, that includes two thermal springs located in the south-east corner of the complex. One of the main valuable peculiarities of the Military Baths is the capacity to keep about 130,000 liters of water in 24 hours (about 1.5 liters per second) from the source that was historically used for thermal mud and currently used by the SPA called “Lago delle Sorgenti”.

The main reservoir of the Acqui Terme-Visone geothermal system has a temperature of 120-130 °C and is probably located at a depth of about 3.5 km, assuming a normal geothermal gradient of 33 °C/km. This reservoir is fed by meteoric waters infiltrating at an average elevation of 1200 m asl in the Ligurian Alps, some tens of km south of Acqui Terme-Visone, as deeply analysed in the Deliverable D.T2.7.3.

“Lago delle Sorgenti” (or “Vascone”) is an artificial pond of 400 m², comprising several emergences, located inside the Old SPAs (Antiche Terme). The outlet temperature reaches a maximum of 59.5 °C and total flowrate ranges between 5 and 7 l/s and the thermal water

discharges are accompanied by gas bubbling. The water is classified as calcium sulphate sodium chloride with a salinity of 2446 mg/l.

A further thermal spring is located 20 m to east from the “Lago delle Sorgenti”, where a further group of three springs collects in a circular well called “La Rotonda”, which has 5 m of diameter and a temperature of 42.5 °C, and then it flows into the general basin.

Fig. 2 -The main front of the Military Thermal establishment on the other side of the Bormida, early twentieth century and the Lake of Springs within the Former Military Baths



Source: Pietro Zucca, Collection, Acqui Terme

Fig. 3 - Perimeter of the concession area for thermal waters "Lago delle Sorgenti"; Area of the Former Military Baths granted to the municipality of Acqui Terme



Source: Act nr 2017/14116 of State Property Agency and Cartography from Mining Concession Act



4. Feasibility Study: the recovery of the Former Military Baths

4.1. Identification and assessment of the most significant environmental aspects

Acqui Terme thermal waters, thanks to their specific chemical-physical composition, are proven to be particularly suitable for the prevention of chronic and / or relapsing diseases of the respiratory tract through a general action of strengthening the immune defences. Furthermore, they have an important therapeutic effect on the osteoarticular system (osteoarthritis, painful spinal syndromes, myalgias, tendinopathies), treat the aftereffects of fractures and paresis, chronic respiratory diseases, gynecological dysfunctions, improve dermatological diseases and have a good effect on cellulite and peripheral vascular disease in general.

Therefore, if one of the main Action Plan objectives is to assess the environmental impacts derived from the potential activation or reactivation of different services and products in the context of the Military Baths recovery, take into account the beneficial effects of thermal waters and its chemical peculiarities, it is a crucial element for the effectiveness of the entire study.

In this sense the creation and development of Quality and Environmental Management System (QMS and EMS) coherent with the quality of the services potentially provided and compliance with environmental protection standards, it has been identified as the most appropriate means to achieve and maintain the protection and valorisation of SPA natural resources.

Indeed, the application of QMS and EMS ensures that the development of thermal activities is sustainable and compatible with the environment and oriented towards a continuous improvement of the activities performance and pollution prevention, while maintaining a fair balance between social and environmental responsibility, economic and ensuring the satisfaction of the customers of the structure, to find out an environmental policy in line with the purposes and the context in question.

Taking inspiration from QMS and EMS principles, the feasibility study of the Former Military Baths consists of two steps:

- the identification of the hypothetical main activities that could be activated in the thermal structure;
- the analysis to identify and assess the significant environmental direct and indirect aspects.

The results of the environmental analysis will be essential to identify the potential actions of recovery and re-use of the Former Military SPAs and the actions to mitigate and/or reduce the impacts related to thermal services and products.



4.2. Activities and evaluation of significant direct and indirect environmental aspects

Within Former Military Baths context, some potential activities intended for users and implementable inside the SPA facilities has been identified and hypothesized.

In order to carry on the analysis of the most significant environmental impacts, it is assumed that three thermal pools at 36°C and a Finnish Sauna, a Turkish Baths and a Solarium will be established, in addition to a wellness session, where it would be possible to carry out beauty treatments, massages, whirlpools, mud therapy, inhalations and thermal aerosols.

The activities for users identified are listed and briefly described below:

- *Activity: Bathing - Place of implementation: Thermal Pools*

As mentioned before, the SPA could consist of 3 pools fed by the thermal water distribution centre drawn from the wells under concession. The waters of the thermal pools, characterized by the constant temperature, while from a chemical point of view, defined as hypo/hyper thermal mineral waters, could undergoes a process of continuous replacement as new water is constantly arriving from the spring wells. In the structure there could be further therapeutic wells that feed the various utilities and other wells with a monitoring function, which cannot be used, as well as the thermal spring.

