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Technology and Costs

TECH 2022S8: Water Desalination for Green Hydrogen Production

Water Desalination for Green Hydrogen Production is one in a series of reports published as part of NexantECA's 2022 Technoeconomics – Energy & Chemicals (TECH) program.

Overview

The production of green hydrogen by electrolysis requires green electricity and freshwater as feedstocks. Proven technology has been employed at scale to desalinate plentiful seawater resources, but this requires energy that currently comes from fossil fuels. Furthermore, desalinated water produced for domestic purposes is not sufficiently pure for electrolysis. The high purity standards of process water for electrolysis will require the production of deionized water in large industrial volumes.

This TECH report provides an overview of the conventional and developing technological, economic and market aspects of water desalination for green hydrogen production.

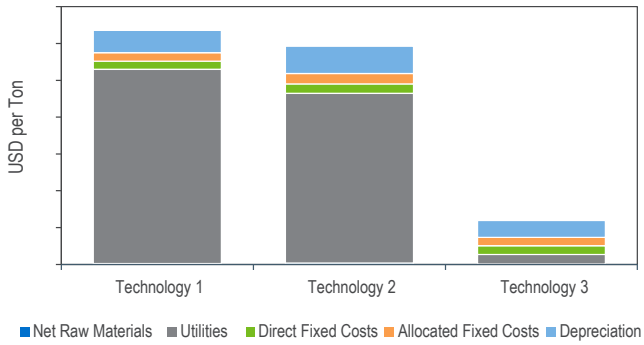
Commercial Technologies

The major commercially available desalination technologies can be classified under thermal or membrane separation

- Thermal processes use heat to vaporize water, which is then condensed on a cooler surface leaving behind the minerals and salts in a saline solution. The most common of these are Multistage Flash (MSF) and Multi Effect Distillation (MED). These processes differ in the way that heat is applied, in MSF the heating component is submerged in water whereas in MED the saline water is sprayed onto the heating surface.
- Membrane technologies by contrast operate at ambient temperature and use a physical means for separation. The simplest physical means of membrane separation is by particle size, whereby a membrane behaves in a similar way to a sieve. Driven by a pressure differential water flows through the membrane and larger particles left behind unable to pass through a membrane's small pores. The most widely used membrane desalination technology is Reverse Osmosis (RO). Both filtration and RO processes are pressure driven but unlike filtration, RO attempts to exclude ionic solutes producing higher purity water.

Process Economics

Cost estimates have been developed for the desalination of seawater to produce potable quality water via the three most common technologies for desalination: MSF, MED and RO. These have developed for MEA, China, Western Europe and USGC.



Commercial Overview

Current desalination capacity additions are driven by water stress. However, in the short to medium term, demand for water as a feedstock for green hydrogen production in water stressed regions would also result in capacity additions. This TECH report covers market drivers, capacity additions, and key players in the water desalination sector.

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- Process economics – comparative costs of production estimates for different technologies across various geographic regions
- Overview of product applications and markets for new as well as established products
- Regional supply and demand balances for product, including capacity tables of plants in each region
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Technology and Costs comprises the Technoeconomics – Energy & Chemicals (TECH) program, the Biorenewable Insights program (BI), and the new Cost Curve Analysis. These programs provide comparative economics of different process routes and technologies in various geographic regions.

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