

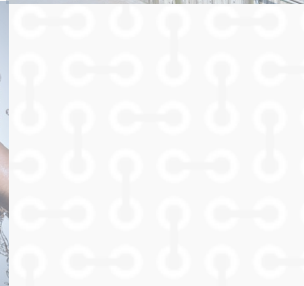
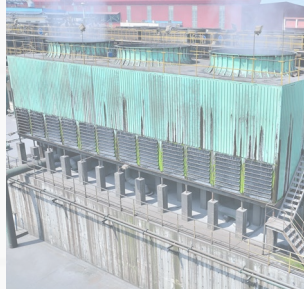
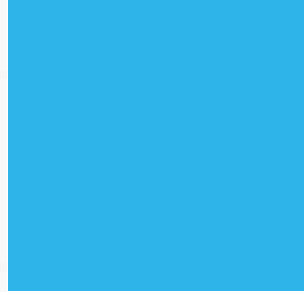
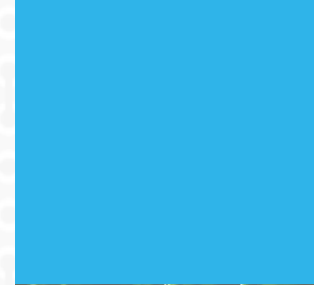


TIEEP Water Forum

Introduction to Voltea's CapDI Technology and its Applications

6-May-21

Joshua Summers



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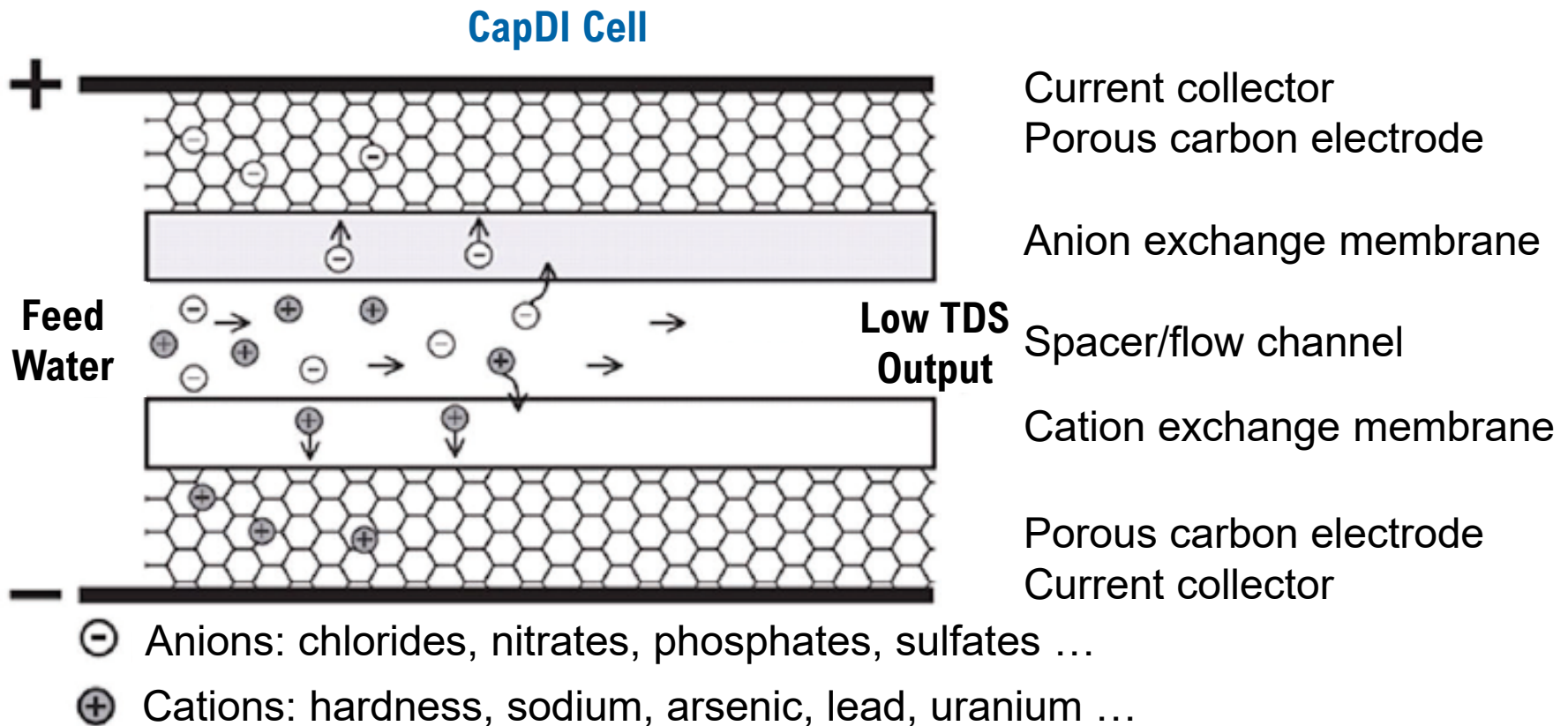


What is CapDI?



