

# Ceramic Technology & Economics For Production Water Repurposing & Irrigation



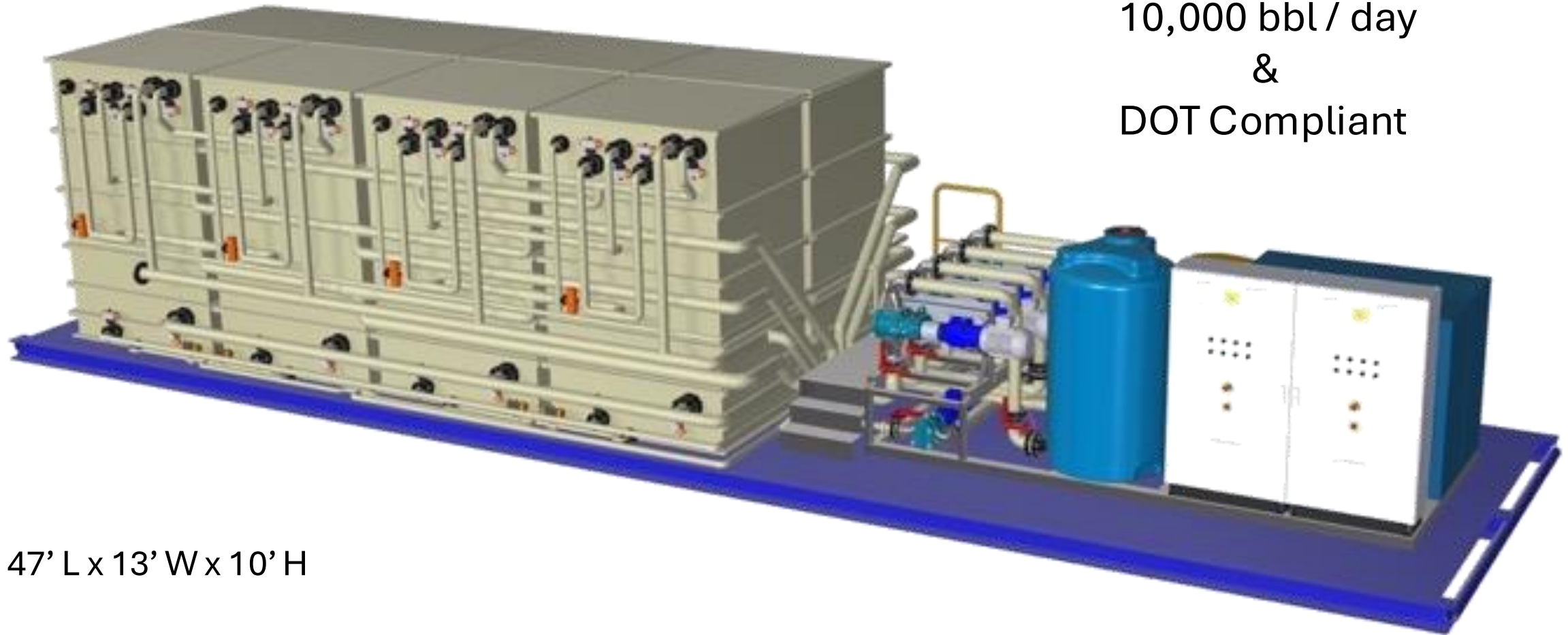
**International Certified CleanTech Water Stewardship Company**

Founded 2013

Brian J. Ward, APATEQ

# OilPaq Ceramic Technology

10,000 bbl / day  
&  
DOT Compliant



47' L x 13' W x 10' H

# Dilemma

“By **2030**, oil and gas geological plays across the U.S. are expected to produce more than **60 million barrels of produced water per day.**”

