

ENERGY EFFICIENT WASTE HEAT COUPLED FORWARD OSMOSIS FOR EFFLUENT WATER MANAGEMENT AT COAL FIRED POWER PLANTS

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Abstract

Project Description

This project will evaluate a transformational low energy (less than 200 kilojoules/kilogram water) waste heat coupled forward osmosis (FO) based water treatment system (the Aquapod©), adapted to meet the complex and unique environment of a power plant environment, to manage effluents, meet cooling water demands and achieve water conservation. The target is to enable recovery of at least 50 percent of the water in highly degraded water sources without extensive pretreatment in a cost effective manner.

Project Benefits

The use of the Aquapod© FO process can double to quadruple the amount of water recovery from power plant effluents per unit of input energy compared to the current state-of-the-art. It is also an intrinsically safe process unlike the current state-of-the-art which utilizes gaseous ammonia. Project outcomes will enable the early stage evaluation of a transformational water treatment system adapted to the power plant environment. A partner utility is engaged early in the technology development to assure that results would be applicable to large scale coal-fired power plants.

Technology Background

Forward Osmosis (FO) is essentially the flow of water from a dilute salt solution to a concentrated salt solution (also called draw solution) when separated by a semi-permeable membrane.

□ Potential Advantages of FO

- Use of low-grade thermal energy
- Low fouling propensity
- Lower capital cost

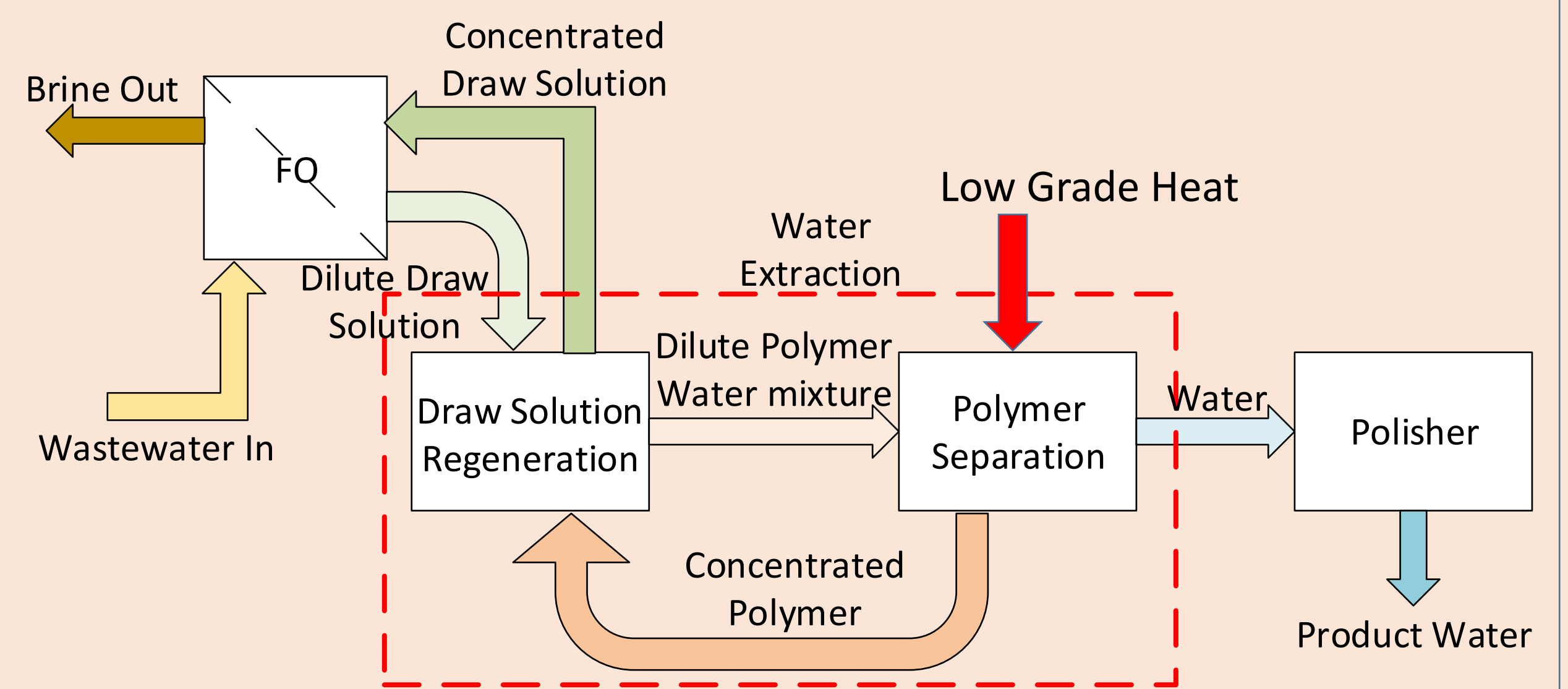
Challenges

- Develop a process that can use low-grade energy to recover water from the diluted draw solution

