

**PRODUCED WATER BENEFICIAL USE: ASSESSMENT OF EMERGING  
DESALINATION TECHNOLOGIES AND HYBRID CONFIGURATIONS**

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Treating produced water for beneficial use is being investigated as an attractive alternative to traditional disposal methods because it offers an opportunity to augment fresh water supplies. Based on the quality and composition of produced water, desalination is often imperative to meet potable and non-potable water reuse standards. The application of conventional desalting processes (including reverse osmosis, electrodialysis, ion exchange and thermal evaporation processes) in produced water treatment is often limited by high fouling and scaling propensity, high energy consumption, high capital and O&M costs, low water recovery, and complexity of operation. An economical operation of certain processes is commonly limited to produced water types of certain water chemistries.

Emerging desalination technologies and hybrid systems that are being developed focus on improving certain aspects of performance limitations of existing desalination processes, including increasing water recovery and reducing fouling, energy consumption, and costs. These new technologies can be classified into three categories: thermal (dewvaporation, membrane distillation, wind-aided enhanced evaporation), physical (forward osmosis), and chemical (capacitive deionization, salt extraction from concentrate). Other hybrid configurations include physical-chemical pretreatment, membrane pretreatment, seeded slurry processes to remove scaling compounds in a controlled fashion, electromagnetic field for scaling control, membrane filtration enhanced by vibratory shear process (VSEP), reverse osmosis/electrodialysis and reverse osmosis/electrodialysis reversal.

These new technologies and hybrid systems are assessed based on several key criteria such as water recovery, production efficiency, water quality, infrastructure constraints, modularity, energy and chemicals requirements, costs, and operating and maintenance considerations. The potential of these technologies in produced water treatment will be discussed.

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