



### Masters Dissertation Showcase Year 2023

<b>Department: Environmental Engineering</b> Programme: <b>Masters in Engineering</b> Specialization: <b>Environmental Engineering</b>	
<b>1</b>	<b>Title of the Thesis</b> Techno-economic feasibility to treat seawater for human consumption and utility
<b>2</b>	<b>Abstract</b>  For human survival and development, it is essential to have access to clean water. In recent years, water scarcity has become an increasingly prevalent issue worldwide, and the demand for freshwater is expected to continue to rise. Seawater represents a potential source of freshwater which covers more than 70% of the earth's surface. Seawater cannot be used directly since it has a level of TDS and other micro-organisms that are harmful to human consumption directly, therefore seawater must be treated before it can be used for human consumption and other utility purposes. Triplicate sampling is done to study seawater quality for 12 selected parameters at three locations near human settlements. Seawater assessment was carried out in December, February, and April at Karachi.  In this research, a small-scale unit is designed and fabricated. The treatment unit is driven by solar energy that contains a solar panel of 165 watts and a 200 Ah battery. The system operates at 3 peak hours of sunlight. The small unit comprises a five-layered filtration media followed by the distillation process. Filter media results showed an 80.06% of TDS decreased from 33240 mg/l to 6630 mg/l and 99.15% of TDS decreased from 6630 mg/l to 57 mg/l after the distillation process. Similarly, there was significant reduction in sodium 80.06% in filtration 99.37% after distillation, chlorides were reduced 79.7% in filtration and 99.32% in distillation, sulfate showed a decrease of 71.92% in filtration and 100% in distillation, <i>Ecoli</i> showed a 100% decrease in filtration and distillation both and turbidity showed a reduction of 31.16% in filtration and 91.81% in distillation. Working model produced 3.7 liters of distilled water per hour. It is recommended to conduct further experiments with different materials for improved results. The study's findings contribute to understanding the use of serve as a key information document for future decisions about desalination projects in Karachi.  <b>Keywords:</b> solar energy, urban problems, water scarcity, desalination, SDGs, Karachi, seawater filtration, TDS.
<b>3</b>	<b>Impact on Sustainability of Urban Regions or SDG-11 "Sustainable Cities and Communities"</b> (min 400 words)  The project "Techno-economic feasibility to treat seawater for human consumption and utility" besides targeting SDG-06 "Clean water and Sanitation", it also aligns with SDG-11 "Sustainable Cities and Communities" Impacting on Sustainability of Urban Regions as availability of clean water for drinking is getting limited. Existing resources are insufficient to fulfil the needs of urban metropolitan like Karachi city and surrounding. It is imperative to identify or arrange alternative sources. This project focus on technological and economic feasibility analysis if we utilize seawater for drinking and consumption practices. Knowing the fact seawater is highly saline with more than 35000 mg/L of TDS (Total Dissolved Solids). The proposed design and mechanism can encompass the needs of an individual house using proposed or improvised design. We utilized solar panel as source of energy requirement to condensate water after pre filtration of raw

	seawater using alternative gravity sand filtration mechanisms. This concept is similar to desalination approach with changes of prior filtration and condensation with heat exchange and internal transfer. This design is a kind of self-sustained household comprising of three to five individuals to provide clean water for drinking. The concept design is sustainable with manual periodic cleaning without the assistance of technical persons.
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Figure 2 Fabricated prototype in working condition for a time at Seaview site