**In < 5 years**

**21.9 Trillion bbls production water per year!!!**

**The production water tsunami, but no where to put it???**

# What Is The Solution?

**Stop using fresh water**

**Less than 1.0% O&G operations require fresh water**

Stewardship

E&P / Water Service Paradigms / Production

Recycling & Reclamation

***Technology is READY!***

Repurpose & Replenishment

Industry / Agriculture / Riparian / Aquifer

Conservation & Reservoir

State Permitting & Regulation

Community & Voters

***SAFETY READY*** / Unbiased Education & Media

# Production Water Service Industries

**Sustainability**

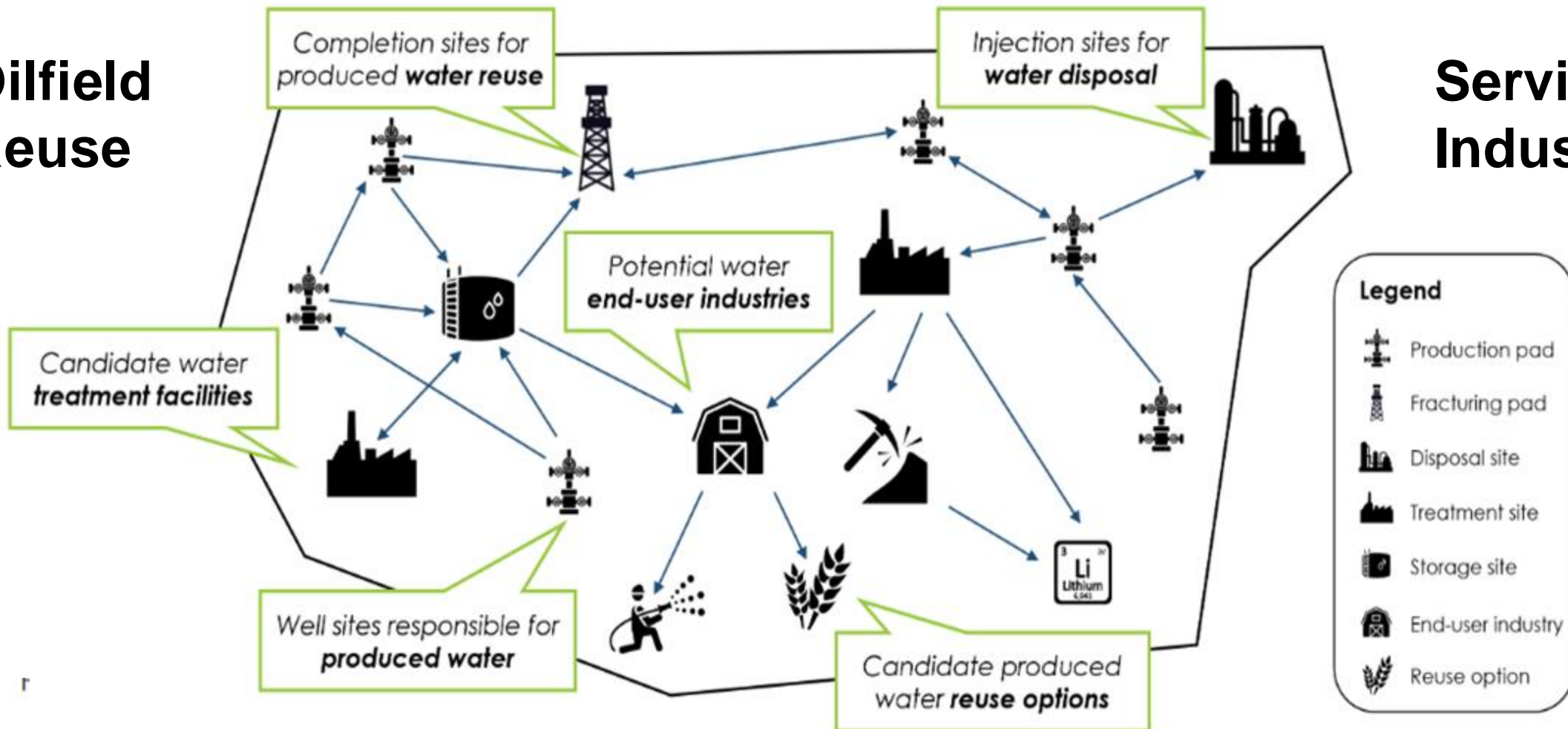
**Stewardship**

~ 13,825,419,000 bbl Reused / 2021

< 11,802,853,000 bbl to be Recycled / 2021

**Oilfield Reuse**

**Service Industries**



# OilPaq Service Industries' Applications

## Most Economical & Highest Quality Brine Water



SWD & Brine Water Reuse