- *Activity: Leisure and relax - Place of implementation: Solarium*

The solarium areas could be located in various areas of the SPA. In the solarium areas there could be umbrellas, deck chairs and sun loungers used for rest by customers. Adjacent to the solarium areas, baskets of different colours could be set up to facilitate the separate collection of waste.

- *Activity: Aesthetic treatments - Place of implementation: Wellness Centre*

This activity should be carried out by the Wellness Centre. Aesthetic treatments could be carried out such as massages, face cleaning and masks, mud therapies and inhalation therapies. And in this context, also the Finnish sauna and Turkish Baths will be placed. In this activity, from the environmental point of view, particular attention should be paid to the production of waste, mostly hazardous waste with infectious risk (health).

Furthermore, additional places necessary for support activities, for example offices for administration activities, areas for chemical storage, as well as water system, air conditioning system, cold rooms, generator, waste water network, system for inhalation and aerosol treatments will be considered in the environmental assessment.

4.3. Evaluation of direct environmental aspects

Based on the activities previously mentioned, the direct and indirect environmental aspects are identified and evaluated in the following paragraphs. Starting from the definition of "environmental aspect", as an element of an organization's activities, products or services that can interact with the environment. We can individuate two types of environmental aspects: the direct and indirect ones.



A Direct environmental aspect is defined as an activity over which a company can be expected to have an influence and control. For example, emission from processes.

The criticality of the impacts is assessed by several factors, as listed above:

- P (probability of occurrence): indicates how likely the impact is to occur;
- C (severity of the impact and its consequences): quantifies the severity of any damage to the environment;
- F (frequency of occurrence): refers to the frequency of occurrence over time of the impact;
- R (Removal of the impact): evaluates the removal of the impact;
- L (impact prescriptiveness): quantifies the relationship between the impact and the legislative requirements applicable to the organization, including failure to meet regulatory requirements.

Significance is assessed by attributing a Risk Index (IR) to each of them.

The IR index is calculated as the sum of the numerical coefficients attributed to the various factors; the environmental aspect can have different level of significance:

- Low, $IR < 5$;
- Medium $IR > 5$ and < 10 ;
- High $IR > 10$.

The environmental assessment and the criteria adopted for the attribution of the numerical coefficients follow the standards reported in the procedure of the Quality and Environment Management System - ISO 14001. Furthermore, further Environmental Assessments and Environmental Declarations found in the bibliography, made in hotel and SPA contexts / structures.

The *Table 1* shows the possible evaluations for each risky aspects related to the potentially implementable activities considered.



Tab. 1: Evaluation of direct environmental aspects

Environmental Direct Aspects	Impacts	IR index	Significance
Discharge of water in the public sewer contaminated by detergents, and substances for swimming pools	Water contamination in the public sewer	11	Yes
Spillage of dangerous substances	Water contamination in the public sewer	12	Yes
Special waste production	Soil and water contamination	12	Yes
Supply of water for sanitary and drinking purposes	Depletion of natural resources	10	No
Extraction of thermal water	Depletion of natural resources	11	Yes
Discharge of thermal water deriving from thermal pools and other (e.g., mud and inhalation treatments)	Increase in groundwater or surface water temperature and contamination from deposits of mineral clay residues	11	Yes
Electricity supply	Pollution deriving from energy production processes	11	Yes
Consumption of other types of resources (substances for the maintenance of greenery and infrastructures; products for beauty and SPA treatments)	Depletion of natural resources	11	Yes
Fuel consumption	Depletion of natural resources	9	No
Emissions into the atmosphere from movements of employees with motor vehicles	Disturbance of the balance of the natural habitat	9	No
Injection of additional noise into the natural environment from activities and plants	Disturbance of the balance of the natural habitat	9	No
Smells from the use of maintenance substances	Disturbance of the balance of the natural habitat	9	No
Land use for anthropogenic activities	Alteration of the original natural landscape, influence on protected areas	9	No

Source: Elaboration based on procedure Quality and Environment Management System - ISO 14001



4.4. Evaluation of indirect environmental aspects

An environmental aspect is defined as indirect when the organization may have influence on that, but limited control over the process or activity that produce it, which usually it is delegated or partially managed with a third part. For example, supply chain-controlled aspects or customer-controlled aspects.

The criticality of the impacts is assessed by several factors, included:

- C (severity of the impact and its consequences): quantifies the severity of any damage to the environment;
- F (frequency of occurrence): refers to the frequency of occurrence over time of the impact;
- R (Removal of the impact): evaluates the removal of the impact;
- CG (management impact control): quantifies the level of control over the external party that generates the impact.

