AmmEL - ELECTRO AMMONIA REMOVAL
ESD - CAPACITATIVE DEIONIZATION

Advanced electrochemical systems for water treatment

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Creating Synergy for Sustainable Future

NOVEL WATER TREATMENT SYSTEMS

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Forward-Looking Statements

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The forward-looking statements relate to, among other things, regulatory compliance, the sufficiency of current working capital, the estimated cost and availability of funding for the continued research and development and marketing of ENPAR’s patented and proprietary technologies. Such statements reflect the current views of ENPAR management with respect to future events and are subject to certain risks, uncertainties and assumptions. Many factors could cause the actual results, performance or achievements of ENPAR to be materially different from any future results, performance or achievements that may be expressed or implied by such forward-looking statements.

ENPAR Technologies Inc.

- Founded 1996, spin-off of University of Guelph, IPO in Feb 1997

- Directors
  Mr. Nizar Kammourie, Managing Director, Saudi Brothers, Saudi Arabia
  Sunil Ghorawat, Managing Director of Earth Water India (former CEO Pentair India)
  Mr. Ed Tsang, former CEO of Heinz China
  Dr. Barry Shelp, Prof. of Biochemistry, Univ. of Guelph
  Dr. Gene Shelp, President and CEO

- Senior Team Members
  Dr. Iurie Pargaru, Senior Research Scientist
  Mr. Daren Yetman, A.Sc.T., Senior Project Manager
  Dr. John Motto, Senior Chemist

Water Issues

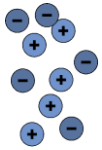
- Ammonia
- Arsenic
- Fluoride
- Hardness
- Metal ions
- Nitrate
- Radionuclides
- TDS (Salinity)






ENPAR is committed to the engineering, manufacturing, and sales of advanced electrochemical systems for water treatment.

AmmEL
Electrochemical
Ammonia Removal



ESD
Electrostatic
Deionization

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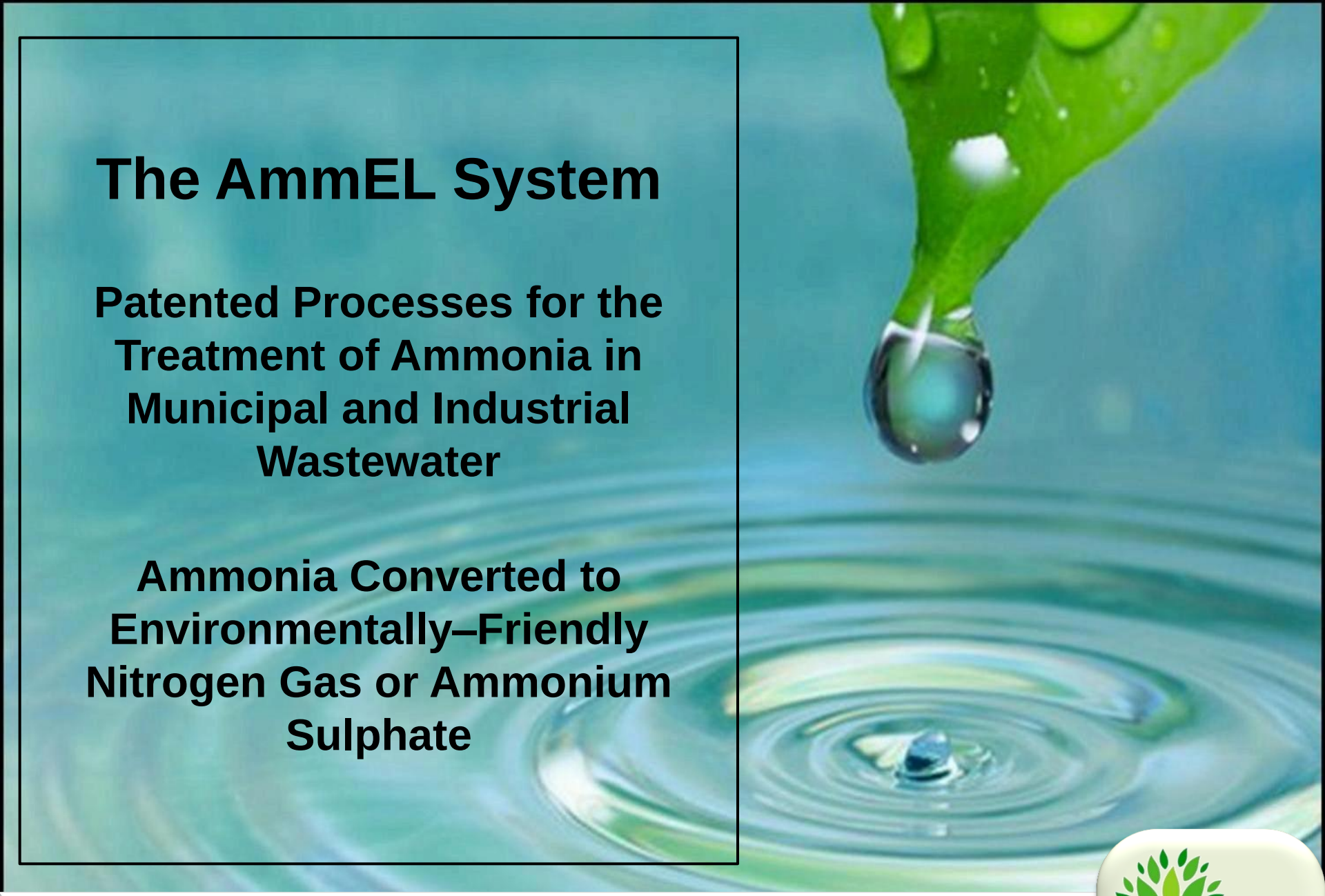
ENPAR's Water Treatment Solutions

