



Produced Water Reuse towards Circularity: Case Study in Oil Facilities

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Overview

- Introduction
- Produced Water Reuse
- Technologies
- Case Study 1: Low Salinity Produced Water
- Case Study 2: High Salinity Produced Water
- Water Circularity in Oil Operations
- Path Forward



Introduction: Oil and Gas Supply Chain



5 Crude Grades
(Arab Light)

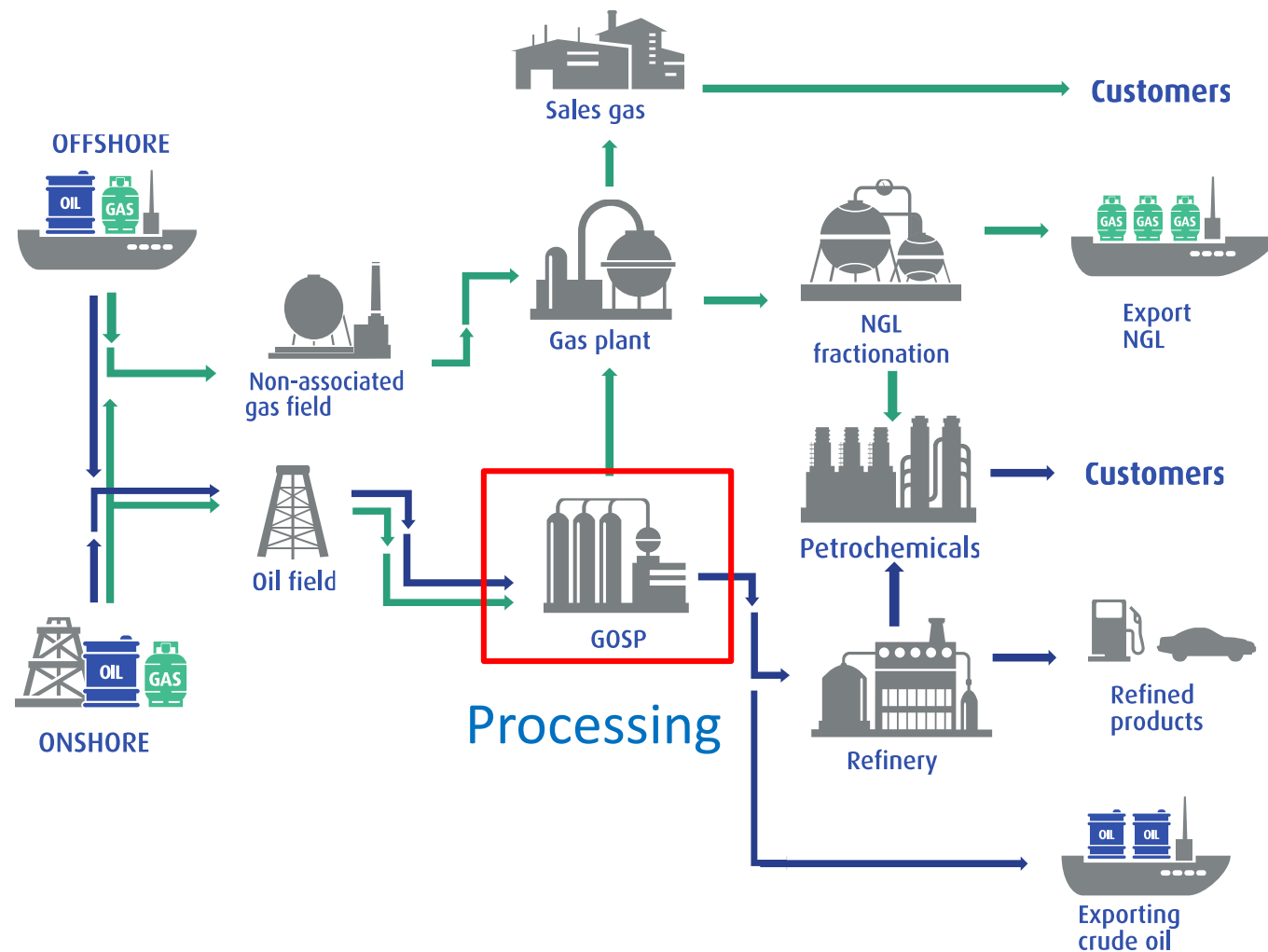


50+ GOSPs

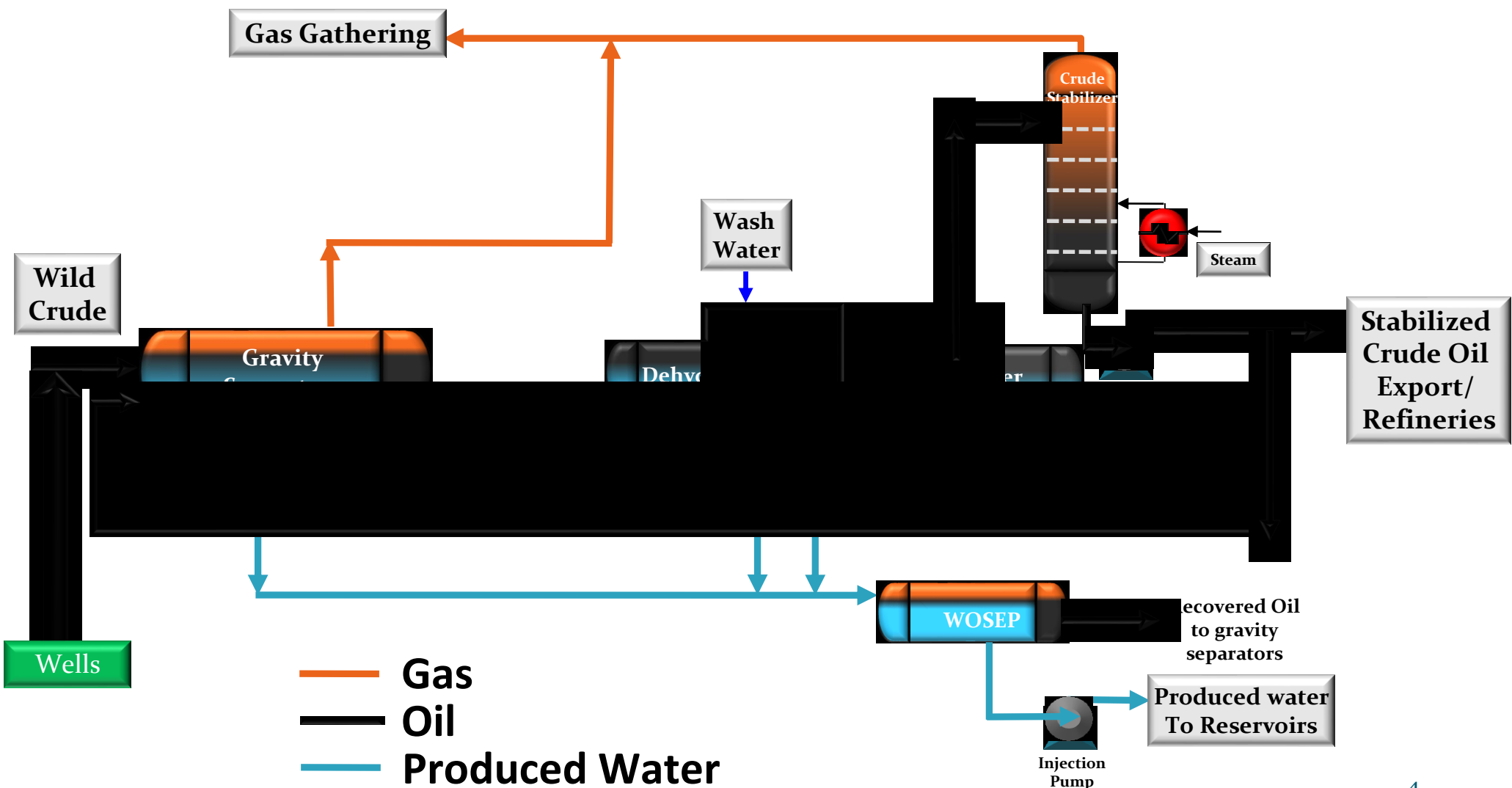


Crude Quality Spec:

- BS&W
- Salt-in-Crude
- H₂S
- Vapor Pressure



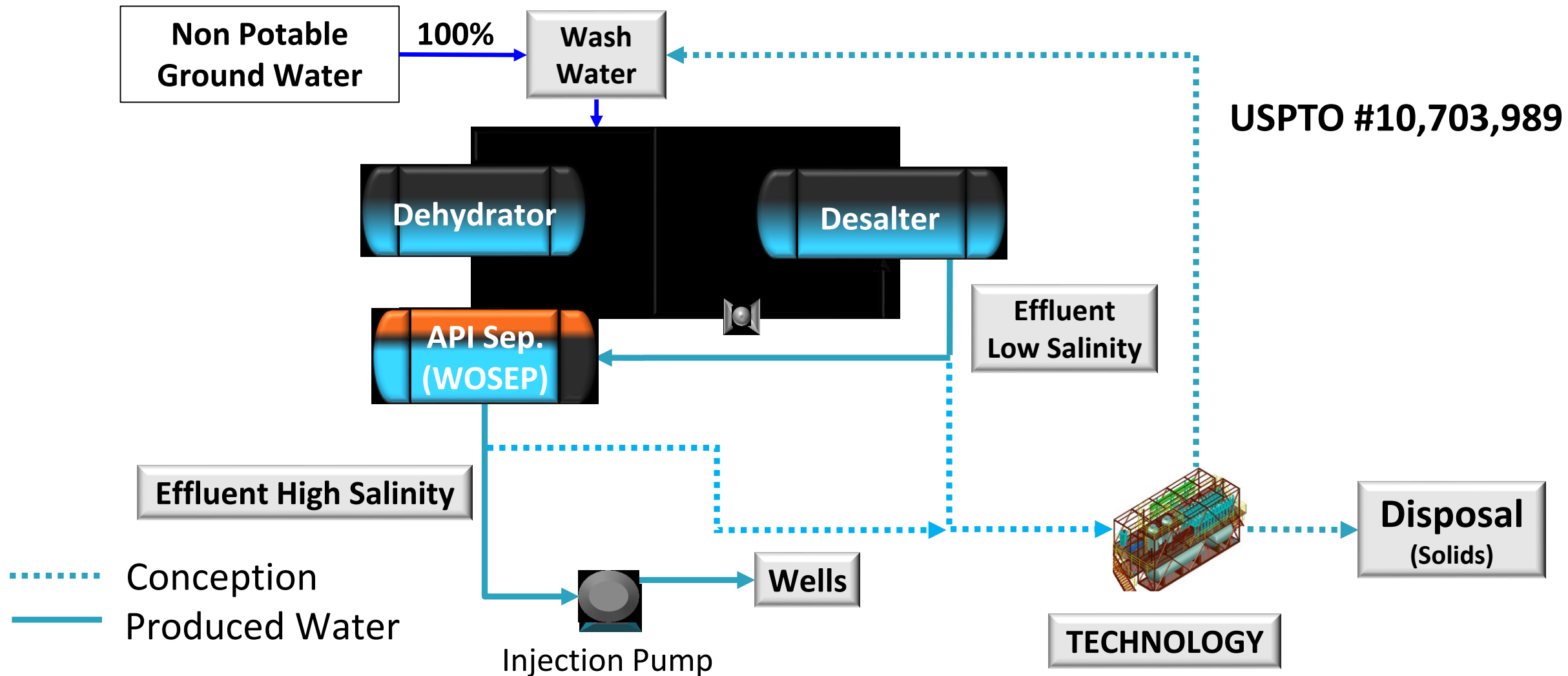
Introduction: Gas Oil Separation Plant (GOSP)