Particularly, for the thermal sector and the regeneration of the Former Military Baths have been identified the following indirect environmental aspects:

Consumption related to customer behaviour

This aspect is of great importance in the indirect impacts of the SPA since the amount of waste produced and drinking water and electricity consumed depends partly by the conduct of customers. Moreover, the flow of clients generates induced vehicular traffic with the consumption of non-renewable energy sources such as fuels and widespread atmospheric emissions.

Conduct of other services (maintenance, customers-oriented services)

This aspect is relevant in the indirect impacts of the SPA as a consequence of the activities as regards maintenance and some of the services offered to the customer, mostly connected to the wellness centre.

On the other hand, the restaurants are considered as provide by third-party companies, which use the utilities of the site and generate impacts on the consumption of resources, emissions into the atmosphere, that in any case are evaluated as not significant.



Tab. 2: Evaluation of indirect environmental aspects

Environmental Indirect Aspects	Impacts	IR Index	Significance
Emission of air contaminated by smells (restaurant activity)	Contamination of external ambient air	9	No
Consumption of water and electricity for customer behaviour; activities of the restaurant and wellness center	Resource consumption	10	No
Gas consumption for restaurant activities	Resource consumption	10	No
Use of cleaning products for restaurant and wellness center	Groundwater and soil pollution	7	No
Production of special waste for restaurant activities	Groundwater and soil pollution	8	No
Municipal waste production for restaurant and wellness center activities	Groundwater and soil pollution	7	No
Municipal waste production for customer behaviour	Groundwater and soil pollution	11	Yes

Source: Elaboration based on procedure Quality and Environment Management System - ISO 14001

To conclude, it can be assumed that for the direct significant aspects specific improvement actions could be implemented and operational control procedures applied; for insignificant aspects, only operational control procedures could be applied.

Regarding the indirect environmental aspects, the one particularly significant is relating to urban waste produced by customers, while for the others, improvement actions and training and information actions could be practised by the organization.



5. The Product Environmental Footprint

In addition to the feasibility study described previously and the identification of the environmental direct and indirect aspects, another main key point of the Action Plan is to present a new and efficient environmental assessment methodology, with the aim to highlight and quantify the potential environmental impacts of products/services that use thermal water in the Thermal District of Acqui Terme.

For this reason, the Product Environmental Footprint (PEF) has been inspiring the whole structure of the Action Plan.

PEF is a multi-criteria measure of the environmental performance of a good or service throughout its life cycle. The Life Cycle Assessment (LCA Method) uses quantitative indicators, such as global warming potential, water consumption, natural resources consumption, to assess the environmental impacts of products or services and to reduce themselves.

PEF has been detected as a common methodological approach to enable private and public institutions to assess and benchmark the environmental performance of products, services based on a comprehensive assessment of environmental impacts over the life-cycle. The rules provided in the PEF method enable to conduct PEF studies that are more reproducible, comparable and verifiable, compared to existing alternative approaches.

The situation of the thermal center of Acqui Terme is very particular. Since the company that manages hyperthermal water for services aimed at curative purposes and/or connected to the sphere of well-being does not actively and directly participate in the implementation of the pilot action, the environmental footprint of the services/products provided by the company itself cannot be assessed.

Basing on these circumstances, in agreement with the Municipality of Acqui Terme, it was decided to verify the ecological footprint of three potential products and/or services in relation to the possibility of reactivation of the “Former Military Baths” owned by the Municipality of Acqui Terme, in order to highlight and quantify the potential impacts on the environment.

The idea is to design future services/products taking into account the complete life cycle of services and products. Already in the design phase it is possible to evaluate the entire life cycle of the services/products with the aim of detecting how these “interact” with the environment, including the pre-production (thermal water), production, distribution, use and reuse, final disposal. The ultimate goal is to understand and manage the complexity of the supply chain: critical issues can be identified in the entire life cycle of products/services, to hypothesize solutions aimed at saving and recovering energy and materials (in particular thermal water).

The three different products/services that are identified to implement the environmental footprint are:

- reuse of waste water from the processing of thermal pools for energy production;
- thermal muds;
- inhalation treatments.



These services/products are considered significant from the point of view of the cycle of uses of thermal water in Acqui Terme and at the same time have a significant environmental impact and worthy of attention in planning activities aimed at assessing and reducing these impacts.



6. Mitigation Actions

The Action Plan proposes the implementation of particular actions aimed at the sustainable use of thermal waters on a local scale, including actions to mitigate and/or reduce the impacts related to their use, strictly linked and connected with the concepts of Green City and Eco-Sustainability.

