THE UNIVERSITY OF WESTERN AUSTRALIA

Research Development & Innovation

Improved Efficiency Evaporation/ Liquid Stream Concentration

Using waste heat sources 65..90°C

UWA technology licensing/ partnering opportunity

- **Improved efficiency**
- **Increase (freshwater) production**
- **Decrease heat rejection loads**

Your Problem(s)

- Inefficiencies in concentrating your liquid process stream
- Inefficiencies in cleaning up (distilling) your wastewater stream
- Limited availability of fresh water
- High cost of rejecting your excess process heat cooling tower, evaporation pond)

The Solution

- Steam Boosted Multiple Effect Distillation
- Flash Boosted Multiple Effect Distillation
- Distributed Boosted Multiple Effect Distillation
- Direct Steam Boosted Multiple Effect Distillation

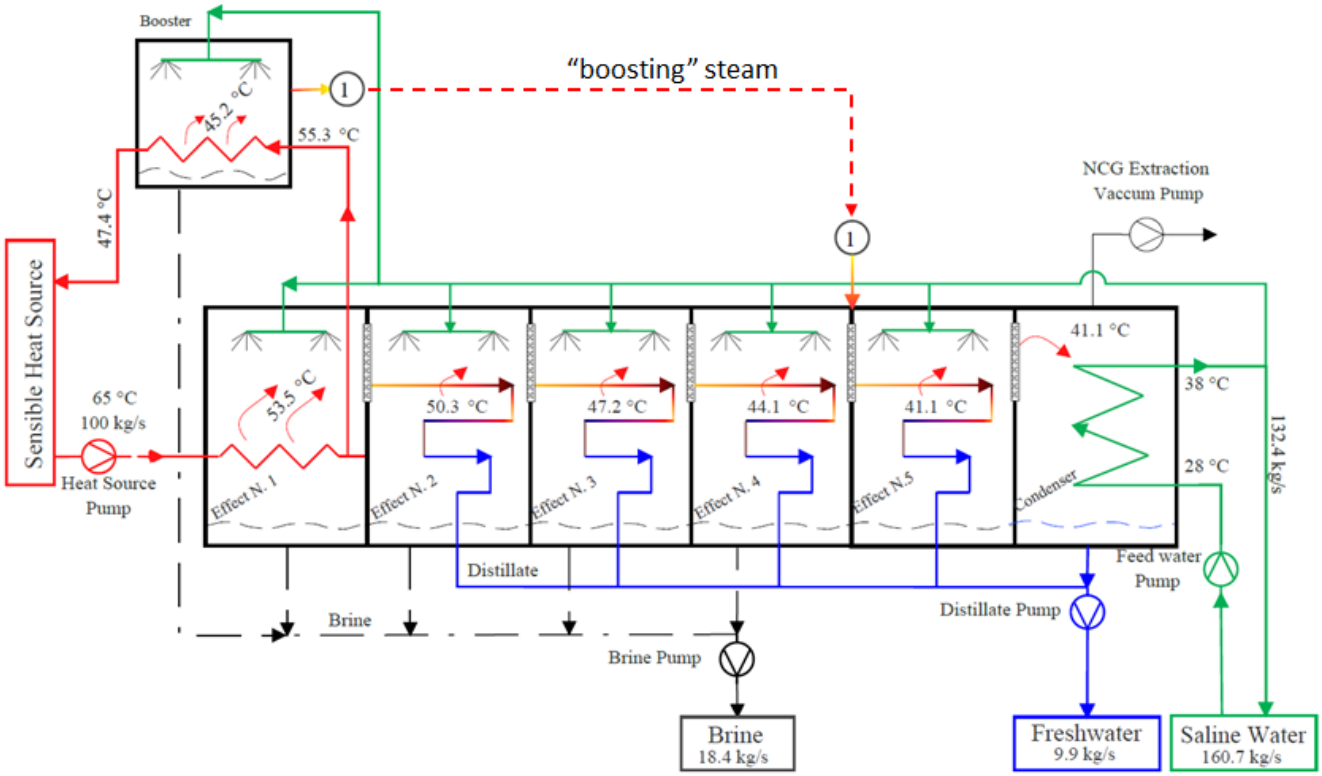

Figure 1: Steam Boosted MED System

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Background

Research at The University of Western Australia (UWA) in collaboration with the National Centre of Excellence in Desalination Australia (NCEDA) into novel technologies for exploiting low-grade geothermal and waste heat sources (65...90°C) have led to the technology being presented here.

