

Sustainability Engineer for a Day

[Click here for an instructional video to support the task](#)



Introduction

Engineers have an important role in designing a more sustainable future. To address the Clean Water and Sanitation UN Sustainable Development Goal (SDG) this activity will consider how drinkable water can be produced sustainably, minimising the energy requirement, and providing from renewable sources. As a Sustainability Engineer for a Day, you will define and control essential design parameters to obtain the best performance and highest efficiency from any process. This session will introduce you to the fundamental principles of water desalination and give you an insight into the parameters that affect a process. The questions you will consider will be how to maximise the amount of clean water produced; how to minimise the energy required and can that energy be provided from renewable sources?

Background

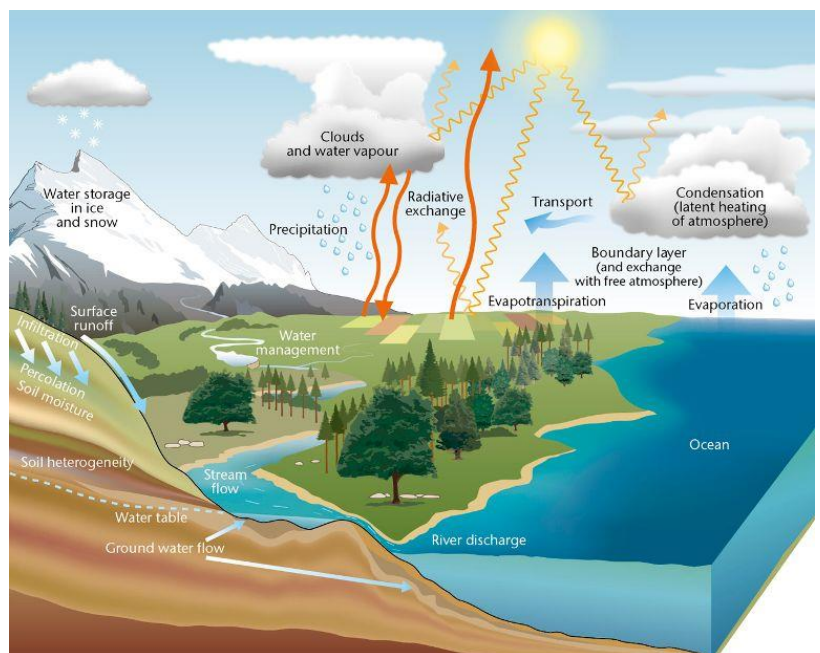
Sustainability, in short, is the ability to meet the needs of the present without compromising the ability of future generations to meet their needs. The concept of sustainability is often composed of three pillars: economic, environmental, and social. Increasingly, countries are making public commitments to sustainability by reducing waste, investing in renewable energy, and supporting organisations that work toward a more sustainable future. [1]

Water consumption is increasing worldwide. In addition to conventional water use, water-intensive goods manufacturing is stressing global freshwater resources. Water is the largest natural resource, but only 3% of it is freshwater, of which just 33% is accessible for use in agriculture and cities. The rest is frozen in glaciers or hidden too deep underground. Increases in global freshwater consumption has led to the depletion of aquifers; this is a problem that will likely get worse as demand grows. It is therefore very important that we develop more sustainable supplies of fresh drinking water.

Water continuously cycles in the nature; the water cycle works by using the energy of the sun to exchange water from the surface of the earth to the atmosphere and back again in a continuous cycle, whether liquid, solid or gas, as indicated in the diagram. As a Global Sustainability Engineer for a Day, the question is how can we replicate this cycle/process (or part of it) to produce drinking water from various sources or moisture in the air?

The water cycle in nature →

(Source: metoffice.gov.uk)



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The Task

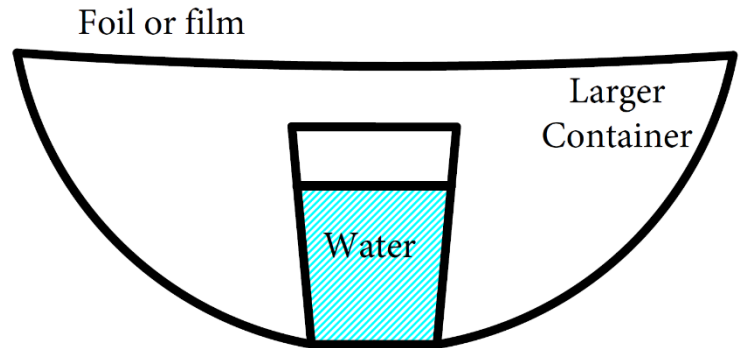
To replicate the water cycle in nature we will start with seawater (salt-water), add some heat, then collect freshwater that is ready to drink.

1. Add 9 grams of table salt (around 1.5 teaspoons) to an empty cup (around 250ml)
2. Add hot water around 70°C (158°F) or boiling into the cup around 240ml. Ask someone for help if required to handle the hot water.
3. Stir the cup content to dissolve the salt.
4. Cover the cup with a plastic bag (not that sustainable!), aluminium foil, or another upside-down cup. Basically, a container to capture the water vapour (aka the evaporate) or the humid air on the top surface; an example is shown in the figure below.
5. Wait for 5 to 10 minutes. Condensation should start immediately, especially if the covering object was chilled beforehand, giving more time to collect more condensate.
6. Try to collect the condensed water and estimate the quantity.
7. You can take this further by checking the condensate for salt content, to do so, take a couple of drops and keep on the clean piece of foil, wait until it dries or force it to dry. Has any salt appeared? What if you use a couple of drops of the source water?

Now you have completed the experiment, spend some time to think about the process and suggest ways (design changes) to make this continuous and sustainable.

Think about: What do you learn from this, as a Civil Engineer report on the following:

- How would you make the process Continuous?
- How would you make the process Sustainable?
- How would you increase the collected water quantity using the same energy input?



Health and Safety

Avoid the use of too hot or boiling water, let cool down for a while. If you are not sure, ask someone for help if required to handle the hot water.

Record your participation

After completing the task and posting your work to the [Padlet](#), ensure that you complete this [form](#) to record your participation to acquire your Certificate of Participation.

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