- Reduces Seismic Stimulation
- Reduces SWD Downhole Pressure
- Tank Farm/Midstream Distribution
- Revitalizes SWD Strata
- Extend SWD Lifespans
- Conserves Fresh Water Resources
- Industry Repurpose & AG Irrigation
- P&A Orphan Wells
- Mineral Mining
- Chemical Production
- Industrial / Refrigeration / Cooling Tower / Deicing



Economical Pretreat Desalination Tech's



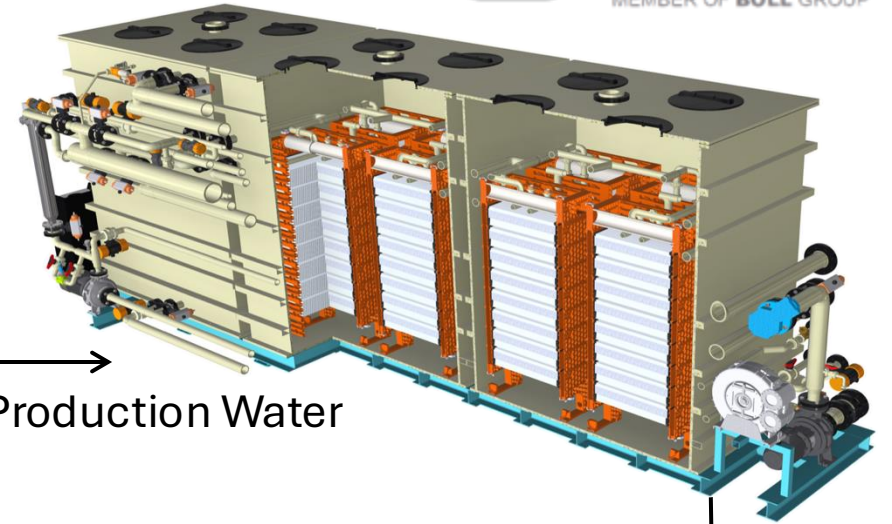
Pipeline



Truck



Production Water Hub Facility



Production Water

Production Water

# \$ Venture Capital Investment \$

Existing Production Water Network Infrastructure

Highest Quality & Lowest Cost Brine

Drilling



Fracking



Workovers



Disposal



Irrigation



Weighted Brines & Other Industry Repurposing

# OilPaq Brine Quality

Lowest OPEX & Highest Quality Brine Water

## Water Quality

- UF Filtration 0.1  $\mu\text{m}$
- TSS < 1.0 mg/l, typical
- TPH < 1.0 ppm, typical
- SRB & APB removal > 99.0 %