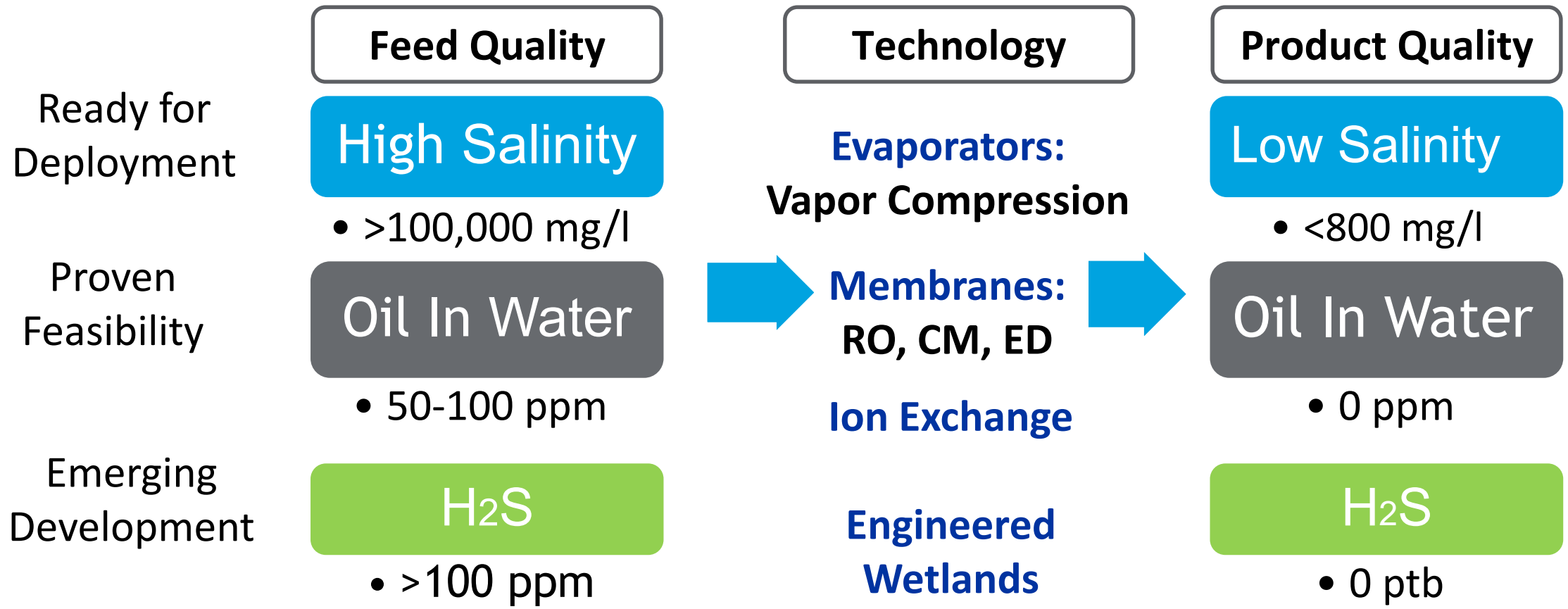
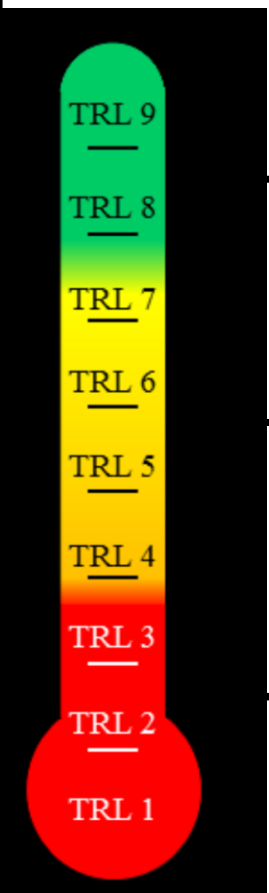
Introduction: Water Quality

mg/L	Non Potable Aquifer Water 1	Non Potable Aquifer Water 2	Seawater	Produced Water 1	Produced Water 2	Produced Water 3	Produced Water 4
Sodium (Na)	1600	16360	17600	39000	25000	52600	71477
Calcium (Ca)	580	3480	620	10000	8640	23800	19200
Magnesium (Mg)	100	690	2100	1130	1420	3120	1922
Barium (Ba)	--	--	--	1.8	4.6	10	--
Carbonate (CO3)	--	--	20	--	--	--	--
Bicarbonate (HCO3)	180	180	120	515	440	130	195
Chloride (Cl)	2890	32470	31000	45331	57800	132000	149600
Sulfate (SO4)	1090	1100	4280	618	557	320	366
Strontium (Sr)	14	40	--	350	370	950	--
TDS	6454	54320	55740	98393	94157	212930	242830
T/°F (°C)	--	--	--	155 (68)	160 (70)	220 (104)	185 (85)