As mentioned above, basing on the main results from the analysis of the environmental aspects focused on the hypothesis of recovery of the complex of the Military Baths and the study results of PEF application on three product and services for the sustainable management of water used in the thermal circuit and SPA, the Action Plan addresses three main environmental priorities relating to:

- decreasing electricity and water consumption;
- cutting off the use of substances dangerous to the environment;
- promoting the waste recycling through the improve the quality of the separate collection of waste in order to reduce the unsorted waste.

These priorities have been declined in a set of thermal water-oriented mitigation actions, inspired by the principles of PEF methodology and implementable in the Former Military Baths SPA facility.

- *Use of Geothermal energy through the installation of a heat pump to mitigate emissions into the atmosphere and to power the SPAs energy saving system.* Given the high temperature of the thermal water and thanks to a system that includes heat exchangers and the reuse of the same until its almost complete exhaustion, it could be possible to avoid considerable CO₂ emissions for a "normal" heating system. The temperature difference of the thermal water is exploited to heat the structure and to produce hot water: this process takes place through large heat pumps that extract excess calories from the thermal water. In addition, photovoltaic systems could be connected to the distribution electricity grid and could fully cover the needs for the extraction of thermal water from the well and for other functions that require electricity. In this sense, also the use of external sensors that capture the intensity of natural light in order to reduce or regulate the internal one, timers that turn off or adjust the various ignitions, the use of LED or low-consumption bulbs could be evaluated.
- *Activate more sustainable uses of water resources in order to reduce their depletion,* through the use of meters for monitoring and controlling water consumption and the extraction of thermal waters from the thermal wells in use.
- *Apply a constant water quality monitoring and a filtering system* in order to reduce the potential chemical pollution.
- *Protect the aquatic ecosystem by lowering the temperature of the water used in balneotherapy,* also in order to discharge it at a temperature suitable for the recover thermal energy to be used within the structure.
- *Preserve the SPA facility surrounding green areas by reducing the use of any chemical products,* through the preparation of natural infusions used for the pesticide treatments of plants and the shredding of pruning residues with a shredder for the production of "compost", or natural



fertilizer. In addition, a small and autonomous "ecological island" could also be evaluated and a machine for the transformation of the wet fraction into compost.

- *Promote the use a Thermal Sludge Certification Protocol in order to monitor the thermal muds disposal and mitigate their discharge impacts.* Disposal procedures according to the legislation could be carried out and sized maturation, storage and filtering plants could be properly designed.
- *Favour the rainwater storage inside large tanks.* The rainwater could be taken for uses related to the irrigation and a filtering and recycling system associated with special tanks could be also used to avoid water dispersion of from taps and showers.

The proposals for mitigation actions above mentioned and the experiments carried out on products/services, joined to topics such as "Eco-design", Social Responsibility and Landscape Planning, will be tested and shared with the Municipality of Acqui Terme and the other stakeholders, as crucial step to achieve the final goal of spreading a more aware and respectful use of thermal resources, with a view to environmental sustainability and the territory that surrounds us.



7. Conclusion. Acqui Terme as a Green City

The climatic changes and the meteorological phenomena that today invade and modify our territory also have consequences on the concept of Green City. Now Cities need to be dynamic, to change, regenerate and adapt quickly.

The measurement of the phenomena and factors surrounding the city is crucial: a careful and in-depth study improves the city and its management of water, materials, mobility and energy.

In this way, the city fits in and adapts better to the surrounding area, with a consequent reduction of environmental impacts and the introduction of waste into the air, water and soil.

Coherent with this vision, the final goal of the Action Plan is to promote the thermal area of Acqui Terme and to enhance the thermal water resource, placing it at the service of a broader process of territorial actions aimed at improving the overall sustainability of the territory, not only in terms of water-oriented services but also of energy saving as a set of integrated actions able also to promote a widespread sustainability influencing different sectors (mobility, touristic etc...).

Indeed, within Green City perspective, the water resource is interpreted, no longer as a simple service, but as a factor that accompanies the growth of the territories.

The transition to the Green City requires the creation of more efficient and sustainable forms of energy use in the long term and the reuse of thermal water for energy purposes is inherent in this vision. At the moment, Acqui Terme thermal waters used for balneotherapy activities, but once cooled they are discharged into the sewer system and dispersed in the subsoil or in the surface water network near the SPAs themselves. This process causes severe thermal pollution, which could be avoided through the use of a series of geothermal pumps, capable of lowering the temperature of the water and extracting a significant amount of energy from it. Although this technology is not an innovation, it is still a technology in strong evolution towards excellent performance and efficiency standards that would allow the use of water resources, avoiding waste and creating an effective water waste management system.

In this way, a new function in the circular system of the green city could be given to Acqui Terme thermal water.



8. Literature

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