The Technology

Multiple-Effect Distillation (MED) is a well established method for the concentration of liquid process streams and desalination. Thermal methods generally consume more energy than the reverse osmosis method, however, when used with geothermal or waste heat sources, thermal methods have an advantage.

Thermal methods are also able to treat brackish or wastewater sources often incompatible with membrane RO systems. The produced water typically meets “boiler grade” requirements and can hence be used for industrial steam generation.

1) Steam Boosted MED

Figure 1 shows a “Steam Boosted MED” system – compared to standard MED systems it includes an additional booster unit that receives the heat source after it has driven the main MED unit. As a result, additional thermal energy is extracted from the waste heat source and reducing the return temperature. The additional steam generated is then fed to one of the downstream MED effects to perform further distillation thereby increasing the overall system efficiency. A typical improvement is in the order of 35% (of increased freshwater production).

Figure 2: Prototype MED System

2) Flash Boosted MED

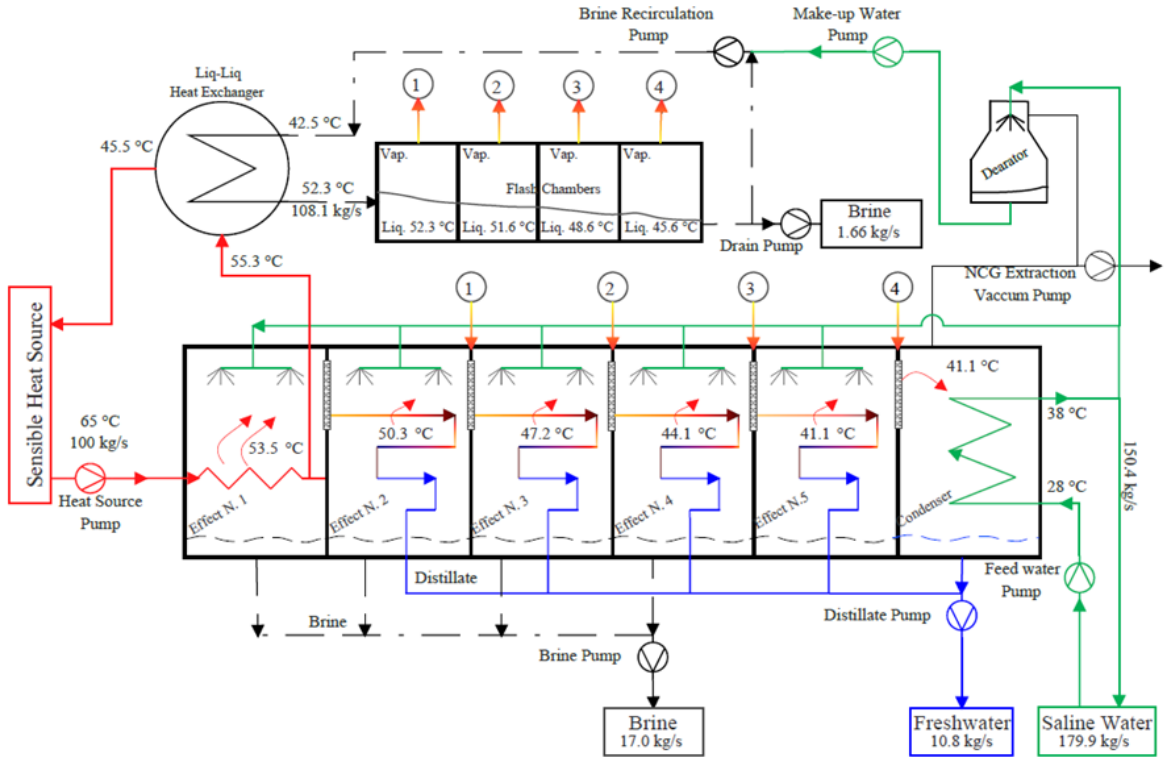

Figure 3: Flash Boosted MED System

The Flash Boosted MED system works analogously to the Steam Boosted MED system – the additional steam is produced with several flashing chambers and each steam output is fed to a different MED effect with compatible temperature & pressure thus maximising the overall system efficiency. This system can increase the freshwater production by up to 55%, and is particularly suited for temperatures of 75°C or more.