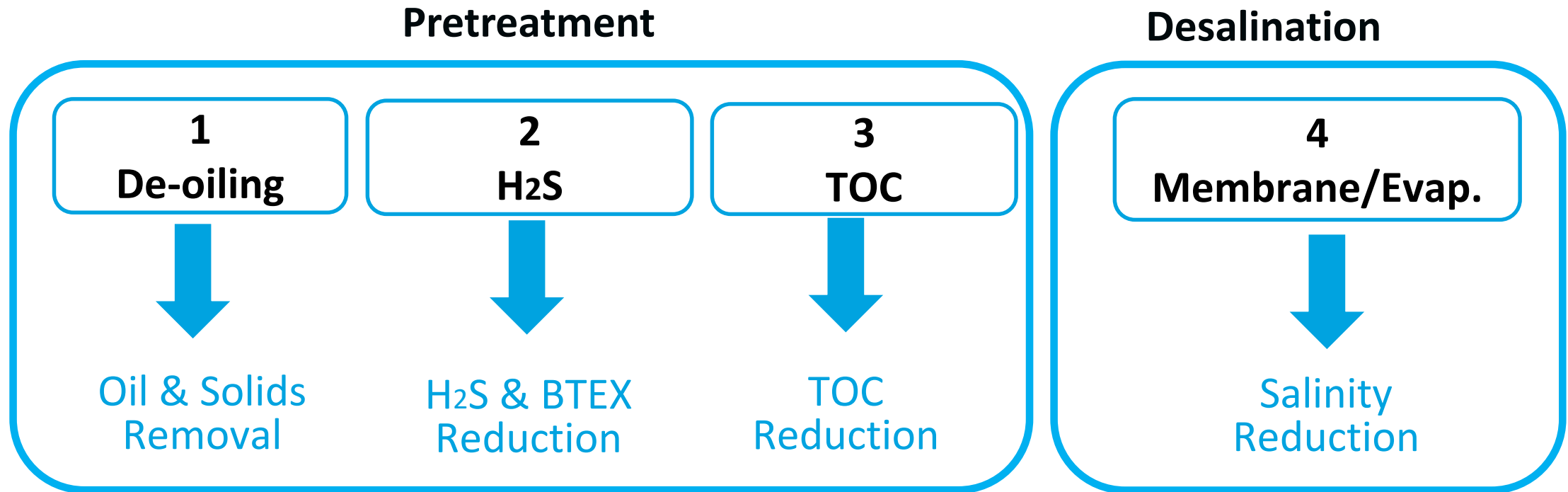
Produced Water Reuse



Technology Selection Plan : Produced Water Desalination

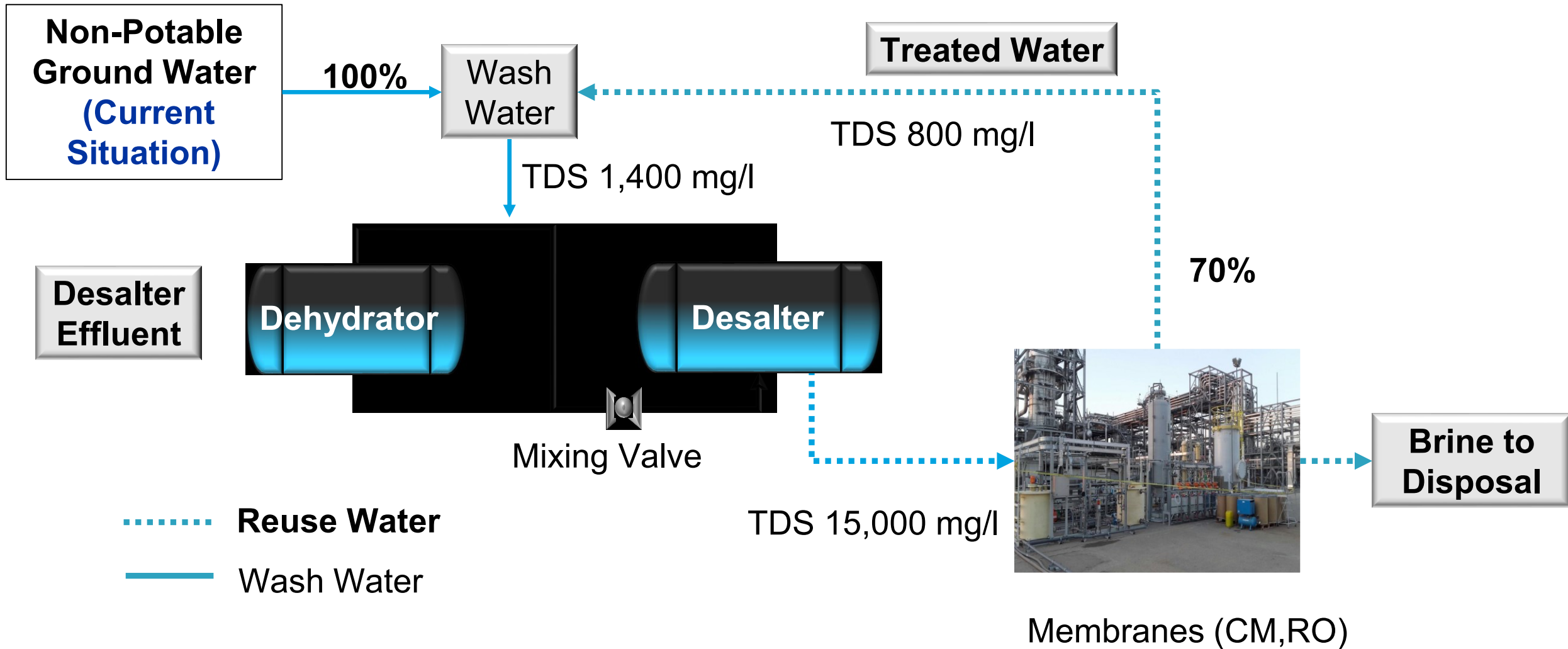


Produced Water Desalination: Process Scheme



24 x 7; 70% Water Recovery; High Temperature 140-150°F (60-65°C)

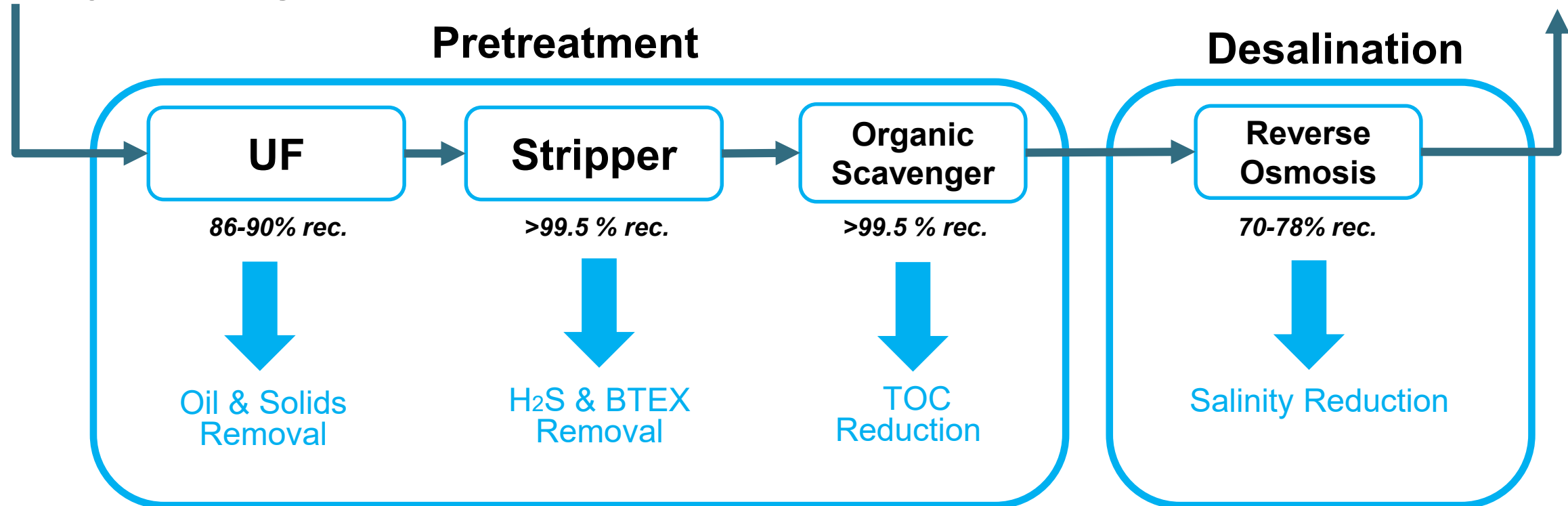
Case Study 1: Low Salinity Produced Water