	AmmEL	ESD
Technology Type	Physical / Electrochemical	Electrochemical
Application	Ammonium Treatment	TDS, metals, nutrients
Advantages	Toxic Ammonia to Nitrogen Gas No Carcinogen Nitrate No Greenhouse Gas - NOx High Efficiency at Low Temp Not sensitive to water chemistry High efficiency (< 1 mg NH_4^+/L)	High Water Recovery (>90%) High Ion Removal Efficiency No Moving Parts Low energy consumption (0.4 kWh/m^3 pure water for nitrate/sodium removal)
Market Sectors	Mining / Industrial Waste Water Municipal Waste Water Contaminated Ground Water	Industrial Waste Water Municipal Waste/Drinking Water Brackish Ground Water
Competition	Biological / Chemical	Reverse Osmosis / Membrane
Capital Cost	$1.2M vs $1.7-$2.5M (1M LPD)	Cost competitive
Operating Cost (no labour)	Tertiary - $0.08/$m^3$	Drinking water $0.06 /$m^3$ vs $0.08-$0

The AmmEL System

Patented Processes for the Treatment of Ammonia in Municipal and Industrial Wastewater

Ammonia Converted to Environmentally–Friendly Nitrogen Gas or Ammonium Sulphate



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System Applications

- Secondary treatment of sludge dewatering filtrate and tertiary treatment for municipal waste water treatment plants (MWTP) and lagoon systems

