SUSTAINABILITY ISSUES IN SWIMMING POOLS AND SPAS

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ABSTRACT
This paper discusses sustainability applied to swimming pools and spas. Sustainability is nowadays a subject that crosses every human activity and health, sport and recreational activities are no exception. Well being is a target of modern society and can not be dissociated from social, environmental and economic aspects.

Keywords | Sustainability, swimming pools, spa

INTRODUCTION
Many of the first swimming activities seem to be related with religious rituals, recreation or military manoeuvres and the first swimmers most likely would live near rivers or sea. In Rome and Greece, swimming was part of the education but in the Middle Age swimming became unpopular in Europe because people believe that the water help spread the plague and other common epidemics. Swimming pools did not become popular until the middle of the 19th century.

Now it is possible to find public swimming pools in almost every city in developed countries, which makes it easy for people to swim for health, pleasure or competition. Those who really like swimming can also consider the installation/construction of a pool in their own yard.

Although the word sustainability has spread and became popular it is not yet often applied to swimming pools and spas. It aims to integrate economic viability, environment and social concerns, thus considering the "triple-bottom-line". Often this leads to the idea of trade-offs between these three goals, where improving one aspect will worsen the other ones which in many cases does not happen. There are many situations where "win-win-win" situations are possible if all three aspects are considered during the phases of conception, management and shut-down of facilities looking at their life cycle.

There are different conceptions of sustainability as the term is relatively young and complex although the process to reach sustainability should incorporate the knowledge and opinions of the different stakeholders. In the case of swimming pools and spas it should involved the engineers, the owners (private or public), the staff, the users, etc.

The Environmental sustainability is often related to anthropocentric and ecocentric views. The first one is more concern with resource management/care and the second one to safeguarding ecosystems (Carew and Mitchell, 2008).

When we consider social sustainability we can look at Maslow's Hierarchy of Needs. Human have physiological needs (food, drink, etc.), safety needs (safety from physical harm, etc.), belonging needs (belonging, love, etc.) esteem needs (self-esteem, esteem of others) and self-actualisation needs (fulfilment of potential) (Carew and Mitchell, 2008).

In economic sustainability we can include appropriate design: technologies designed by engineers should be appropriate particularly in terms of use of resources. We can go even further and valuate environment goods and services what would impact on engineering decision processes. The evaluation

of different technological options could be quite different using this ecological economic approach (Carew and Mitchell, 2008).

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SWIMMING POOLS AND SPAS DESIGN AND CONSTRUCTION

There are some initial aspects that should be considered when designing a swimming pool namely the choice of the local and if it will be an indoor or outdoor swimming pool. The engineer should consider factors like ground plan, slope, and geology. 0ther factors like wind and sun conditions are also important and should be considered since they can affect major aspects of swimming pools like energy conservation. So it is essential to study these conditions because they can allow, for example, the decrease in the consumption of energy by improving the conditions for using solar energy, by decreasing the necessity of room heating, etc. The number of potential users should also be considered since it can affect the required capacity of the swimming pool, the design and selection of equipment and pool amenities among other factors.

The materials of construction should be selected according quality, cost, need of maintenance and local availability among other factors. From a point view of sustainability materials that last longer/need fewer repairs can decrease the amount of waste generated and resource consumption. Local materials have the advantage of having smaller impacts due to the transport.

When choosing paints, low volatile organic paints should be selected because they contribute to the preservation of air quality during construction but also in maintenance operations.

Plumbing system, pumps and motors should be carefully designed and particularly attention should be given to the materials selection, needs of maintenance and repair trying to use equipment that has a longer service life and is capable of fulfilled all the necessary requirements of swimming pool well functioning. This will assure that all operation rules/recommendations or legal requirements are fulfilled (ex.: water regeneration) and users social needs satisfied (safety).

Good design and installation of electrical system is also important as well as the filters design, namely, type, capacity and maintenance requirements. The selection of the heater should be carefully tough as it has a significant weight in operation costs and also in the environment (resource depletion, global warming, acidification, etc.). If possible (economically and technically) solar energy should be considered as an option, choosing solar–fuel boilers. If solar can not be an option then cleaner fuels should be chosen (gas boiler instead of oil fuel boiler).

There are also other minor equipment that should designed/considered because they improve the performance of swimming pools economically, environmentally and socially, since they allow better use and operation of the facility. Time clocks, flow meters, thermometers, ladders, automatic pool cleaners (if necessary), remote control devices (if necessary) are examples of that type of equipment.

Special attention should be given to internal and external lightening. The design of the swimming should maximize the use of natural light during the daytime and mechanisms or procedures to avoid unnecessary artificial lightening should be foreseen. Light bulbs of lower consumption should be installed.

If it is an outdoor swimming pool covers should be considered since evaporation increases the consumption of water, energy and chemical. Even in indoor swimming pools heat retention covers are highly recommended.