3) Distributed Boosted MED

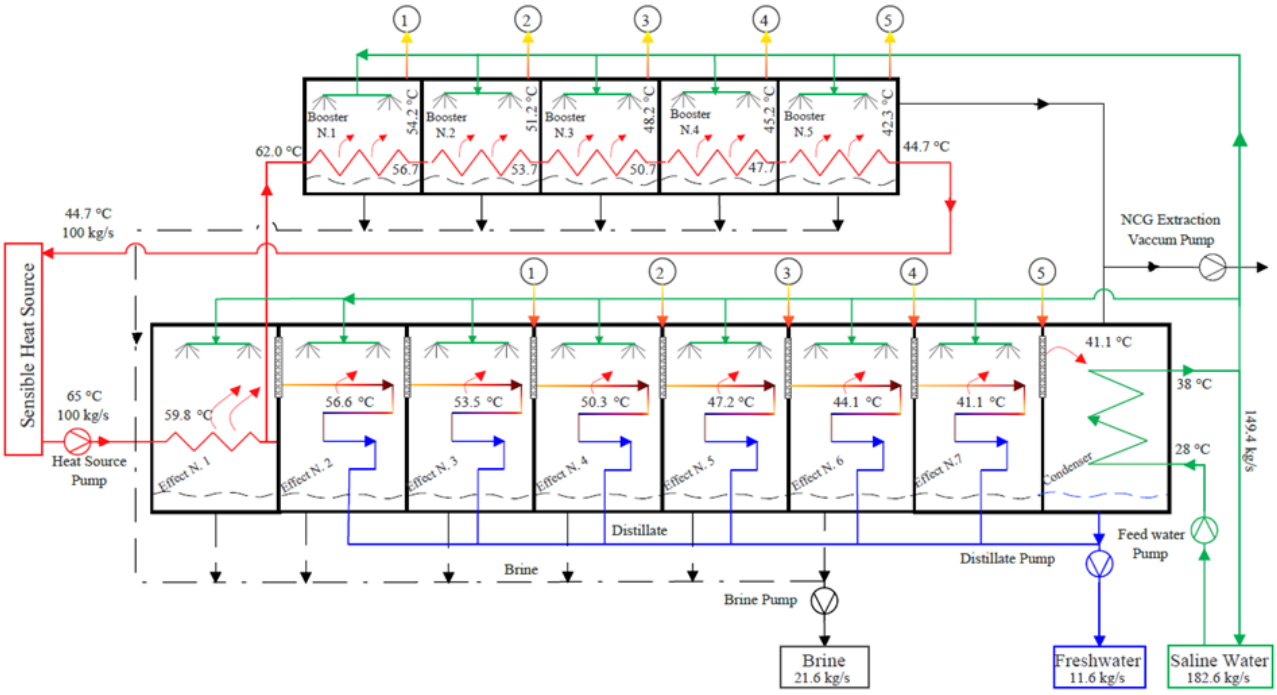

Figure 4: Distributed Boosted MED System

The Distributed Boosted MED system uses multiple steam booster units to maximise the thermal energy extracted from the heat source and then feed the generated steam into the appropriate MED effects. This configuration increases freshwater production by up to 55% and has lower electrical pumping requirements than the Flash Boosted MED system. This system also performs well at temperatures down to 65°C.

4) Direct Steam Boosted MED

Waste heat in the form of low temperature/low pressure steam can easily be fed directly into a compatible effect of an MED system thus making full use of the available thermal energy.

Efficiency Gains

Efficiency gains will need to be assessed on a case by case basis, however, the main benefit of the above technologies will be an increase in water production/ liquid stream concentration (e.g. 30…55%) while also reducing the temperature in the returned waste heat stream. Specific examples are given in the References listed below.

The University of Western Australia

UWA is a research-intensive university ranked 96th in the world (Shanghai Jiao Tong University's internationally recognised Academic Ranking of World Universities – August 2016), and one of the internationally recognised Australian Group of Eight Universities.

References

'New MED based desalination process for low grade waste heat', 2016, vol.394, Desalination.

'A Novel Low Grade Heat Driven Process to Re-Concentrate Process Liquor in Alumina Refineries', 2016, Hydrometallurgy (also presented at 10th International Alumina Quality Workshop).

'A Novel Flash Boosted Evaporation Process for Alumina Refineries', 2016, vol. 94, Applied Thermal Engineering.

'Thermo-Economic Analysis of two Novel Low Grade Sensible Heat Driven Desalination Processes', 2015, vol. 365, Desalination.

'Application of the Boosted MED Process for Low-Grade Heat Sources – A Pilot Plant', 2015, vol. 366 Desalination.

Please feel free to contact Tom Schnepple or Professor Hui Tong Chua for copies.

Intellectual Property

The technology is protected by US 9,365,438 and other pending patent applications.

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