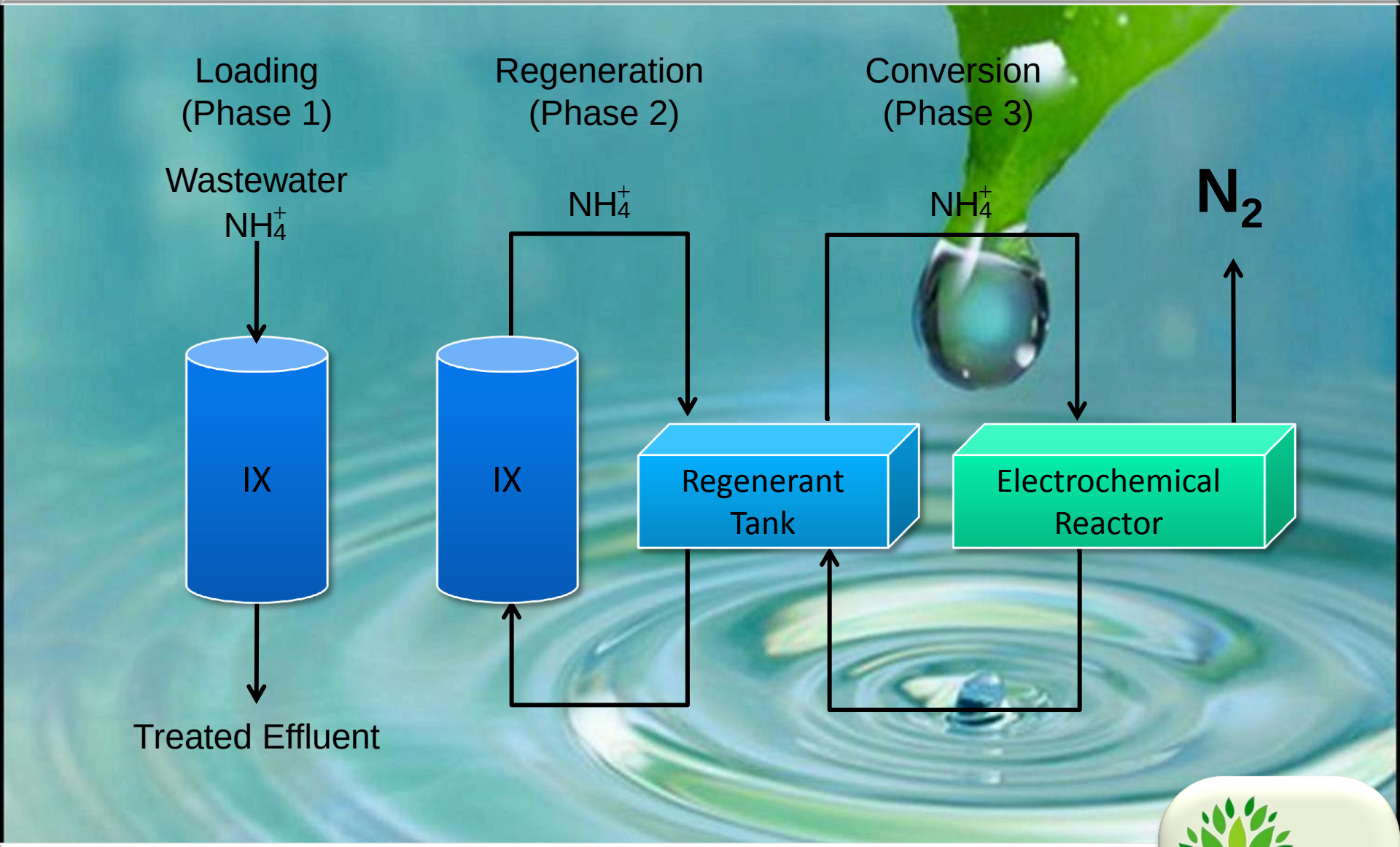
- Mining effluents or process streams containing ammonia derived from the use of ammonia based explosives and/or the oxidation of cyanide

- Process streams related to steel, fertilizer and chemical industries

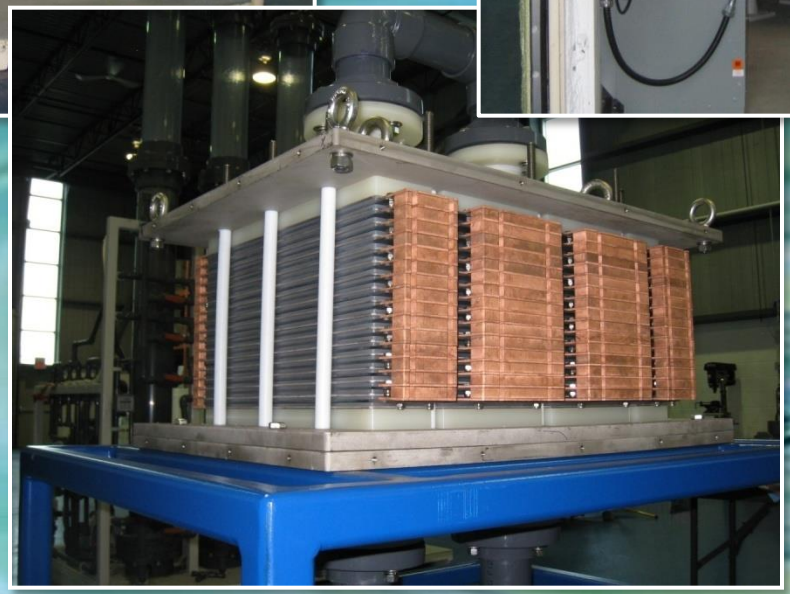
Three Variants of the AmmEL System

	AmmEL-LC	AmmEL-HC	AmmEL-MC
Operational NH_3-N Concentration	< 100 mg/L	>100-1000's mg/L	>50-1000's mg/L
Ammonia Removal Through…	Ion Exchange	Strip and Scrub	Membrane Diffusion
Ammonia Recovered As	N_2 (destructive via Electrochemical Reactor)	N_2 (destructive) or $(NH_4)_2SO_4$ (can be recovered and re-used)	$(NH_4)_2SO_4$ – (can be recovered and re-used)