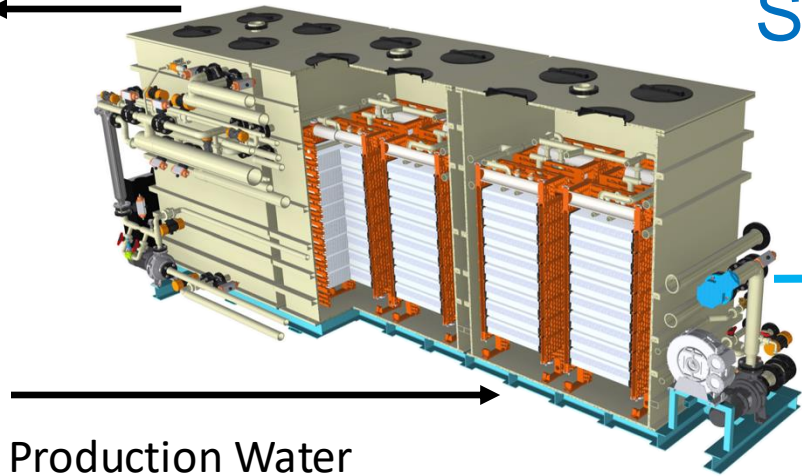


Profitability: Why pay more for lesser quality brine?

# OilPaq

## SWD & Desalination Process

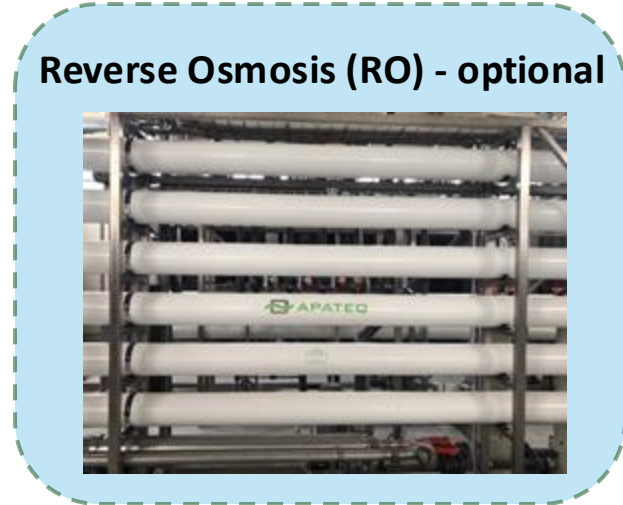
Recovered Oil



99% Brine recovery  
Highest Quality Brine

If TDS is < 30,000 mg/l

Reverse Osmosis (RO) - optional



~ 80%  
Freshwater  
Recovery

Permeate Out



Irrigation  
Quality

Frack & Repurpose



SWD



Water Desalination



Economical Pretreatment

Alleviate Seismic Stimulation & Decrease Downhole Pressures

# OilPaq

## Optimize SWD Capacity

$$\beta_{\text{SWD}} = \frac{\text{Solids}_{\text{Raw PW}}}{\text{Solids}_{\text{Treated PW}}}$$

$\beta$  SWD Capacity = + 300% SWD Lifespan

**Decrease SWD Downhole Pressure**

**Alleviates SWD Seismicity**

**Decrease SWD Acid Jobs & Workovers**

# OilPaq

## Production Water Solids & Oil Separation



# OilPaq

Optimize SWD Operations

**SWD Pilot:** 24 hours at 1,000 bbl/day = **650 lbs solids/day**

**10,000 bbl/day SWD**

**1,186 Tons solids/year**

~ 10 Ton dump truck every 3 days



# OilPaq

## Pilot Operations



# OilPaq

## Pilot Analytics Summary

		Reduction	Inlet mg/l	Outlet mg/l	Part. Size $\mu\text{m}$
Test 1	TSS	89.0%	83.9	9	< 0.1
	TPH	Below Detection	12.06	< 1.0	
	BTEX	90.0%	0.16	0.016	
Test 2	TSS	99.7%	139	0.4	< 0.1
	TPH	Below Detection	2.3	< 1.0	
Test 3	TSS	93.0%	295	20	< 0.1
	TPH	Below Detection	30.82	< 1.0	
	BTEX	99.0%	1.22	0.011	
Test 4	TSS	49.0%	442	226	< 0.1
	TPH	Below Detection	12.73	< 1.0	
	BTEX	94.0%	0.325	0.019	

