

K5/1122: A comparative life cycle assessment (LCA) for the provision of potable water from alternative sources (seawater, wastewater and mining water) in South Africa

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Partner Organisations: Veolia Water; Umgeni Water; eThekweni Water and Sanitation

Project Description:

The lack of water is a growing concern in South African cities and in the near future, alternative sources of water will be necessary to satisfy demand. The additional sources of water that could be considered would include trans catchment transfers, modification of existing assets (increasing the height of dam walls, reallocation or purchase of existing water rights or aggressive water conservation / water demand. In public fora concerning water resources and reclamation it is frequently stated that desalination is the preferred choice above the construction of another dam or wastewater reclamation. By determining the LCA of desalination processes more information becomes available which will guide more informed decision making.

Currently, the eThekweni Municipality is in different stages of planning to obtain potable water from the recycling of wastewater as well as from desalination. Another alternative source of water particularly in Gauteng is the reclamation of mine water. This study will investigate the environmental impacts of these 3 technologies by employing a life cycle assessment approach. Such a study is useful and necessary in order to effectively summarise and provide information regarding focus areas with the highest environmental burdens of these technologies in order to improve them environmentally and to assist in the future design of such water treatment plants in the country. Previous studies have shown that LCA has the potential to deliver improvements to local water systems (Friedrich and co-workers, 2001).

However, such a study has only been employed for conventional technologies. Water demand is increasing in all municipalities in South Africa and such technologies which are currently relatively rare will become mainstream in the future (Friedrich and co-workers, 2001). Therefore, it is imperative to shape this design process by considering local environmental factors from the outset so as to reach the best outcome that can be effectively utilised as a model for future projects of this nature. As water is an essential ingredient and used for virtually any product manufactured in the country, the environmental burdens associated with the generation of potable water are a key component in a national LCA database. Such database is planned under the umbrella of the United Nations Environmental Programme (UNEP) and the National Cleaner Production Centre of South Africa. In the absence of South African information, importers of South African goods might use any international data available. Potentially, this has the tendency to reflect negatively on these goods which might in turn lead to environmental scepticism towards South African exports.

The study revolves around conducting a series of LCAs on various proposed water treatment plants using alternative water sources (sea water and wastewater). Such a study will aim to compare the overall environmental burden associated with various water treatment technologies. In order to achieve this objective, design and operational data are required to analyse processes in the production of both potable and industrial water.

Aims:

1. To generate environmental information by investigating each of the water treatment technologies (desalination, recycling of wastewater and reclamation of mine water)
2. To improve the overall environmental performance of these processes
3. To guide designers and owners of these potential life cycle environmental consequences of the selected technologies
4. To develop capacity in undertaking life cycle assessments

Outcome and expected impacts:

The main outcome from this research would be an improved local environmental design of the technologies investigated (desalination, recycling of wastewater and reclamation of mine water). The benefits will be shared by the entire water sector of the country since future employment of the technologies investigated will be improved. This includes municipalities and consultancies as well as researchers in the field. In academic circles, one way of measuring the impact of research is by ascertaining the use of the study by other interested parties. For example,

the local LCA study which was funded by the WRC on an urban water system generated 3 scientific articles in local and international journals. The citation index and the number of citations for these papers on an international level are high. However, these statistics do not take into account the local improvements at plant/process/technology level nor the change of mind set that such studies initiate. One way to overcome this flaw in the new study is to make use of surveys and questionnaires for local stakeholders.

A second important outcome would be the generation of local LCA data for the technologies and processes researched. This will be of particular interest to the local and the international LCA community as well as to government officials and environmental consultancies which deal with environmental LCA scores, carbon and water footprinting of products manufactured in the country. Demand for this type of data is increasing and such data is used widely internationally for decision-making when sourcing products. Therefore, the benefits of this study will be far-reaching and seen across the entire economical sector of the country. These benefits can then be measured by targeting stakeholders using the data and sending questionnaires or conducting interviews.

Publications and reports

Journal Papers

Posters

Conference Papers and Presentations

- Goga T, Friedrich E and Buckley C. A comparative life cycle assessment (LCA) for the provision of potable water from alternative sources (seawater, wastewater & mining water) in South Africa. Presented at the WISA Water Reuse Symposium, Johannesburg, 28th – 29th September 2015
- Goga T, Friedrich E and Buckley C. *A LCA (Life Cycle Assessment) comparison of wastewater reclamation and desalination for the eThekweni Municipality*. Presented at WISA Conference, Durban, 15th – 17th May 2016

Reports and other