What is CapDI Technology?

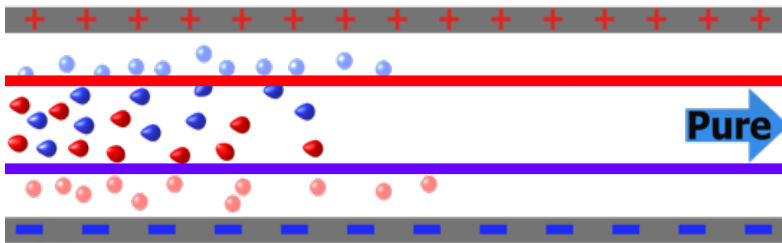
CapDI (Membrane Capacitive Deionization) is a patented electrical process allowing the removal of ions from water.



What is CapDI Technology?

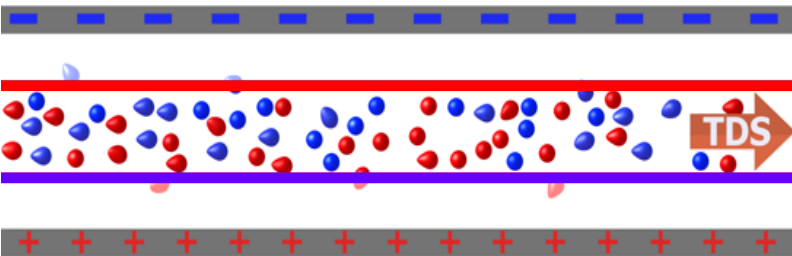
Two step process using <1.2 V DC to remove TDS/ions from feed water

Step 1 - Purification:



Feed water passes between oppositely charged electrodes which electrostatically remove dissolved ions, leaving low TDS water flowing out of the cell.

Step 2 – Regeneration/waste:

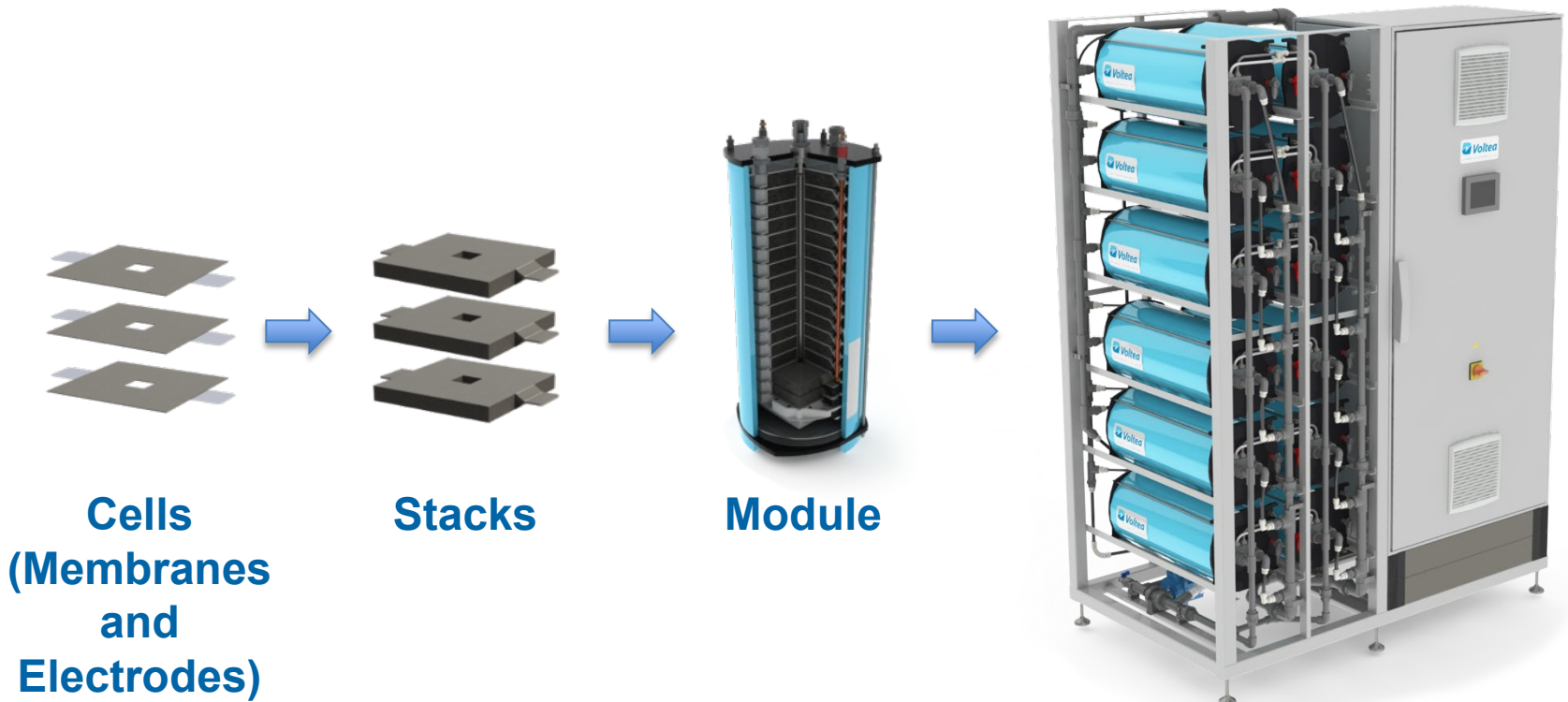


Feed water flushes through the cell at a lower flow rate, while electrode polarity is reversed. Ions are rejected from the electrode surface, concentrated in the flow channel and flushed from the cell before the cycle is repeated.

System Composition : From Cells to Systems

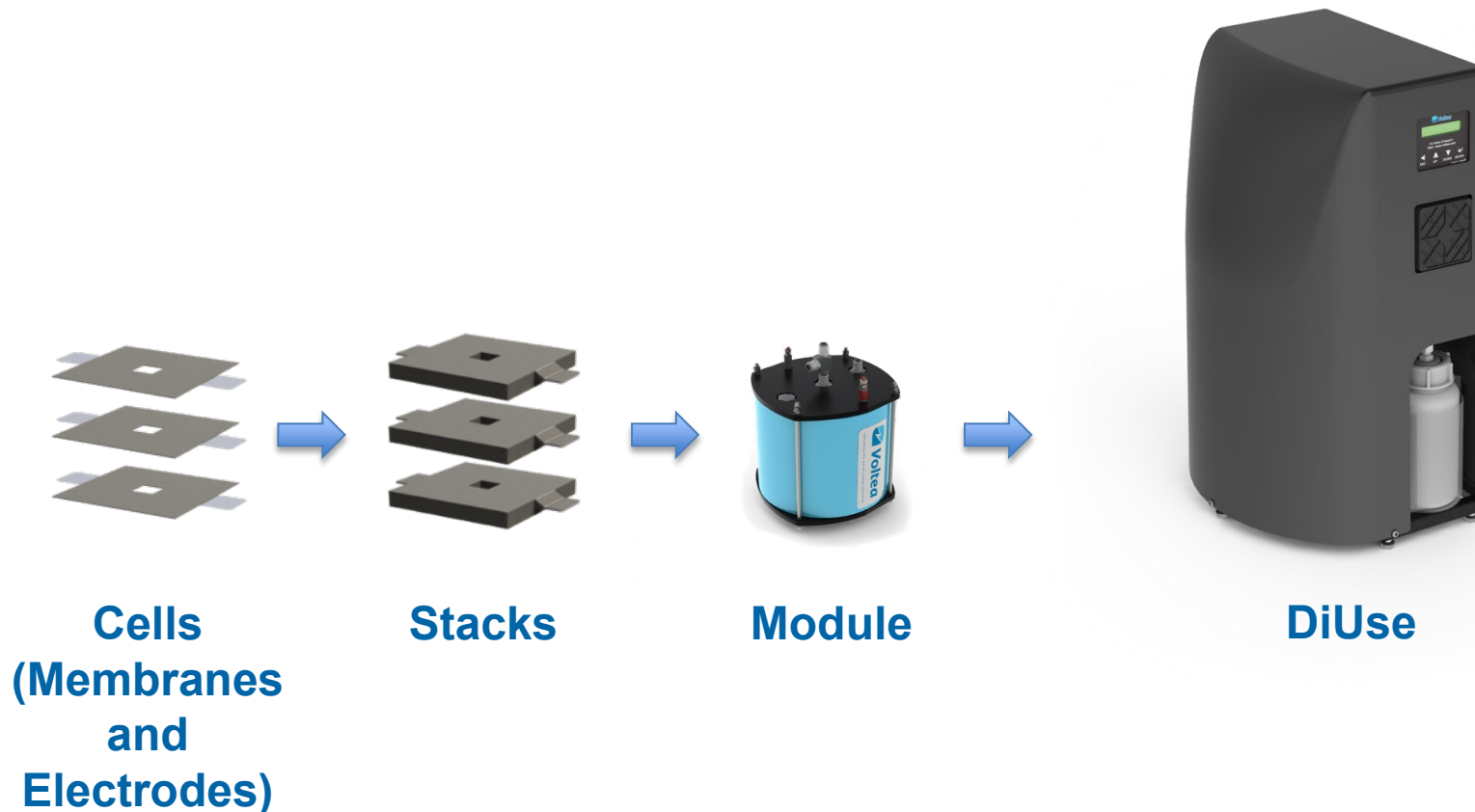
Our CapDI Systems are composed of modules, which are built from stacks comprising of membrane and electrode cells

