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Defining aquatic centres for energy and water benchmarking purposes

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ABSTRACT

Aquatic centres are major community facilities that require a large amount of water and energy to operate. Aquatic centres are very complex buildings which have made it difficult to obtain clear and verifiable indicators to measure and compare their energy and water consumptions. This paper clarifies and defines what constitutes an aquatic centre by investigating those operating within Victoria, Australia using the Internet. Information from 110 aquatic centres was collected and used to establish various categories of aquatic centre based on the types and number of amenities that they provide. This study defined an aquatic centre as a community or public venue that provides at least an indoor swimming pool and three different types of amenities (e.g. gymnasium, sauna/spa, café and crèche). This paper also discusses how the lack of clear definition of aquatic centres can create confusion when researching and comparing their energy and water usages. This is achieved by reviewing academic and industry literature and also comparing existing energy and water benchmarks of aquatic centres. This investigation also confirmed that there are no universal guidelines for benchmarking aquatic centres. Therefore, guidelines for defining aquatic centres and also for benchmarking energy and water use of aquatic centres are proposed.

1. Introduction

Many countries around the world are now in agreement that climate change is one of the greatest threats facing the planet (European Union, 2015). Climate change and global warming refer to an increase in average global temperatures caused primarily by increases in "greenhouse" gases such as carbon dioxide (CO_2) (Shah, 2015). Global greenhouse gas emissions are primarily caused by human activities through burning of coal, oil, and natural gas to generate energy for power, heat, industry and transportation and large cuts in emissions will be required to reduce the worst consequences of climate change (Hansen, Sato, & Ruedy, 2012). Some ways of reducing greenhouse gas emissions include developing new technologies to achieve greater energy efficiency and retrofitting buildings (Hansen et al., 2012). Energy efficiency has the unique potential to simultaneously contribute to long-term energy security, economic growth, and improved health and well-being of building occupants and in particular it is a key means to reduce greenhouse gas emissions (International Energy Agency (IEA), 2014). A study done in 2006 by United Nations Environment Programme (UNEP) and World Bank estimates that China and India could cut current energy consumption in the building sector by 25 percent, by using high-efficiency lighting, efficient air conditioners, boilers and the waste heat recovery systems technologies that are widely available today (UNEP, 2006).

Greenhouse gas emissions from the building sector have more than doubled since 1970 to reach 9.18 $GtCO_{2e}$ in 2010 (Lucon et al., 2014) and the building sector contributes up to 30% of global annual greenhouse gas emissions (UNEP, 2009). The building sector alone consumed approximately 32% of the total global final energy which makes the building sector one of the largest end-use sectors worldwide (IEA, 2013) and this sector is constantly increasing. For example, more than half of the world's new buildings are constructed in Asia every year. China alone has 40 billion square metres in existing buildings and adds an additional two billion square metres of floor area each year, almost half the global total and in India, the construction of new buildings more than doubled between 2000 and 2005 (Asia Business Council (ABC), 2008). Given the inefficiencies of existing and old buildings worldwide and the growth in construction of new buildings to accommodate the rise in population, greenhouse gas emissions will continue to rise significantly if no action is taken (International Energy Agency (IEA), 2014).

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In 2014, European Union (EU) leaders agreed on a new policy framework for climate and energy (2030 Climate and Energy Framework) which aims at a reduction target of the domestic greenhouse gas emissions of at least 40% by 2030 compared to 1990 (European Commission, 2015). The European Commission proposed a 30% energy savings target for 2030 and this was based on past achievements reached which showed that new buildings now use half the energy they did in the 1980s (European Commission, 2015). The 2010 Energy Performance of Buildings Directive and the 2012 Energy Efficiency Directive were legislated by the EU to provide clear directions to reduce the energy consumption of buildings (European Commission, 2015). One of the Energy Performance of Buildings Directives is that EU countries must set minimum energy performance requirements for new buildings, for the major renovation of buildings and for the replacement or retrofit of building elements (heating and cooling systems, roofs, walls, etc.) (European Commission, 2015). Based on European Union directives to reduce building energy use consumption, sports buildings with swimming pools are seen as potential targets for energy efficiency projects because of their high energy consumption (Step2Sport, 2015). A reduction of 10% in energy consumption of aquatic centres can avoid the production of at least 3.5 million tonnes of carbon dioxide emissions in Australia (Rajagopalan, 2014). Aquatic centres and indoor swimming pools are complex buildings with unique conditions such as specific ventilation requirements, high humidity levels, water evaporation and pool water heating, usually not encountered by other building types. The complex nature of aquatic centres/indoor swimming pools have made it difficult to obtain clear and verifiable indicators with which to measure and compare energy and water consumption, leading to lack of research and standards on this particular type of buildings compared to other building types (retail, office, residential, educational etc.). At present, there are no general Australian energy and water performance standards for public swimming pools, for buildings housing public pools or parts of buildings housing public pools (Wilkenfeld, 2009). Reliable performance requirements and indicators are one of the main “building blocks” for a successful greenhouse gas mitigation and energy efficiency strategy for buildings (UNEP, 2009). Another issue is the lack of clarity regarding the definition of an aquatic centre and the types of amenities that are provided. In order to measure the performance of an aquatic centre, there is the need to clearly define what exactly is being measured.