The AmmEL-LC Process



Mobile AmmEL-LC Unit



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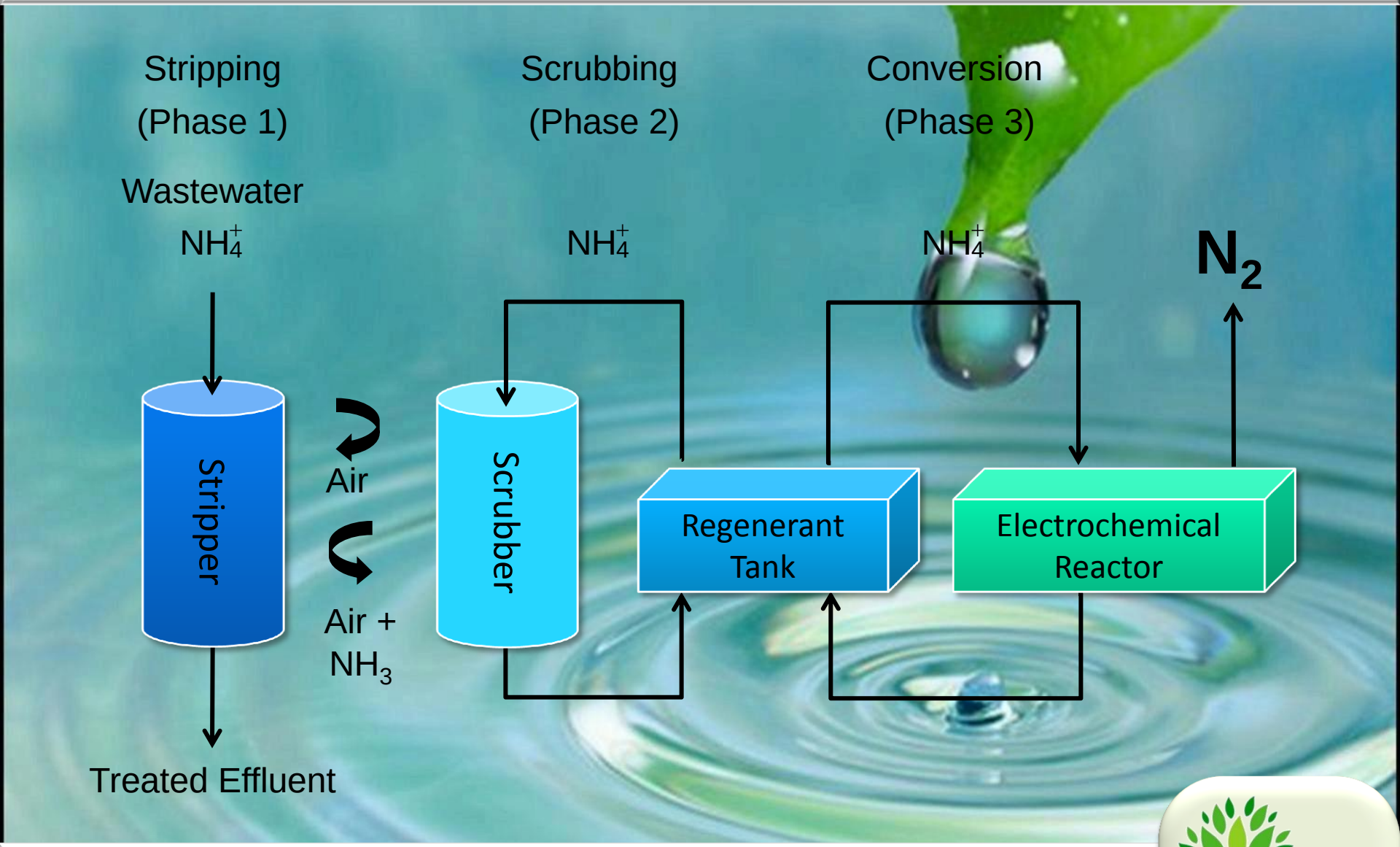
The AmmEL-HC Process



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The AmmEL-HC System

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ESD - Electrostatic Deionization

Electrostatic Removal of Total Dissolved Solids from Industrial and Municipal Wastewater and Groundwater

Recycle and Reuse Application

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ENPAR's ESD System treats all dissolved ions including arsenic, fluoride, hardness, metals and nitrate while maintaining *HIGH WATER RECOVERIES*.

