

Title in English

The Impact of Water Recycling on the Operational and Environmental Performance of Facilities in the Haramain High Speed Train Project

Title in Arabic

أثر إعادة تدوير الماء على الأداء التشغيلي والبيئي للمنشآت في مشروع قطار الحرمين السريع

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Introduction:

Water recycling is considered an efficient strategy to conserve water resources, reduce water demand, and minimize the environmental impact of water consumption. Many regions worldwide face water scarcity issues, so the world nations prioritize water conservation. The development of the water treatment process to reuse the water demonstrates its advantages. The environmental advantage from reductions in water diversions and the less of wastewater affect towards the environmental water quality. Certainly, there are challenges of water recycling involved with the high treatment cost, the required space for this system, and the potential toxicity of the treated water. Therefore, this research aims to study the impact of water recycling and its positive effects on the facilities performance.

Research Problem:

The research problem is the increased percentage of wastewater in facilities, which raises environmental problems. Therefore, it led to the theory of recycling this wastewater as a solution to decrease environmental pollution and the inefficiency of facility performance.

We summarize the research problem in a central question:

- How advantageous recycling water will be?

The Sub-questions of the research problem:

- What are the types of water recycling?
- What are the benefits of water recycling?

Research Importance:

The research's importance lies in providing a clear understanding of the various procedures of water recycling methods applied in facilities, and their beneficial impact environmental and operational wise.

Research Hypotheses

Implementing water recycling systems in facilities will lead to improved operational efficiency and reduced environmental impact.

Research Goals:

- Showing the applied water treatments in facilities and their results.
- The importance of these systems towards the environmental crises.

Literature Review:

	Researcher Name	Research Date	Research Study About	Results
1	Garcia, M Rodriguez, P Martinez, L	2018	Implementing water recycle systems in food processing industries, plus their impact on the environmental sustainability.	This study pointed the amount of water reserves that can be conserve, enhance process efficiency, and lower the environmental effects of water use and wastewater discharge.
2	Smith, J Johnson, A Brown, K	2019	This study provides the results of installing water recycling systems in public buildings and commercial facilities, such as offices, hotels, and shopping centers. Also, the researchers evaluated the aftermath of these systems, especially when there is a large number on these facilities.	There was a huge reduction in the water demand, which this considered an excellent saving of water resources. The financial savings from bringing down utility costs. Setting a better standard of sustainable credentials for all buildings.
3	Lee, S Chen, H Wang, Q	2020	Researcher looked on the relationship of applying water reprocessing with manufacturing facilities. The research	Assessing operational and environmental impacts of water recycling on the following points:

			pointed out the fact there is an annual consumption of fresh water by 18.2 billion gallons per day.	By measuring water usage, which was 40% reduction. By the cost saving, there is a significant saving of up to 7.3 billion gallons per day. The positive impact towards environment by reducing the wastewater and saving the energy.
4	Apostolidis, N Hertle, C Young, R	2011	Based on the seriousness of this matter to Australia, since it is the driest inhabited continent on earth. Water recycling has become a mainstream for most developments.	The barriers have been removed to use recycled water for firefighting, toilet flushing, and cooling towers.

Comments on Previous Studies:

The consideration of multiple factors such as population growth, urbanization, and climate change, where it will be more necessary to find water sources. There will be more pressure for water recycling. The benefits will be better utilization of water resources, efficient cost saving, and less negative impact on the environment.

Research Methodology

The methodology used is observing the built-in systems and analysing their results. Also, The data acquisition sources from the Haramain High Speed Train Project.

- The research uses a descriptive method where It will study the impact of the installed water recycling system. Case study of a KAEC train station.
- The study population and sample type will be conducted based on interviews with station management and employees.

Research Limits

The research will be limited to the grey water system in one train station in KAEC city, from 2018 to 2023.

Initial Reference List:

- [Challenges in Reusing Produced Water. \(n.d.\). Challenges in Reusing Produced Water.
<https://www.spe.org/en/industry/challenges-in-reusing-produced-water/#:~:text=Opportunities%20and%20Challenges&text=Potable%20reuse%20of%20produced%20water%20faces%20similar%20challenges%20to%20other,produced%20water%2C%20and%20public%20acceptance>](https://www.spe.org/en/industry/challenges-in-reusing-produced-water/#:~:text=Opportunities%20and%20Challenges&text=Potable%20reuse%20of%20produced%20water%20faces%20similar%20challenges%20to%20other,produced%20water%2C%20and%20public%20acceptance)
- [Anderson, J. W. \(2003, August 1\). The environmental benefits of water recycling and reuse. Water Science & Technology: Water Supply; UWA Publishing. <https://doi.org/10.2166/ws.2003.0041>](https://doi.org/10.2166/ws.2003.0041)
- [Apostolidis, N., Hertle, C., & Young, R. \(2011, September 9\). Water Recycling in Australia. Water; Multidisciplinary Digital Publishing Institute. <https://doi.org/10.3390/w3030869>](https://doi.org/10.3390/w3030869)