This paper has three objectives. The first objective is to clarify the definition of an aquatic centre based on what amenities are included (Section 2). This will enable researchers to select and classify aquatic centres, not only for energy and water benchmarking purposes but also for other research related to aquatic centres. The second objective of this paper is to show how the lack of clear definition of aquatic centres can create confusion and difficulties when researching and comparing their energy and water usages (Section 5). This will be achieved by reviewing academic and industry literature and also comparing existing energy and water benchmarks of aquatic centres. The third objective is to create a guideline to facilitate the identification of aquatic centres (Section 6).

2. What is an aquatic centre?

A major issue around the aquatic and recreation industry sector is that there is not enough clarity regarding the definition of aquatic centres and the types of amenities that are provided, as noted by Tower et al. (2014). The authors also acknowledged that it was difficult to suggest a single term that accurately describes all aquatic and recreation facilities. There have been many inconsistencies in naming buildings with swimming facilities nationally and internationally. Many different terms and names have been used in past studies to describe aquatic centres such as: aquatic leisure centres (Sydney Water Corporation, 2011), public pools (Wilkenfeld, 2009), public aquatic and recreational centres (Howat, 2013), aquatic and recreational centres (Tower, McDonald, & Steward, 2014), aquatic facilities (Rajagopalan, 2014), indoor swimming pools and leisure centres (Hancock & Chem, 2011), public swimming bath (Saari & Sekki, 2008), natatoriums (Swimming, 2010; Xie & Cooper, 2006), recreational facilities (Mozes, 2006; Good, Debruyn, & Whitehead, 2007), sport facilities (Trianti-Stourna et al., 1998; Costa, Garay, Messervey, & Keane, 2011), sport complexes (Step2Sport, 2015) and leisure pool facilities (Kampel, Aas, & Bruland, 2014).

There is also inconsistency within the Australian Bureau of Statistics (ABS) regarding the collection of data about the sport and recreation industry. Tower et al. (2014) highlighted that in recent years there have been three changes in the statistical classification of facilities that would include aquatic and recreational centres. Aquatic centres were included under health fitness centres and gyms in 2010 (Australian Bureau of Statistics (ABS), 2014), then changed to structured facilities such as gyms, public pools or courts in 2011 (Australian Bureau of Statistics (ABS), 2011). In 2013, the ABS included public swimming pools as outdoor sports facilities (Australian Bureau of Statistics (ABS), 2013). Therefore, based on the 2013 ABS (Australian Bureau of Statistics (ABS), 2013) classification, an aquatic centre with indoor swimming pools facilities might be classified as an outdoor sports facility which is confusing as they can also include indoor facilities.

In addition, several past studies have not clearly stated what amenities are included. As an example, Tower et al. (2014) stated that an aquatic and recreational centre is defined as a community venue that provides a pool with fitness and active recreation facilities. However, the authors did not clarify whether it includes an indoor or an outdoor pool. Kampel et al. (2014) stated that leisure pool facilities often include several pools, a diving platform, different water attractions and relaxation areas like a restaurant, spa or sauna. However, when they performed their analysis, they categorised the leisure pool facilities based on the number of pools and water attractions. There was no inclusion of any dry areas (e.g. restaurant, sport hall) within any of the categories. Furthermore, in Sydney Water Corporation’s Best Practice Guidelines for Water Management in Aquatic Leisure Centres, there is no definition of what constitutes an aquatic leisure centre (Sydney Water Corporation, 2011). The reports on Operational Management Benchmarks for Australian Public Sport, Leisure & Aquatic Centres prepared by Centre for Environmental and Recreation Management Performance Indicators (CERM PI) in 2013 and 2014 also do not indicate what amenities are included in the aquatic centres (CERM PI, 2013; CERM PI, 2014).

In order to clarify and define what constitutes an aquatic centre, those operating within Victoria, Australia were investigated. As stated previously, aquatic centres are expected to include swimming pool facilities and they are available to the general public. It was assumed that the majority of aquatic centres use Internet websites to advertise their services and amenities offered. Based on this assumption, the Internet was used to search aquatic centres within Victoria. The Australia Swimming Clubs website (Australian Swimming Clubs, 2015) and YMCA Australia website (YMCA, 2015) were the main internet websites used to identify all the aquatic centres within Victoria. Once identified, each aquatic centre’s website was thoroughly investigated to determine what types of amenities were included. Data was collected from approximately 110 aquatic centres and used to categorise aquatic centres based on the amenities they provided.

According to the data collected, aquatic centres can include indoor and outdoor recreational pools, lap swimming pools, diving pools, hydrotherapy pools, family and toddler pools, gymnasiums, fitness centres, saunas and spas, stadiums, childcare facilities and