amount of solids dissolved in the feed stream 18. Thus, it may be necessary to increase the pressure of the brine stream 16 to a higher pressure relative to the pressure of the feed stream 18. A motor-driven, interstage pump (not shown) may be included between the membrane arrays 12, 52 to increase the pressure of the brine stream 16 to this higher pressure. However, since the booster 152 is driven by the hydraulic energy in the brine stream 16, the booster 152 may consume less energy relative to the interstage pump. In addition, using the booster 152 may allow the pressure of the feed stream 18 to be reduced. Thus, the feed pump 20 and the motor 22 may be reduced in size since a reduced amount of pressure is required by them. In addition, the amount of energy consumed by the feed pump 20 and the motor 22 may be reduced.

SUMMARY

[0017] This section provides a general summary of the disclosure, and is not a comprehensive disclosure of its full scope or all of its features.

[0018] A ~~first~~ reverse osmosis system according to an aspect of the present ~~disclosure~~ invention includes a pump, a first membrane array, a second membrane array, a hydraulic pressure booster, and a motor-generator. The pump is operable to pressurize a feed stream. The first membrane array is configured to receive the feed stream and to generate a first permeate stream and a first brine stream from ~~a~~ the feed stream. The second membrane array is configured to receive the first brine stream and to generate a second permeate stream and a second brine stream from the first brine stream. The hydraulic pressure booster is configured to receive at least a first portion of the second brine stream and to use energy from the first portion of the second brine stream to increase pressure of at least one of the feed stream and the first brine stream. The motor-generator is coupled to the hydraulic pressure booster and is operable to use energy from a power supply to drive the hydraulic pressure booster. The motor-generator is also operable to use energy from the second brine stream to provide power to the power supply.

[0019] A ~~second~~ reverse osmosis system according to another aspect of the present ~~disclosure~~ invention includes a pump, a first membrane array, a second membrane array, a first hydraulic pressure booster, and a second

hydraulic pressure booster. The pump is operable to pressurize a feed stream. The first membrane array is

configured to receive the feed stream and to generate a first permeate stream and a first brine stream from the feed stream. The second membrane array is configured to receive the first brine stream and to generate a second permeate stream and a second brine stream from the first brine stream. The first hydraulic pressure booster is configured to receive a first portion of the second brine stream and to use energy from the second brine stream to increase the pressure of the first brine stream. The second hydraulic pressure booster is configured to receive a second portion of the second brine stream and to use energy from the second brine stream to increase the pressure of the feed stream.

[0020] A method for operating a reverse osmosis system according to another aspect of the present ~~disclosure~~ invention includes directing a feed stream to a first membrane array to separate the feed stream into a first permeate stream and a first brine stream, directing the first brine stream to a second membrane array to separate the first brine stream into a second permeate stream and a second brine stream, and controlling a torque output of a motor-generator coupled to a first hydraulic pressure booster to adjust an amount by which the first hydraulic booster increases a pressure of at least one of the feed stream and the first brine stream.

[0021] Further areas of applicability will become apparent from the description provided herein. The description and specific examples in this summary are intended for purposes of illustration only and are not intended to limit the scope of the present disclosure.

DRAWINGS

[0022] The drawings described herein are for illustrative purposes only of selected embodiments and not all possible implementations, and are not intended to limit the scope of the present disclosure.

[0023] FIG. 1 is a schematic view of a first reverse osmosis system according to the prior art;

[0024] FIG. 2 is a schematic view of a second reverse osmosis system according to the prior art;

[0025] FIG. 3 is a schematic view of a third reverse osmosis system according to the prior art;