Case Study 1: Low Salinity Produced Water

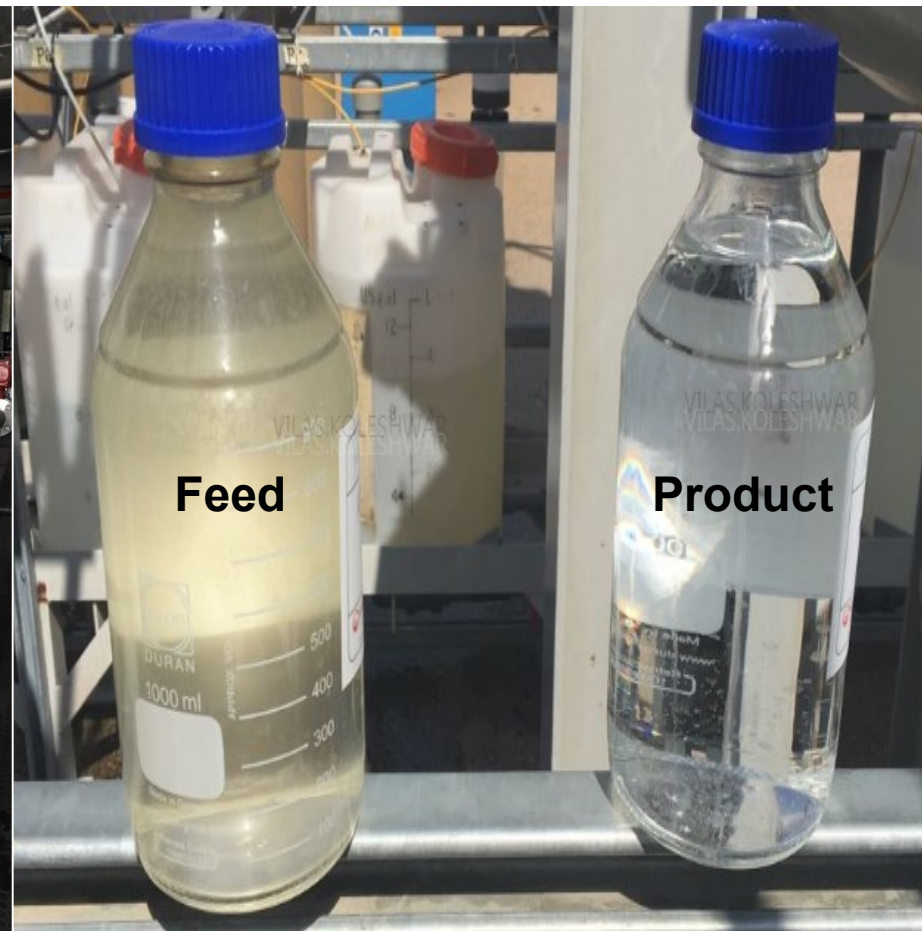
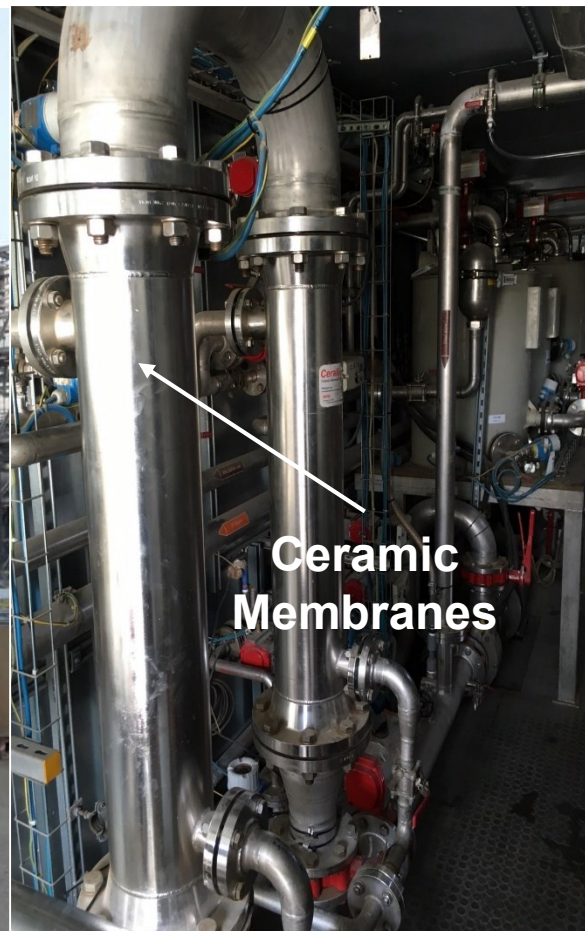
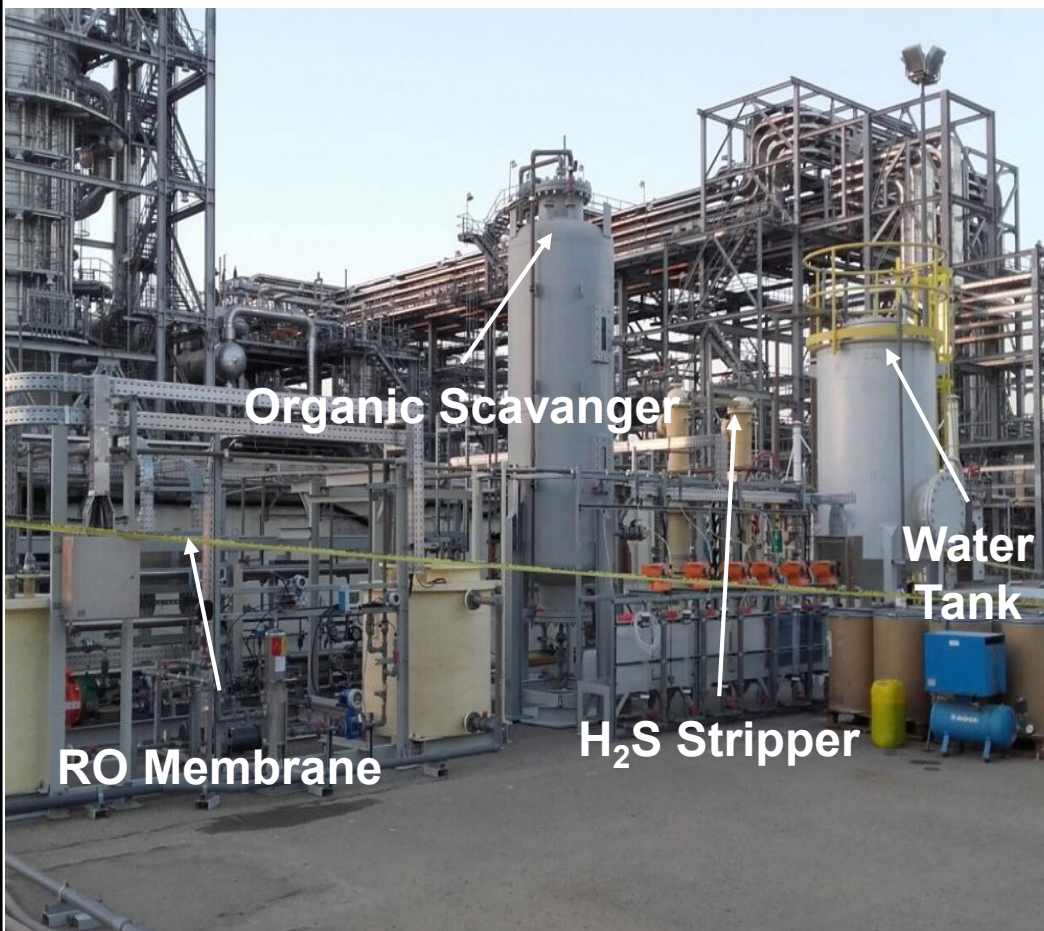
Feed: Produced Water
Salinity: 10,962 mg/l