ESD purifies water through Capacitive Deionization (CDI) using proprietary carbon electrodes.

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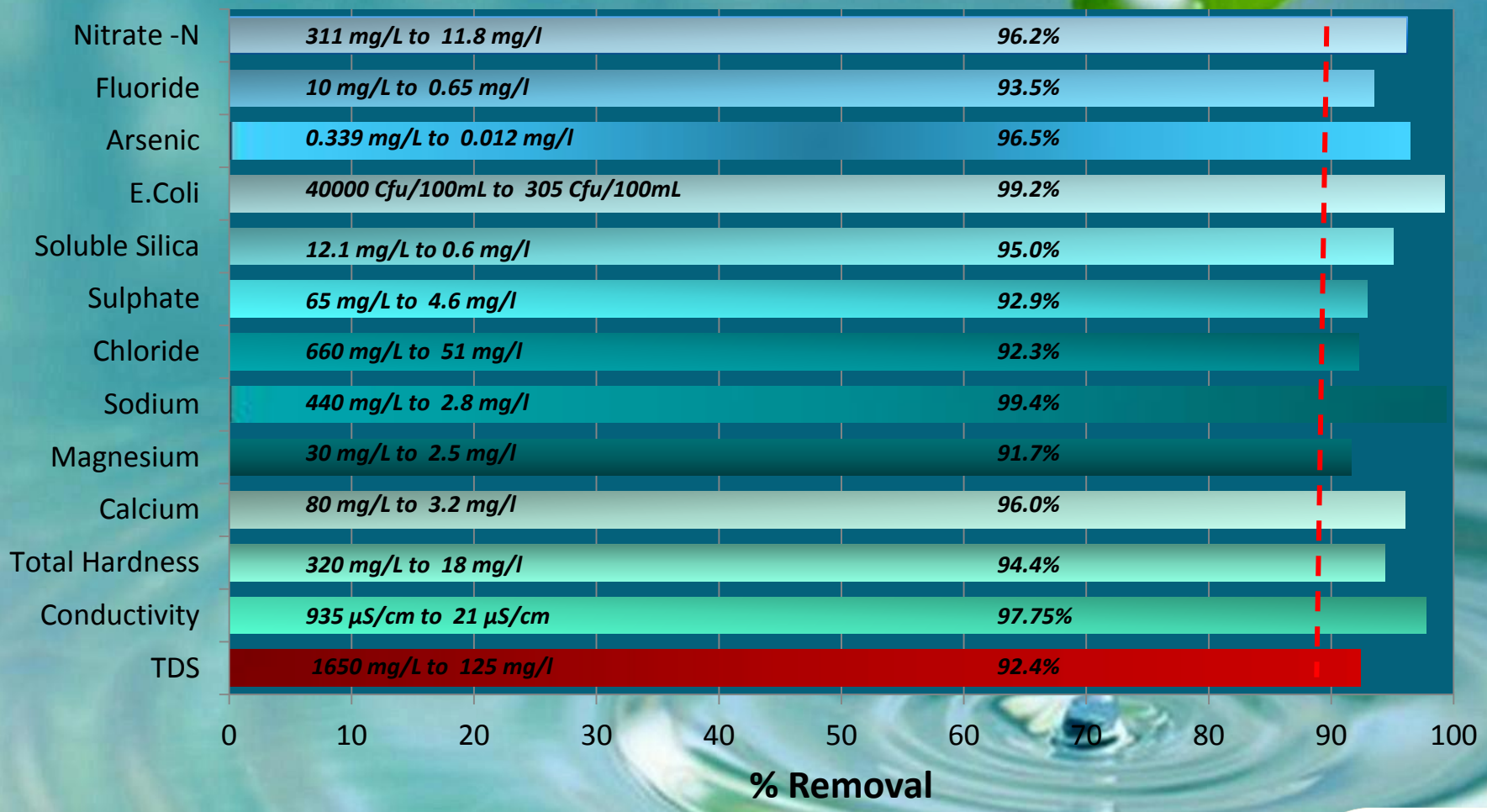
CDI – A Game Changer!

