What is claimed is:

1. An osmotic solute recovery system comprising:

an osmotically driven membrane system comprising a source of dilute draw solution comprising thermally removable solutes;

a first distillation column comprising:

a first inlet coupled to the source of dilute draw solution for introducing a first portion of the dilute draw solution into a first end of the first distillation column;

a first heat transfer means coupled to the first distillation column at a second end, the first heat transfer means having an inlet coupled to a first source of thermal energy and an outlet coupled to the first distillation column for directing thermal energy to the first distillation column to cause at least a portion of draw solution solutes in the first distillation column to vaporize; and

a first outlet for removing the vaporized draw solution solutes from the first distillation column; and

a second distillation column comprising:

a first inlet coupled to the source of dilute draw solution for introducing a second portion of the dilute draw solution into a first end of the second distillation column, wherein the first distillation column and the second distillation column are configured for parallel operation;

a second heat transfer means coupled to the second distillation column at a second end, said second heat transfer means having an inlet coupled to the first outlet of the first distillation column for receiving at least a portion of the vaporized draw solution solutes for use as a second source of thermal energy, a first outlet coupled to the second distillation column for directing the second source of thermal energy to the second distillation column to cause at least a portion of draw solution solutes in the second distillation column to vaporize, and a second outlet coupled to the osmotically driven membrane system for reintroducing the vaporized draw solution solutes from the first distillation column condensed within the second heat transfer means to the osmotically driven membrane system; and

a first outlet for removing the vaporized draw solution solutes from the second distillation column.

2. The system of claim 1, wherein the first outlet of the second distillation column is coupled to the osmotically driven membrane system for reintroducing the vaporized draw solution solutes from the second distillation column to the osmotically driven membrane system.

3. The system of claim 2, wherein the distillation columns further comprise second outlets for removing solvent from the distillation columns.

4. The system of claim 1, further comprising:

at least a third distillation column comprising:

a first inlet coupled to the source of dilute draw solution for introducing a third portion of dilute draw solution into a first end of the third distillation column, wherein the third distillation column is configured for parallel operation with the first and second distillation columns;

a third heat transfer means coupled to the third distillation column at a second end, said third heat transfer means having an inlet coupled to the first outlet of the second distillation column for receiving at least a portion of the vaporized draw solution solutes for use as a third source of thermal energy for use with the third distillation column, a first outlet coupled to the third distillation column for directing the third source of thermal energy to the third distillation column to cause at least a portion of the draw solution solutes in the third distillation chamber to vaporize, and a second outlet coupled to the osmotically driven membrane system for reintroducing the vaporized draw solution solutes from the second distillation column condensed within the third heat transfer means to the osmotically driven membrane system; and

a first outlet for removing the vaporized draw solution solutes from the third distillation column.

5. The system of claim 4, wherein the first outlet of the third distillation column is coupled to the osmotically driven membrane system for reintroducing the vaporized draw solution solutes from the third distillation column to the osmotically driven membrane system.

6. The system of claim 1, wherein the osmotically driven membrane system is a forward osmosis desalination system.

7. The system of claim 1, wherein the dilute draw solution comprises an aqueous solution of ammonium salts formed from a mixture of ammonia and carbon dioxide.

8. The system of claim 1, wherein the first source of thermal energy is steam.

9. The system of claim 1, wherein the dilute draw solution has a concentration of about 0.5 molar or greater.

10. A method of recovering draw solution solutes from an osmotically driven membrane system, the method comprising the steps of:

providing a source of dilute draw solution from the osmotically driven membrane system, wherein the dilute draw solution comprises thermally removable solutes;

introducing a first portion of the dilute draw solution to a first distillation column;

introducing in parallel a second portion of the dilute draw solution to a second distillation column;

introducing a source of thermal energy to a heat transfer means of the first distillation column;

vaporizing at least a portion of draw solution solutes out of the first portion of the dilute draw solution in the first distillation column;

directing at least a portion of the vaporized draw solution solutes to a heat transfer means of the second distillation column;

vaporizing at least a portion of draw solution solutes out of the second portion of the dilute draw solution in the second distillation column; and

recycling at least a portion of the vaporized draw solution solutes from the first distillation column condensed in the heat transfer means of the second distillation column to the osmotically driven membrane system.