Product: Water
Salinity: <1,000 mg/l

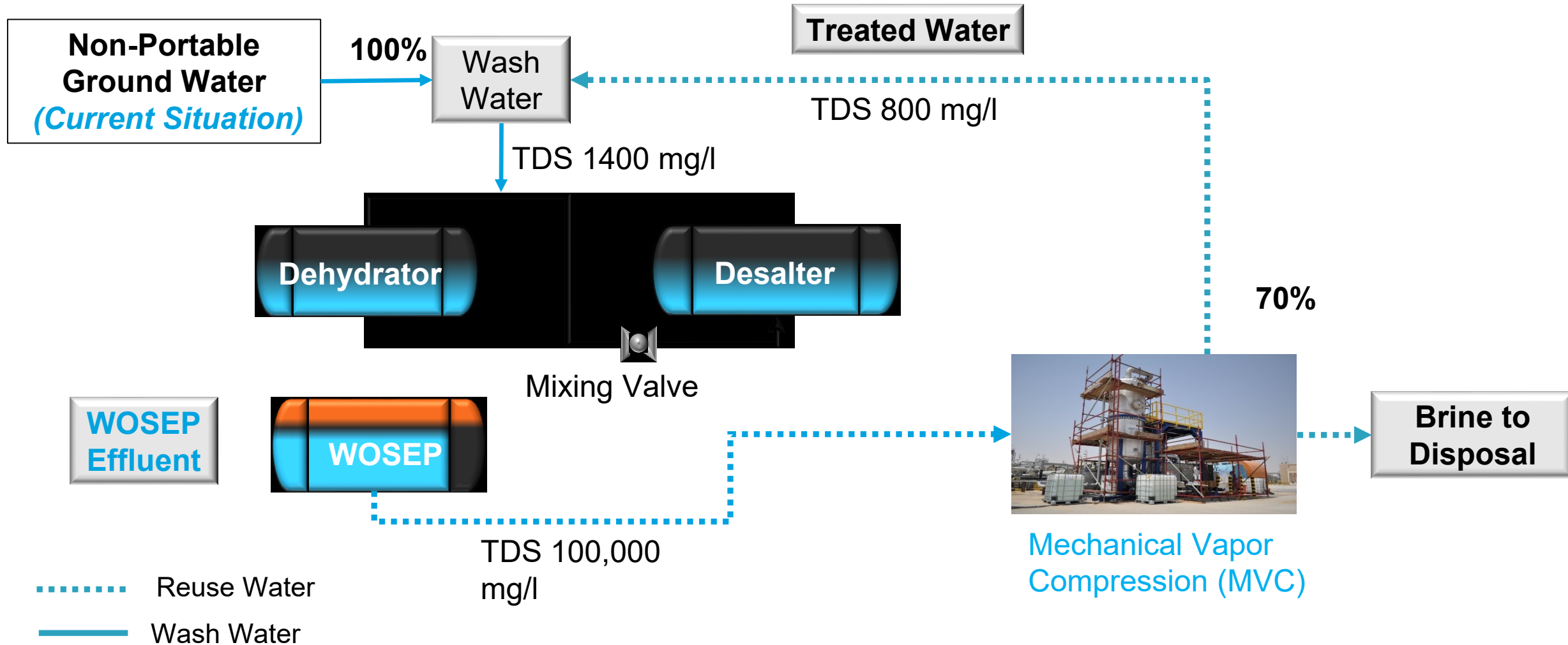


High Temperature 140-150 ° F (60-65 ° C)

