The motivation for this research is to address thermo-economics and dynamic behavior of different Multi-Effect Desalination (MED) feed configurations with/without vapor compression (VC). A new formulation for the steady-state models was developed to simulate different MED systems. Adding a thermal vapor compressor (TVC) or mechanical vapor compression (MVC) unit to the MED system is also studied to show the advantage of this type of integration. For MED-TVC systems, results indicate that the parallel cross feed (PCF) configuration has better performance characteristics than other configurations. A similar study of MED-MVC systems indicates that the PCF and forward feed (FF) configurations require less work to achieve equal distillate production. Reducing the steam temperature supplied by the MVC unit leads to an increase in second law efficiency and a decrease in specific power consumption (SPC) and total water price.

MED systems may be subjected to abrupt or ramp changes (disturbances) in the main input parameters. In the case of heat source disturbance, MED plants operating in the backward feed (BF) may be exposed to shut down due to flooding in the first effect. For MED-TVC, it is recommended to limit the seawater cooling flow rate reduction to under 12% of the steady-state value to avoid dryout in the evaporators. A reduction in the motive steam flow rate and cooling seawater temperature of more than 20% and 35% of steady-state values, respectively, may lead to flooding in evaporators and plant shutdown. Simultaneous combinations of two different disturbances with opposing effects have only a modest effect on plant operation and they can be used to control and mitigate the flooding/drying effects caused by the disturbances. For the MED-MVC, the compressor work reduction could lead to plant shutdown, while a reduction in the seawater temperature will lead to a reduction in plant production and an increase in SPC.

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The public is welcome to attend.