		Reduction	Inlet mg/l	Outlet mg/l	Part. Size $\mu\text{m}$
Test 5	TSS	93.0%	190	13	< 0.1
	TPH	Below Detection	39.6	< 1.0	
	BTEX	98.0%	1.24	0.022	
Test 6	TSS	99.8%	374	9	< 0.1
	TPH	Below Detection	3.8	< 1.0	
Test 7	TSS	91.0%	156	14	< 0.1
	TPH	Below Detection	139	< 1.0	
	TPH	99.0%	1.96	0.029	
Test 8	TSS	95.0%	457	22	< 0.1
	TPH	Below Detection	171.8	< 1.0	
	BTEX	99%	2.27	0.03	

# OilPaq

## Electrical OPEX

Electrical consumption 10,000 bbl/day OilPaq ~ \$0.10 kWh/bbl

<b>Barrels / Day</b>	<b>Expense / Barrel</b>	<b>Expense / Day</b>	<b>kWh / Barrel</b>	<b>kWh / Daily</b>	<b>kWh Rate</b>
<b>2,500</b>	▼ <b>\$0.0145</b>	<b>\$36.25</b>	0.145	362.5	\$0.10/kWh
<b>5,000</b>	▼ <b>\$0.0120</b>	<b>\$60.00</b>	0.12	▼ 600.0	\$0.10/kWh
<b>10,000</b>	▼ <b>\$0.0090</b>	<b>\$90.00</b>	0.09	▼ 900.0	\$0.10/kWh

Profitability: Why pay more for lesser quality brine?

# OilPaq

## Chemicals OPEX

### Assumptions:

- Amount of NaOH and H3PO4 used for CIP is water quality dependent
- **One CIP / month**
- H<sub>2</sub>O<sub>2</sub> and O<sub>3</sub> oxidation additional expense

Barrels / Day	Expense / BBL	H3PO4 gal / CIP	Price / gal	Expense / CIP	CIP Expense / Day
2,500	\$0.002	10.3	\$15.10	\$155.53	\$5.18
5,000	\$0.002	20.6	\$15.10	\$311.06	\$10.36
10,000	\$0.002	41.2	\$15.10	\$622.12	\$20.73

Barrels. / Day	Expense / BBL	NaOH g gal / CIP	Price / gal	Expense / CIP	CIP Expense / Day
2,500	\$0.0002	3.43	\$4.77	\$16.36	\$0.55
5,000	\$0.0002	6.08	\$4.77	\$29.00	\$0.97
10,000	\$0.0002	\$9.56	\$4.77	\$45.60	\$1.53

# OilPaq

## CIP OPEX

**Conservative: \$0.10/gal rate used to offset truck delivery expense**

CIP Water Expenses				
OilPaq BBL / Day	CIP Water Expense / BBL	CIP Water Gallons	CIP Water Expense / gal	CIP Water Expense
2,500	▼ \$0.0028	2100	\$0.10	\$210.00
5,000	▼ \$0.0028	4200	\$0.10	\$420.00
10,000	▼ \$0.0028	8400	\$0.10	\$42.00

**Profitability: Why pay more for lesser quality brine?**

# OilPaq

## OPEX / Barrel

Daily Volume	2,500 bbl/day	5,000 bbl/day	10,000 bbl/day
<b>OilPaq OPEX</b>	<b>\$0.0215 / bbl</b>	<b>\$0.019 / bbl</b>	<b>\$0.016/ bbl</b>
Power / bbl	0.0145	0.012	0.009
NaOH / bbl	0.002	0.002	0.002
H3PO4 / bbl	0.0002	0.0002	0.0002
Water / bbl	0.0028	0.0028	0.0028
Comp Air /bbl	0.002	0.002	0.002
	<b>\$0.0215</b>	<b>\$0.019</b>	<b>\$0.016</b>

Profitability: Why pay more for lesser quality brine?