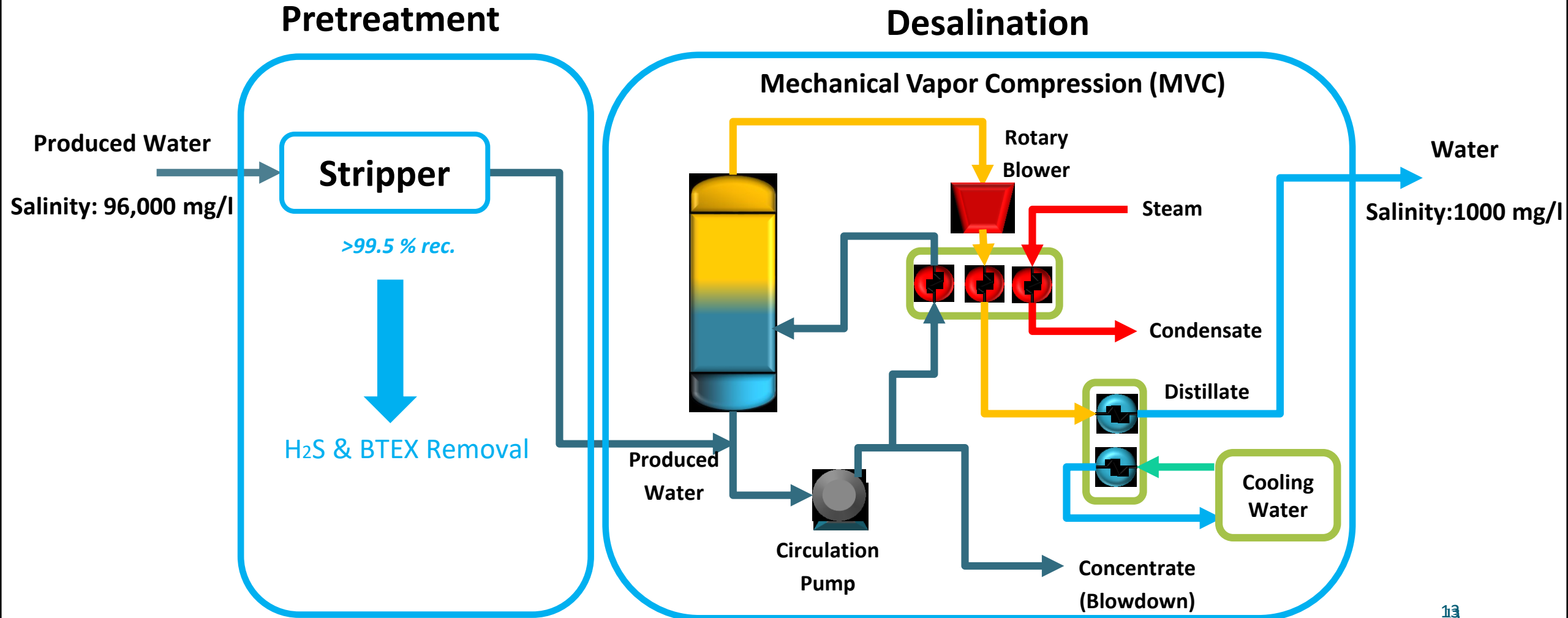
Case Study 1: Low Salinity Produced Water



Case Study 2: High Salinity Produced Water



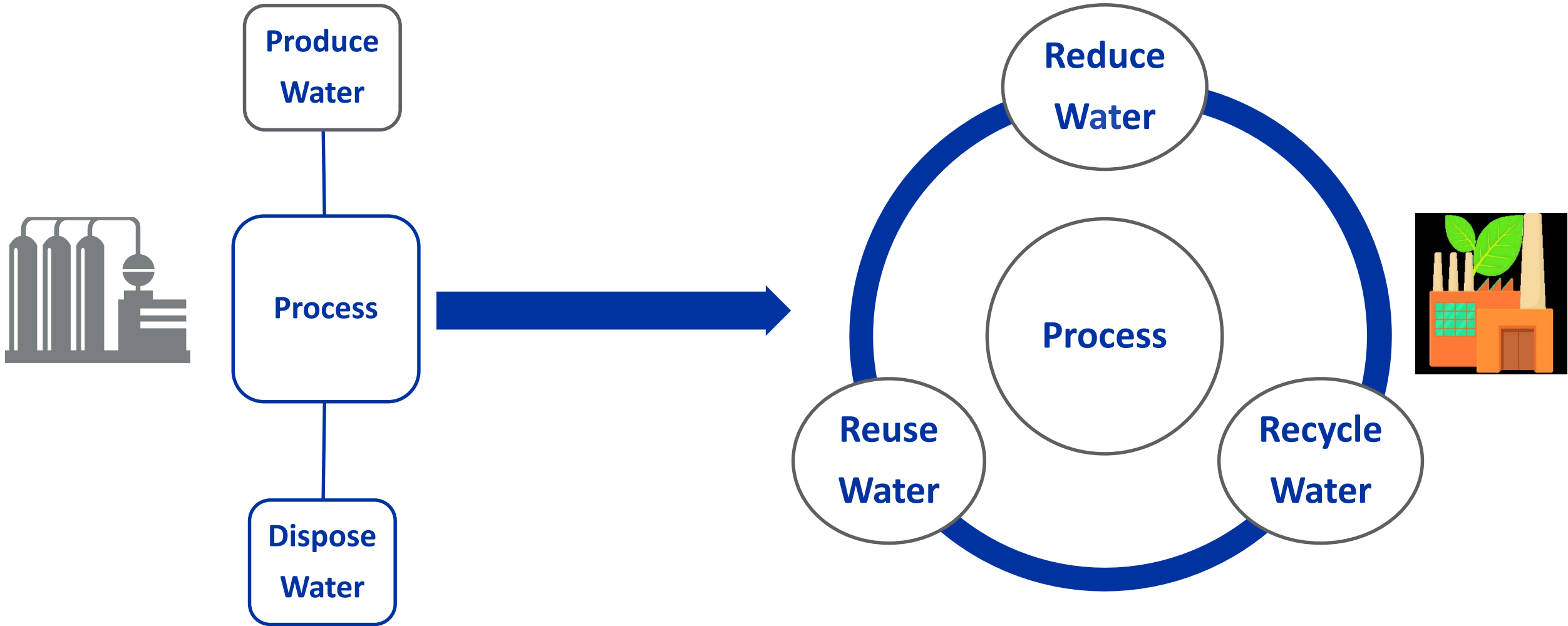
Case Study 2: High Salinity Produced Water