CDI Advantages

- Hi Water Recovery and Hi Ion Removal
- Can be tuned to operate at various levels of ion removal and water recovery efficiencies
- No continual addition of salts or chemicals for drinking water and brackish water applications
- Mono-valent design targets monovalent ions i.e., nitrate, fluoride, chloride, perchlorate, cyanide
- Multivalent design removes equal amounts of all ions
- Low Maintenance and ease of operation

Validation of ESD Technology



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Heart of the ESD System – CDI Cell

Carbon Electrode

Pretreatment for ESD:

- Remove oil and grease
- Filter at 1 μm
- pH 0-9.5
- Max temp – 40°C

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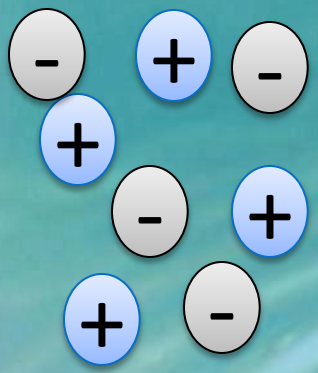
Operation - Purification

- During the purification cycle, contaminants are drawn towards the charged electrodes – positive ions to the negative electrode and negative ions to the positive electrode



Contaminants

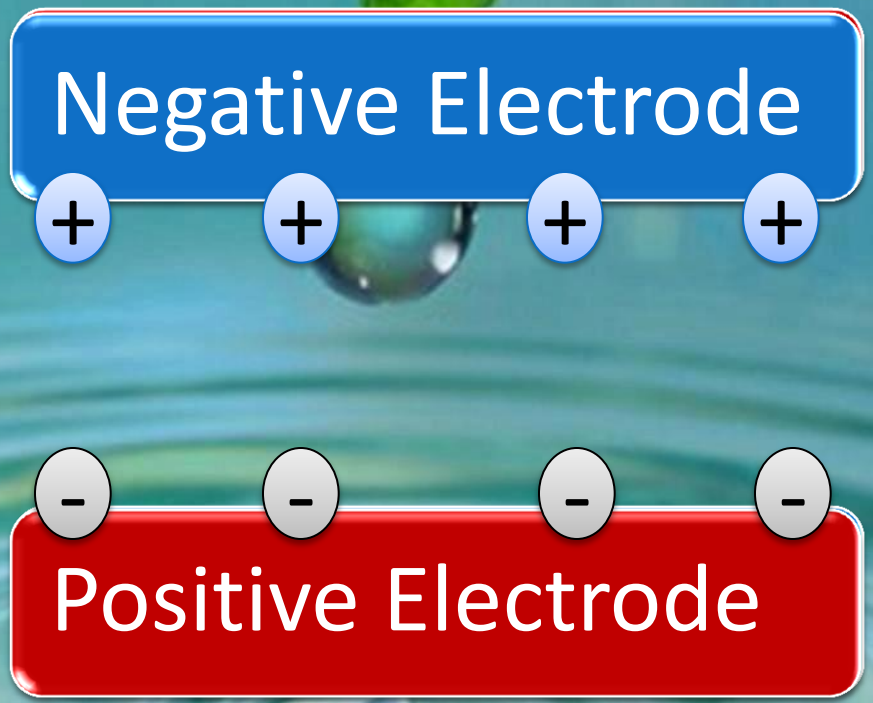
Negative Electrode

Positive Electrode

- U = 1.2 V

Operation - Regeneration

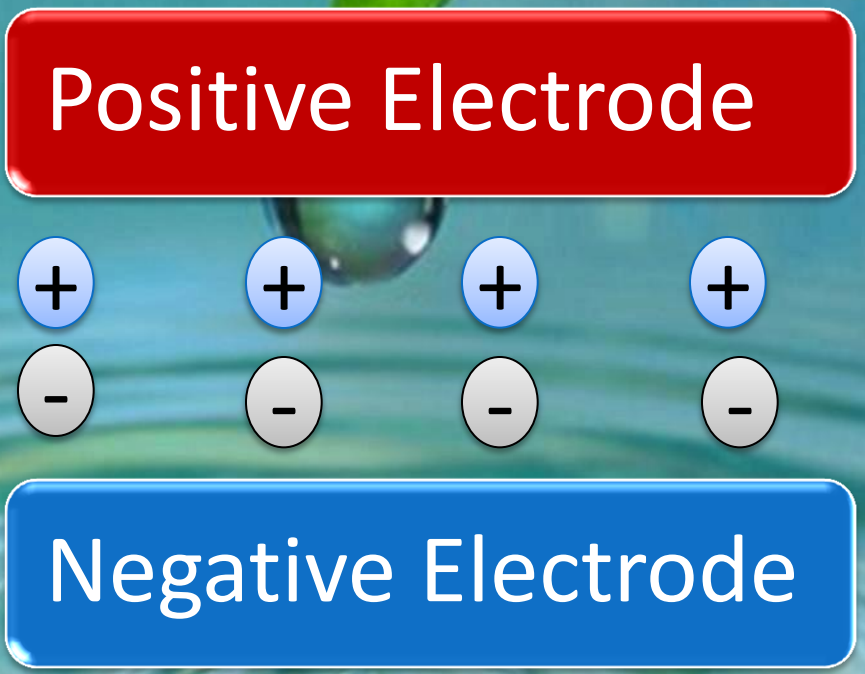
- During the regeneration cycle, the polarity on the electrodes is reversed.
- Ions move away from the electrodes.



- U = 1.2 V

Operation - Purge

- During the purge cycle, the ions are removed as a small volume of concentrate.



- U = 1.2 V

ENPAR Pilot ESD Units

5-Cell ESD 12k
Greenhouse in Leamington, ON

4-Cell ESD 10k
Republic of Korea

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ENPAR Full-Scale ESD Modules