11. The method of claim 10, further comprising the step of recycling at least a portion of the vaporized draw solution solutes from the second distillation column to the osmotically driven membrane system.

12. The method of claim 10, further comprising the steps of:

introducing in parallel a third portion of the dilute draw solution to a third distillation column;

directing at least a portion of the vaporized draw solution solutes from the second distillation column to a heat transfer means of the third distillation column;

vaporizing at least a portion of draw solution solutes out of the third portion of the dilute draw solution in the third distillation column; and

recycling at least a portion of the vaporized draw solution solutes from the second distillation column condensed in the heat transfer means of the third distillation column to the osmotically driven membrane system.

13. The method of claim 10, wherein the step of introducing a source of thermal energy comprises introducing heat at a temperature of about 50 °C or greater.

14. The method of claim 13, wherein the step of introducing a source of thermal energy comprises introducing heat at a temperature of from about 90 °C to about 250 °C.

15. The method of claim 10, wherein the step of providing a source of dilute draw solution comprises providing a dilute draw solution having a concentration of about 0.5 molar or greater.

16. The method of claim 10 or 12, further comprising the step of removing solvent from at least one of the distillation columns.

What is claimed is:

1. An apparatus for separating draw solution solutes and product solvent from a dilute draw solution, wherein the apparatus comprises:

an osmotically driven membrane system comprising a source of dilute draw solution comprising thermally removable solutes;

a first distillation column comprising:

a first inlet coupled to the source of dilute draw solution for introducing a first portion of the dilute draw solution into a first end of the first distillation column;

a first heat transfer means coupled to the first distillation column at a second end, said first heat transfer means having an inlet coupled to a first source of thermal energy and an outlet coupled to the first distillation column for directing the first source of thermal energy to the first distillation column to cause at least a portion of the dilute draw solution solutes in the first distillation column to vaporize; and

a first outlet for removing the vaporized dilute draw solution solutes from the first distillation column; and

a second distillation column comprising:

a first inlet coupled to the source of dilute draw solution for introducing a second portion of the dilute draw solution into a first end of the second distillation column, wherein the first distillation column and the second distillation column are configured for parallel operation;

a second heat transfer means coupled to the second distillation column at a second end, said second heat transfer means having an inlet coupled to the first outlet of the first distillation column for receiving the vaporized dilute draw solution solutes for use as a second source of thermal energy for the second distillation column, a first outlet coupled to the second distillation column for directing the second source of thermal energy to the second distillation column to cause at least a portion of the dilute draw solution solutes in the second distillation column to vaporize, and a second outlet coupled to the osmotically driven membrane system for reintroducing the vaporized dilute draw solution solutes from the first distillation column condensed within the second heat transfer means to the osmotically driven membrane system; and

a first outlet for removing the vaporized dilute draw solution solutes from the second distillation column.

2. The apparatus as claimed in claim 1, wherein the first outlet of the second distillation column is coupled to the osmotically driven membrane system for reintroducing the vaporized dilute draw solution solutes from the second distillation column to the osmotically

driven membrane system.

3. The apparatus as claimed in claim 1, wherein the distillation columns further comprise second outlets for removing solvent from the distillation columns.

4. The apparatus as claimed in claim 1, further comprising:

a third distillation column comprising:

a first inlet coupled to the source of dilute draw solution for introducing a third portion of dilute draw solution into a first end of the third distillation column, wherein the third distillation column is configured for parallel operation with the first and second distillation columns;

a third heat transfer means coupled to the third distillation column at a second end, said third heat transfer means having an inlet coupled to the first outlet of the second distillation column for receiving the vaporized dilute draw solution solutes for use as a third source of thermal energy for the third distillation column, a first outlet coupled to the third distillation column for directing the third source of thermal energy to the third distillation column to cause at least a portion of the dilute draw solution solutes in the third distillation column to vaporize, and a second outlet coupled to the osmotically driven membrane system for reintroducing the vaporized dilute draw solution solutes from the second distillation column condensed within the third heat transfer means to the osmotically driven membrane system; and

a first outlet for removing the vaporized draw solution solutes from the third distillation column.