# OilPaq Costs

## Ceramic Plate Technology

**10,000 bb / day OilPaq**

### Amortized

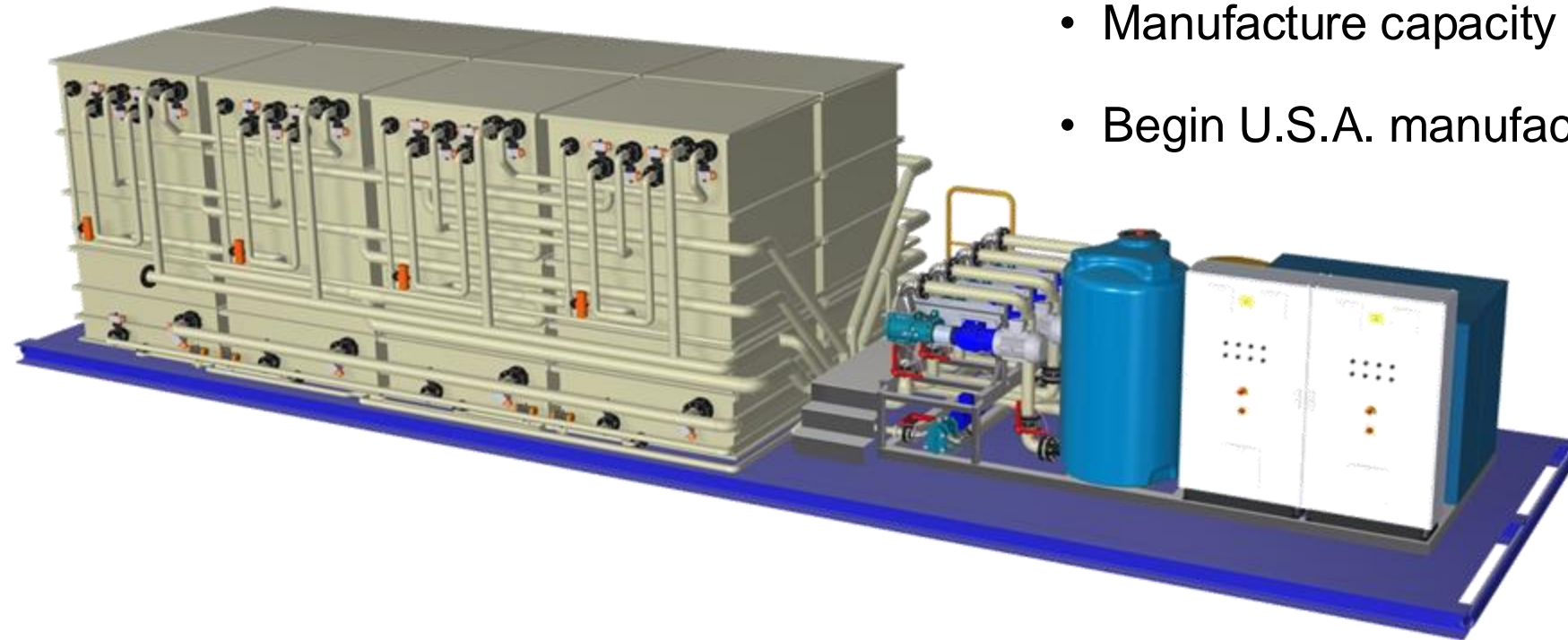
5 years	OPEX + CAPEX	< \$0.10/bbl
10 years	OPEX + CAPEX	< \$0.05/bbl
15 years	OPEX + CAPEX	< \$0.0375/bbl
20 years	OPEX + CAPEX	< \$0.025/bbl

Profitability: Why pay more for lesser quality brine?

# OilPaq

## U.S.A. Manufacturing

- Establish U.S.A. Manufacturing Center
- Requires sustained two OilPaqs per month
- Manufacture capacity ramped up to 100 + OilPaq's / yr
- Begin U.S.A. manufacturing 4<sup>th</sup> Quarter 2025





# Optimize SWD's & Irrigation Restoration

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**Profitability: Why pay more for lesser quality brine?**