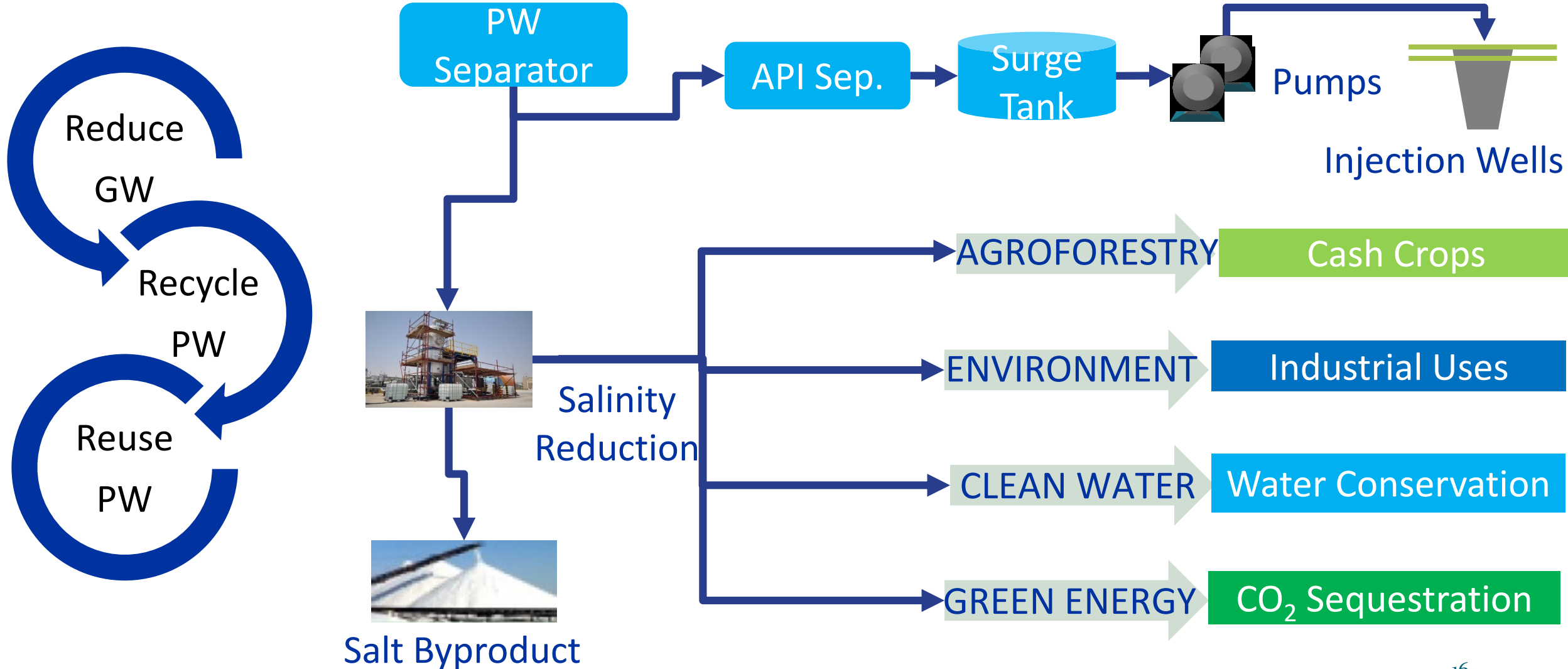
Case Study 2: High Salinity Produced Water



Water Circularity

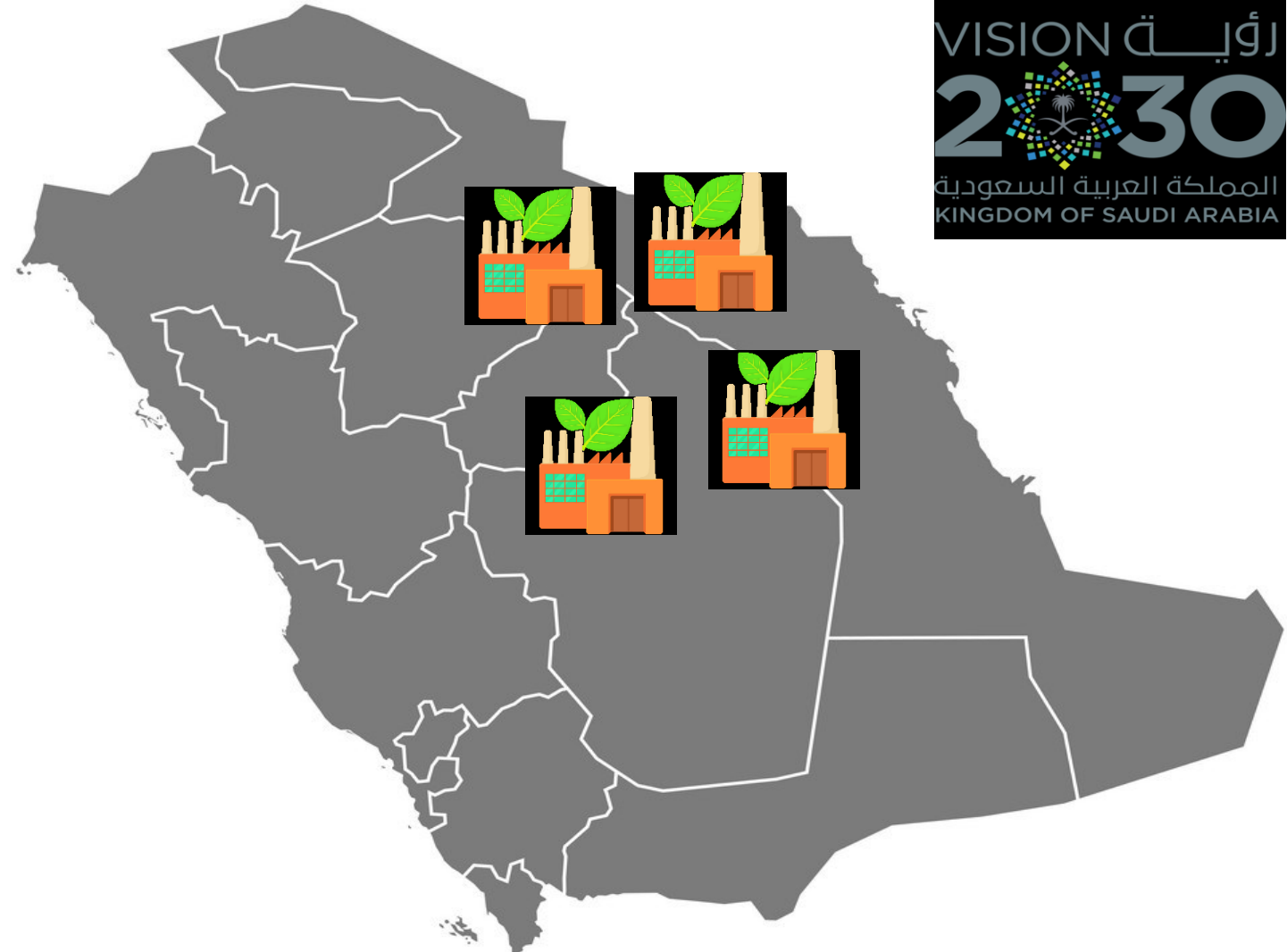


Value Opportunity : Water Circularity



Path Forward: Produced Water Reuse Challenges

- High Salinity
- Technology
- Energy
- Policy



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