Flow rate, feed salinity and targeted purified water quality will determine the number of modules required, while our systems allow easy expansion to meet any increased water demands.



System Composition : From Cells to Systems

Our CapDI Systems are composed of modules, which are built from stacks comprising of membrane and electrode cells





CapDI Advantages

CapDI - Clear Differentiation

CapDI is uniquely different from traditional deionization technologies:

- Salt-Free Softening*
- High Water Recovery*
- Minimal Maintenance*
- No Additional Discharge Permitting*
- Modular Installation*
- Low Fouling Potential*
- Tunable Deionization*
- Low Energy Consumption*
- Minimum Chemical Use*
- Built-In Remote Monitoring and Control*
- Tolerant to chlorine/disinfectants*
- Unaffected By Silica*

A collage of four images: top-left shows a modern kitchen sink; top-right shows a red industrial building; middle-left shows a green corrugated metal wall; middle-right shows green tomatoes on a vine; bottom-left shows a white kitchen counter; bottom-right shows a white dishwasher rack filled with silverware.

Applications

One technology, four broad applications, countless solutions

Residential

Commercial &
Industrial

Ag Tech

Research
and JDA

Voltea's **CapDI** Systems provide **clean, pure water** for an array of applications.

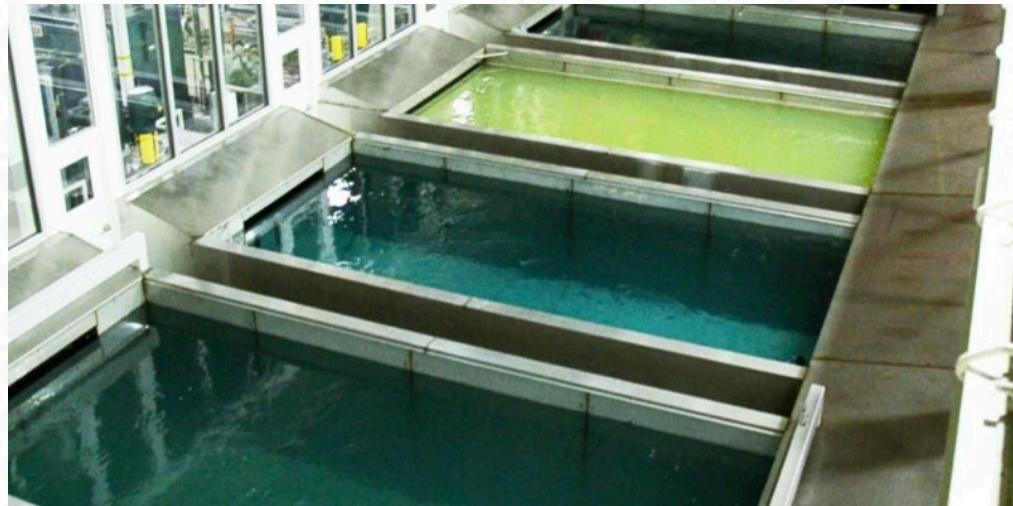
Targeted TDS output, high recovery and low maintenance are a few features that **differentiate** our technology from traditional ion removal options