5. The apparatus as claimed in claim 4, wherein the first outlet of the third distillation column is coupled to the osmotically driven membrane system for reintroducing the vaporized dilute draw solution solutes from the third distillation column to the osmotically driven membrane system.

6. The apparatus as claimed in claim 4, wherein the third distillation column further comprises a second outlet for removing solvent from the third distillation column.

7. The apparatus as claimed in claim 1, wherein the first source of thermal energy supplies heat at a temperature of at least 50°C.

8. The apparatus as claimed in claim 7, wherein the first source of thermal energy supplies heat at a temperature from about 90°C to about 250°C.

9. The apparatus as claimed in claim 1, wherein the osmotically driven membrane system is a forward osmosis desalination system.

10. The apparatus as claimed in claim 1, wherein the dilute draw solution comprises an aqueous solution of ammonium salts formed from a mixture of ammonia and carbon dioxide.

11. The apparatus as claimed in claim 1, wherein the first source of thermal energy is steam.

12. The apparatus as claimed in claim 1, wherein the dilute draw solution has a concentration of at least 0.5 molar.

13. A method of recovering draw solution solutes from an osmotically driven membrane system, wherein the method comprises the steps of:

providing a source of dilute draw solution from the osmotically driven membrane system, wherein the dilute draw solution comprises thermally removable solutes;

introducing a first portion of the dilute draw solution to a first distillation column;

introducing in parallel a second portion of the dilute draw solution to a second distillation column;

introducing a source of thermal energy to a heat transfer means of the first distillation column;

vaporizing at least a portion of the dilute draw solution solutes out of the first portion of the dilute draw solution in the first distillation column;

directing the vaporized dilute draw solution solutes from the first distillation column to a heat transfer means of the second distillation column, wherein the vaporized dilute draw solution solutes from the first distillation column provide a second source of thermal energy for the second distillation column;

vaporizing at least a portion of the dilute draw solution solutes out of the second portion of the dilute draw solution in the second distillation column; and

recycling the vaporized draw solution solutes from the first distillation column condensed in the heat transfer means of the second distillation column to the osmotically driven membrane system.

14. The method as claimed in claim 13, wherein the osmotically driven membrane system comprises a forward osmotic desalination system.

15. The method as claimed in claim 13, wherein the step of introducing a source of thermal energy comprises introducing steam.

16. The method as claimed in claim 13, wherein at least one of the first portion or the second portion of the dilute draw solution is introduced at a concentration of about 0.5 molar

or greater.

17. The method as claimed in claim 16, wherein the at least one of the first portion or the second portion of the dilute draw solution is introduced at a concentration from about 0.5 molar to about 6.0 molar.

18. The method as claimed in claim 13, wherein the method further comprises the steps of:

introducing in parallel a third portion of the dilute draw solution to at least a third distillation column;

directing the vaporized dilute draw solution solutes from the second distillation column to a heat transfer means of the third distillation column, wherein the vaporized dilute draw solution solutes from the second distillation column provide a third source of thermal energy for the third distillation column;

vaporizing at least a portion of the dilute draw solution solutes out of the third portion of the dilute draw solution in the third distillation column; and

recycling the vaporized dilute draw solution solutes from the second distillation column condensed in the heat transfer means of the third distillation column to the osmotically driven membrane system.

19. The method as claimed in claim 13, further comprising the step of recycling the vaporized dilute draw solution solutes from the second distillation column to the osmotically driven membrane system.

20. The method as claimed in claim 13, wherein the step of introducing a source of thermal energy comprises introducing heat at a temperature of at least 50°C.

21. The method as claimed in claim 20, wherein the step of introducing a source of thermal energy comprises introducing heat at a temperature from about 90°C to about 250°C.

22. The method as claimed in claim 13, further comprising the step of removing solvent from the distillation columns.