CLAIMS

What is claimed is:

1. A method for producing a treated water stream, the method comprising the steps of:

receiving a feed stream comprising at least one substance mixed in a water phase; and

processing the feed water stream in a plurality of stages arranged in operation from a lowest temperature and pressure to a highest temperature and pressure, to produce the treated water stream and a concentrated stream,

wherein each stage comprises a vessel, a heat exchanger, an evaporator, and a condenser,

wherein operation of an external heat exchanger in each stage is coupled to waste heat or energy available in the produced treated water, and wherein the external heat exchanger is configured to receive the waste heat or energy available in the produced treated water to heat the feed water stream inside the vessel to evaporate water from the feed water stream at each respective stage, independent of the heat provided by the waste heat or energy available in the produced treated water to the external heat exchangers at the other stages,

wherein each evaporator is configured to evaporate an amount of water using one of direct heat or indirect heat, and

wherein each condenser is configured to condense at least a portion of steam generated by a successive stage.

2. A method of Claim 1, wherein the plurality of stages is arranged in series, wherein a first stage receiving the feed water stream is operated at the lowest temperature and pressure compared to the other stages.

3. A method of Claim 1, wherein the plurality of stages is arranged in parallel, each stage being configured to receive the feed water stream from a same source and further configured to exchange heat with one another.

4. A method of any of the preceding claims, wherein the step of processing further includes

feeding the feed water stream into the first stage operated at the lowest temperature and pressure compared to the other stages, an evaporator of the first stage being configured to produce a water vapor stream that is condensed by a condenser of the first stage to produce a first treated water stream,

extracting a brine-concentrated from the evaporator of the first stage and feeding the brine-concentrated feed stream to an evaporator of a second stage, the second stage comprising a higher temperature and pressure than the first stage, to produce an additional treated water stream and a successive brine-concentrated stream that is fed to an evaporator of a successive stage for the plurality of the stages, each successive stage comprising a higher