Case Studies

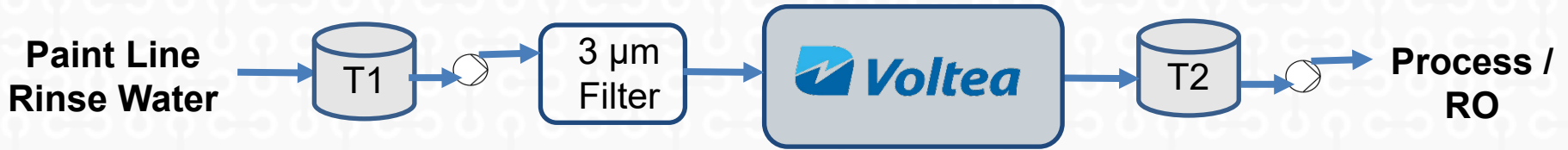
Case Study : Automotive Rinse Water Recovery

- Significant volumes of water used during automotive manufacture: 39,000 gal/car *
 - Large proportion attributed to pretreatment and paint lines
- High quality water used, then disposed of requiring extensive internal and external treatment
- CapDI can be used lineside to recover 70 – 90 % of this ‘waste’ minimizing costs and maximizing efficiency
- CapDI Advantages
 - Low energy requirement
 - High recovery
 - Automated operation
 - Minimal pretreatment
 - Minimal maintenance



* <https://www.automotiveworld.com/articles/water-water-everywhere-vehicle-manufacturing/>

Case Study : Automotive Rinse Water Recovery



<u>Feed TDS (ppm)</u>	<u>Pure TDS (ppm)</u>	<u>Water Recovery</u>	<u>Salt Removal</u>	<u>Energy (kWh/Kgal)</u>
812	113	85%	86%	3.5

<u>Parameter</u>	<u>Unit</u>	<u>Feed</u>	<u>Output</u>
pH		5.5	5.8
Fluoride	ppm	75.9	40.8
Nitrite	ppm	381	43.5
Nitrate	ppm	355	39.2
Hardness (as CaCO ₃)	ppm	2.6	0.34
Iron	ppm	0.5	0.013
Sodium	ppm	84.7	16.4
Copper	ppm	0.3	0.02
Zinc	ppm	185	16.7

Case Study : Cooling Tower Make-up

- Cooling towers often utilize municipal water in their operation, often at high cost, both financially to the customer, as well as in usage to the municipality
- CapDI can often be applied to improve the quality of the feed water
 - Maximizes CoC
 - Reduction in make-up water usage as well as blowdown
 - Optimized chemical usage
 - Improved cooling tower lifetime and maintenance costs
 - Reduced strain on feed water, and blowdown waste treatment
- CapDI Advantages
 - Low energy requirement
 - High recovery
 - Automated operation
 - Minimal pretreatment
 - Minimal maintenance



Case Study : Cooling Tower Make-up – Republic Steel



<u>Parameter</u>	<u>Unit</u>	<u>Feed</u>	<u>Output</u>
TDS	ppm	550	200
Sulfate	ppm	97.5	32.5
Phosphate	ppm	0.3	0.1
Hardness (as CaCO ₃)	ppm	132.5	29.2
Chloride	ppm	98.5	22.5

- Use of CapDI enabled the customer to move away from costly municipal water by utilizing water from the Black River, a water source previously deemed unfit for use in the cooling tower

Case Study : Wellington Brewery

Wellington Brewery : Benefits

- Improved beer quality and consistency
- Ability to tailor water
- Local connection and water source
- Significant reduction in maintenance costs
 - Cleaning chemicals and labour
- Reduction in costs from water modification
 - Salts, lactic acid, labour
- High water recovery, low maintenance system



CapDI : Benefits

- Dynamic feedback to maintain target water quality
- Automated cleanings
- Remote monitoring and support
- Data collection and reporting
- Simple controls and alarms
- Low environmental impact
 - High water recovery
 - Minimal chemical use
 - No salt

Case Study : Wellington Brewery

CapDI enables tunable reduction of mineral content for Wellington Brewery in Guelph



**Feed TDS
(ppm)**

**Pure TDS
(ppm)**

**Water
Recovery**

**Salt
Removal**

Source

588

128

77%

78%

Municipal

Case Study : Wellington Brewery

Parameter	Unit	Pre CapDI	Post CapDI
TDS	ppm	588	128
pH		7.6	7.2
Total Hardness	ppm	462	108
Nitrate	ppm	0.6	0.2
Chloride	ppm	71	16
Alkalinity	ppm	279	103
Potassium	ppm	1.9	0.9
Calcium	ppm	118	28
Magnesium	ppm	41	9
Sulfate	ppm	142	26
Sodium	ppm	34	32
Boron	ppm	0.03	0.02
Non-detect ions not shown, St. Lawrence River Institute of Environmental Sciences			



Joshua Summers
Sales Manager
+1 404 414 4291
joshua.summers@voltea.com



www.voltea.com
info@voltea.com