ESD 112k 36-cell module (max. 150 m^3/day)
built for Korean company JUKAM

ENPAR Full-Scale ESD Modules

ESD 100k 36-cell mobile module (max. 140 m^3/day)
City of Guelph demonstration unit

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ESD 100K Demonstration Plant – Jeddah, KSA

ESD vs Membrane (RO)

(Comparison is for drinking water quality)

ESD	Membrane (RO)
Up to 95% water recovery (WR)	70 -75% WR 1st stage 85% WR 2nd stage
$0.06 per m^3	$0.08 – 0.16 per m^3
No water softening required	Water softening required
Low maintenance	High maintenance
Total ion removal OR selective to monovalent ions	Total ion removal

CDI Technology

- High water recoveries coupled with high ion removal efficiencies.
- No sustained concentrate leading to the formation of precipitates and fouling.
- Long life cycles of the capacitor materials.
- Minimal CIP requirement.
- Not sensitive to Silica.

RO Technology

- Low recoveries at high removal rates.
- Pressurized saline stream leading to concentration polarization forming scales.
- Frequent membrane replacement .
- Frequent CIP requirement.
- Pre-treatment required for Silica.

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Competitive positioning

Performance Metric	CDI Technology	RO
TDS Removal Efficiency (Single Pass)	>95%	>95%
% Water Recovery	>90%	40-50%
Scaling/fouling potential	Very Low	High
Life time	10 years (Capacitors/Membranes)	3 years (Membranes)
Energy Consumption (KWH/Cu.m)	0.8-1.5	3-4
Mono-valent Selectivity	Yes	No
Operating Costs ($/Cu.m)	x	3x
Capital Costs ($/Cu.m)	2x	x