Our Technology Concept (Aquapod ©)

- Uses thermo-reversible polymers to extract water from the diluted draw solution
- Three steps are involved in Aquapod© Technology:
 - Extract water from the diluted draw solution using polymer; separate the polymer phase, leaving behind the concentrated draw solution
 - Heat the separated polymer phase above the polymer cloud point to release the extracted water
 - Polish the extracted water for use

Polymer Assisted Forward Osmosis Aquapod ©



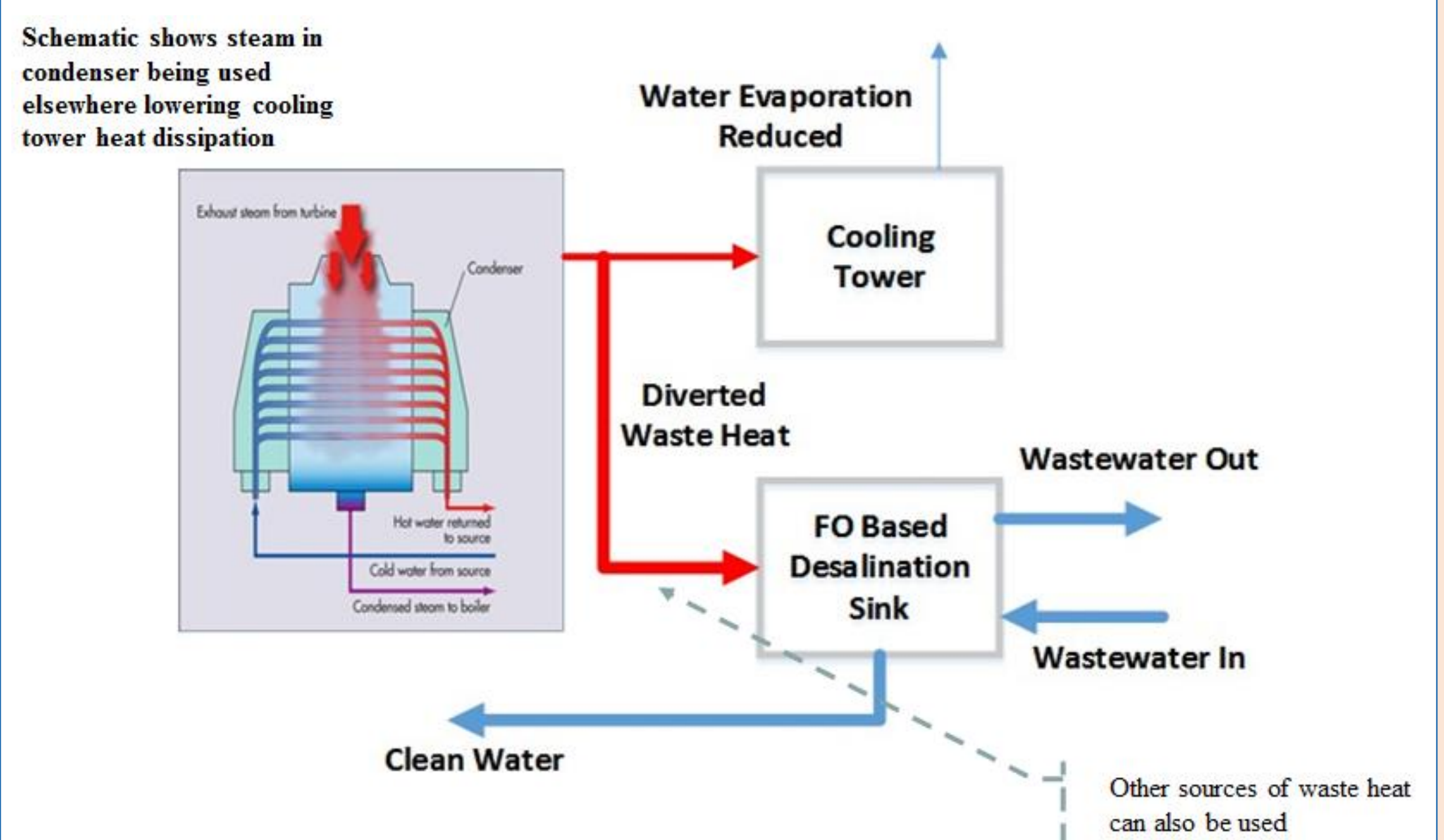
Schematic of Aquapod© Technology

Advantages of Aquapod© Over Current Processes

- Expected lower energy consumption (~200 kJ/kg water compared to state-of-the-art: upwards of 400 kJ/kg – 1000 kJ/kg)
- Simpler equipment
- Intrinsically safe

Expected Outcome

Waste Heat Powered Water Recovery



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