ENERGY CONSERVATION

If a swimming pool or spa was designed with environmental concerns energy conservation was already contemplated in many aspects during the conception phase. Although there are some aspects that should also be considered namely the ones related to the operation and management of the facility. For that reason all the equipment should be well tuned and periodical verifications should be done, like for example the operation of the boiler. Set points should be well established (ex.: showers water temperature) and adjust if necessary and the equipment operation should be optimized. Heating and

ventilation systems should be properly operated. In a existing swimming pool where design didn't contemplate energy conservation, retrofit/repair operations should be seen as an opportunity to reduce energy consumption and an ecological economic approach should be considered (ex.: consider install solar heating, replace high consumption light bulbs, buy energy-efficient motors, etc.).

There are works in literature that cover this topic studying different options to achieve energy conservation and reduce costs associated with energy consumption (Trianti_Stourna et al., 1998; Lam and Chan, 2003; Johansson and Westerlund, 2001; etc)

WATER CONSERVATION

To reduce the consumption of water it is important that operation of the swimming pool or spa in terms of water use is optimized (ex.: avoid excessive water make-up) although regulations and legal requirements should be fulfilled (Beleza et al., 2007).

In order to reduce water consumption all measures that can contribute to reduce evaporation should be considered/implemented, like covers. Operation procedures that involve water consumption should be planed and executed to reduce the quantity of water needed (ex.: filters backwash, cleaning tasks, etc.).

Water consumption should be verified in order to detect the existence of leaks/water losses or other problems.

Water reuse possibilities should be evaluated.

WASTE

Prevention and reduction of the quantity of wastes should be a priority. Good stock chemical management will prevent and reduce the generation of hazardous waste, as for example, will avoid chemical products to get out-of-date. One should also use, whenever possible, less harmful substances. Reuse and recycling should be considered next. So debris from excavation and construction should be recycled/well disposed as well as paints and other materials. All the materials like lamps, scrap, chemical containers, should also be sent to recycling. Repair should be considered before buying new equipment although energy efficient of the equipment should be considered in the decision-making process. Pieces and other products from maintenance should be recycled or well disposed. Containers for plastic, glass and paper should be available and staff and users should be encouraged to participate in these recycling activities.

PLANT MAINTENANCE

Maintenance is an important feature in swimming pools and spas. It contributes to energy, water conservation, reduces operating costs and adds safety for users. Preventive maintenance should be performed and periodicals verifications should be done to the equipment (boiler, pumps, time clocks, etc.) and other items like covers.

This preventive maintenance should consider not only pieces substitution but also some equipment cleaning operations like for example solar panels cleaning.

When doing maintenance environmental concerns should be considered (ex.: use of paints with low volatile organic compounds) (Tamminen, 2007).

SAFETY

Microbiological quality of water, surfaces of the pool edges, showers and changing rooms are a major concern in swimming pools and spas. Microbiological standards and frequency and methods of control of water quality are generally imposed by regulations to guarantee the safety of the users. Although surfaces analysis could be improved since they are also a point of potential microbiological development and contamination (Leoni et al., 1999).

For these reasons disinfection and cleaning are important tasks in the functioning of swimming pools and spas. Correct management, execution and control of these tasks will increase safety, will improve air quality (excessive use of chlorine often leads to poor air quality), will decrease resources consumption and operating costs, etc.

Users play also an important role in this so they should be encouraged to pre-swim showering and to have hygiene in order to avoid water pool contamination.

The risk of drowning should be reduced and equipment and procedures to prevent it should be foreseen.

Air quality is also an important issue and periodical verifications should be done to find and solve the problems associated with this matter.

Staff should wear personal protective equipment when dealing with hazardous substances or executing dangerous procedures.

POOL AMENITIES

Although pool amenities are usually an accessory part in swimming pools they can have an important role in social terms. Concession stands, small shops and smaller facilities (like saunas) can contribute to the well-being of the users (comfort, social integration, etc.).

MANAGEMENT

Environment and social concerns should be considered in the decision-making process implementing a more ecological economic approach. Life cycle cost evaluation should be done. Preventive maintenance and optimization of equipment operation are important measures to achieve sustainability of swimming pools and spas.

Management and staff formation and knowledge update should be valuated. Users should be involved not only in their direct participation (ex.: pre-swim showering) but also in the functioning of the facility (water temperature pool, air temperature, etc.). Inquiries can be helpful to improve the swimming pool performance operation in economical, environmental and social aspects. Green purchase (ex.: buy materials that can be recycled) can contribute also to increase sustainability.

SURROUNDINGS

Negative impacts of construction, operation and shutdown of swimming pools and spas on the surroundings should be reduced.

If windbreaks were created around the pool or spa to prevent heat loss they should be integrated in the local surroundings.

CONCLUSIONS

Many of the above measures have economic benefits and also environmental and social advantages. They contribute to reduce resource consumption (fuel, water, materials), to decrease air and water pollution and waste generation. Besides the direct social advantages related to the use of swimming pools, people will also benefit for having a better environment thus increasing their quality of life and well-being.

Some of the above measures may involve some capital investment but others are related to economical and environmental optimization of the functioning of the facilities and their implementation cost is low. The stakeholders like the owners, the staff, and the users should be involved in this process in order to maximize economical, environmental and social performance and increase sustainability of swimming pools and spas.

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