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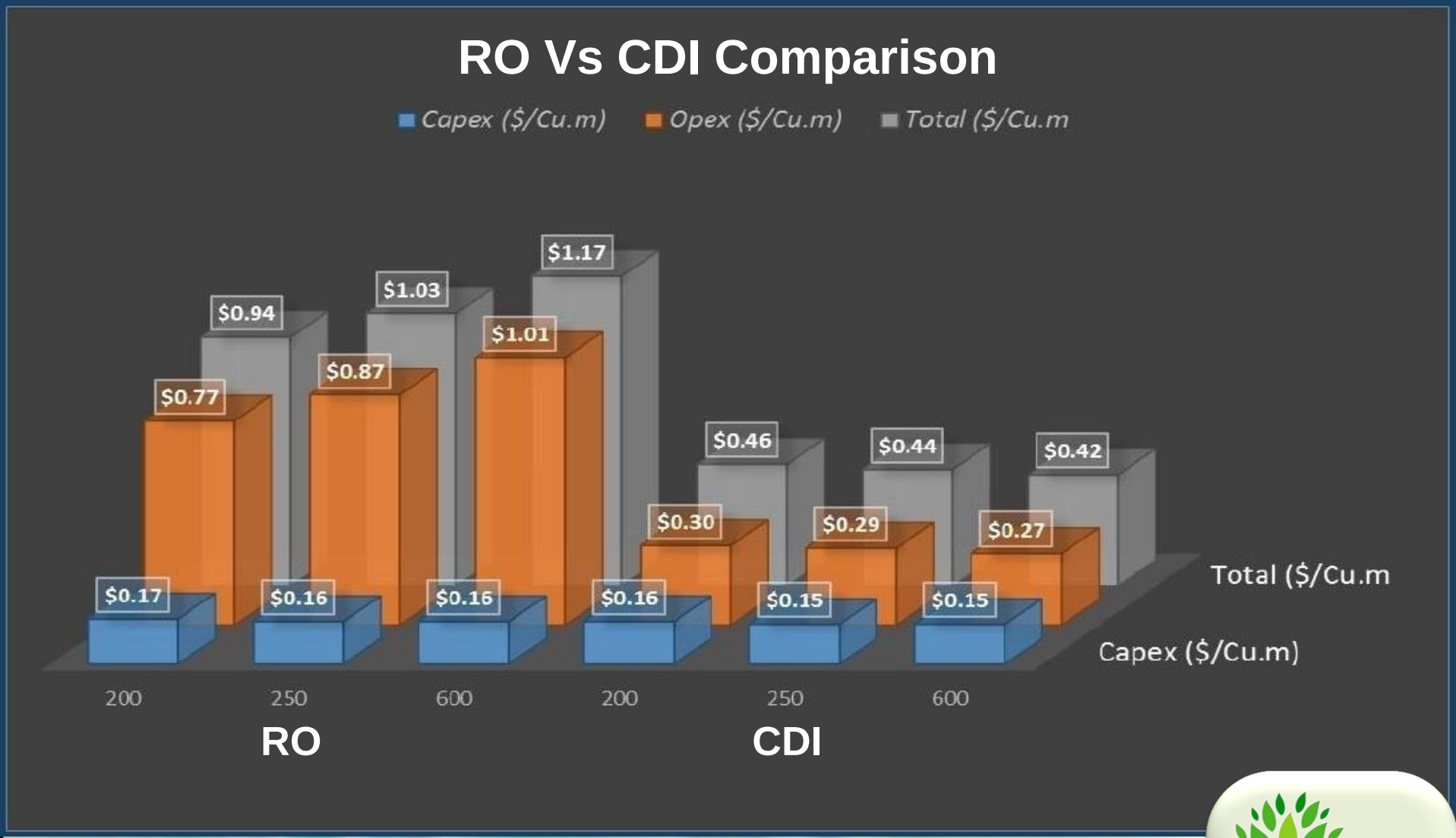
Competitive positioning



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ESD - Attractive ROI

SPECIFICATION	VALUE	UNITS
System Capacity	200	GPM Product Flow
TDS	40-400	ppm
Salt Removal	97	%
Water Recovery	95	%
Energy Consumption (KWH/Cu.m)	0.8	KWH/Cu.m
CAPEX+OPEX, CDI	$0.46	$/Cu.m Product
CAPEX+OPEX, RO	$0.90	$/Cu.m Product
Cost Savings with CDI	$0.43	$/Cu.m Product
Product Flow for break even	461030	Cu.m
Product Flow	1658010	Cu.m
Time to breakeven	<1.5	years

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Summary

- Currently a need for a reliable, high efficiency, low maintenance technology for the treatment of drinking water, wastewater, and industrial process water .
- The ESD System is a promising technology for the treatment of a variety of water streams.
- Compared to traditional approaches (e.g. RO), the ESD System provides high contaminant removal efficiencies while achieving high water recoveries.
- Proven Technology with fast ROI .

THANK YOU!

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