SRP GreenSteam™

Solution Showcase

1.1 SRP | Execution Capability at Scale

- 35+ years | 6,000+ systems | 4+ Bn litres treated
- Executed projects for Army, Railways, Defence, PSU, Hospitals, Refineries, Power plants
- Multi-state execution (15+ states)
- Over 350 employees across all functional disciplines.
- Mix of Capex + Long-term O&M responsibility

1.2 SRP | Built-In Compliance

- ISO systems, NSIC, MSME, MII compliance
- PSU-grade documentation & audits
- IIT MoU for validation, testing & optimisation
- Regular third-party inspections (PSUs /Railways)

2. Boiler Feed Water: Where Chemistry Impacts Generation

- Boiler feed water quality directly governs:
  - Boiler tube integrity
  - Turbine efficiency and blade life
  - Plant availability and heat rate
- Even short-duration chemistry excursions cause cumulative, irreversible damage.
- Modern thermal units demand continuous, ultra stable feed water chemistry.

3.1 The structural limitation of regeneration-based dm

Why Conventional Resin DM Becomes a Risk:

- Resin-based IX (Ion Exchange) DM plants are cyclic by design.
- Water quality degrades progressively between regenerations.

3.2 Chemical regeneration is now a liability

- Safety, Compliance, and Reliability Concerns
- Bulk storage and handling of HCl / NaOH
- Regeneration effluent requiring neutralisation
- High EHS exposure and audit sensitivity
- Increased manpower and supervision dependency

3.3 ZLD has fundamentally changed dm economics

System-Level Cost Impact

- IX regeneration produces high-TDS, chemically loaded wastewater
- Under ZLD, this stream is among the costliest to evaporate and crystallise
- Regeneration waste often exceeds 5000-20000 ppm TDS
- ZLD converts chemical DM from a utility into a system-wide cost liability

4. Introducing GREENSTEAM™

A Total Membrane-Based Boiler Feed Water Solution

It is an integrated RO–EDI boiler feed water architecture, designed to replace cyclic chemical demineralisation with steady-state electro-membrane operation.

4.1 GREENSTEAM™ Process Architecture

Process configuration:

Raw / Clarified Water

- Advanced Pretreatment (SSDI / UF as required)
- Reverse Osmosis (97–99% ionic & silica rejection)
- Electro deionization (EDI)
- Boiler Feed Water Tank
- RO removes the bulk ionic load, organics, colloidal & reactive silica
- EDI continuously polishes RO permeate via in-situ electrochemical regeneration
- Electrical field (> water-splitting threshold) generates H^+ / OH^- in-situ, maintaining resin activity
- No batch regeneration, no acid/caustic dosing, no purity cycling

Design outcome:

- Stable ultra-pure BFW suitable for high-pressure and supercritical boilers.
- Compact, skid-based architecture compatible with retrofit constraints.

4.2 Engineering Philosophy Behind GREENSTEAM™

1. Designed for steady-state ionic purity, not batch recovery.
2. . Typical product water quality:
   - Resistivity: 16–18 MΩ·cm
   - Conductivity: <0.06 µS/cm
   - Silica: <5 ppb (suitable for ≥180 bar operation)

Continuous electrochemical resin regeneration eliminates:

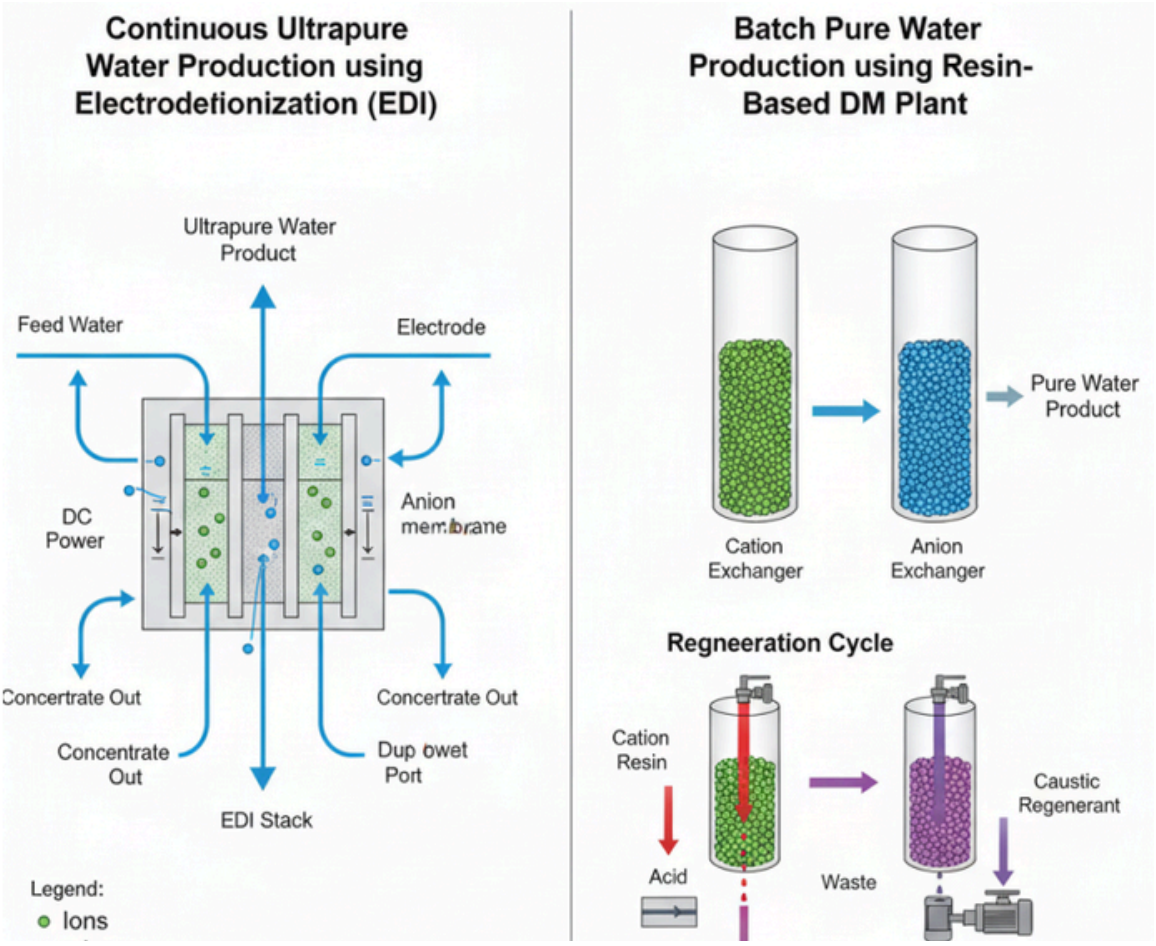
- Sodium slip
- Silica tailing
- End-of-run excursions

4.3 Technical Comparison: GREENSTEAM™ vs RESIN DM

Aspect	GREENSTEAM™ (RO + EDI)	Conventional IX / Resin DM
Core principle	Continuous electro-membrane demineralisation	Batch ion exchange with chemical regeneration
Mode of operation	Steady-state	Cyclic (run–exhaust–regenerate)
Regeneration method	In-situ electrochemical	External acid & caustic dosing
Product water quality	Stable: <0.06 µS/cm, <5 ppb silica	Variable; tailing near exhaustion
Sodium / silica slip	Structurally eliminated under design limits	Inherent risk during end-of-run
Chemical handling	None for regeneration	Mandatory (HCl / NaOH / neutralisation)
ZLD impact	No impact	High-TDS, chemically loaded regen waste
Automation level	High (current/voltage-controlled)	Moderate (operator & timing dependent)
Availability	>99% achievable	Typically 80–90% effective
Suitability for high pressure boilers	Excellent	Increasingly constrained

4.4 Process Mechanism Difference

Conventional Resin based DM	GREENSTEAM™
1. Fixed resin capacity 2. Exhaustion → regeneration → downtime 3. Quality improves after regen, degrades with time	1. RO removes ionic load upfront 2. EDI continuously regenerates resin via electric field 3. Purity is flow-dependent, not time-dependent **Impact on generation:** Flat chemistry profiles → better boiler and turbine protection.



4.5 Proven at scale in thermal power applications

Flagship Case: Con Edison, East Eiver (USA)

- Application: 100% boiler makeup water
- Capacity: ~1,530 m³/hr
- Technology: RO + CEDI

Results:

✓<0.1 µS/cm conductivity
✓<15 ppb silica
✓99% availability
✓Zero acid / caustic handling

Table — Examples of Thermal Power Applications

Project	Plant Capacity	BFW	Plant type	Key Driver
Poland Power Plant	235 MW	RO + EDI dual-train system	Thermal power (Repowering)	100% makeup, chemical elimination
Valleyview GS (Canada)	100 MW	54.5 m³/hr	DM Retrofit	Eliminate regeneration & downtime
Qassim II & III (KSA)	2 x 360 MW	257 m³/hr	Greenfield CCGT	Supercritical purity
Shandong Power Plant (China)	400–600 MW	~220 m³/hr	EDI Upgrade	Energy efficiency
Texas Power Plant	821 MW	200 gpm RO+EDI system (36.3 m³/hr)	Repowering	Achieves <1-5 ppb silica for high-pressure steam turbines

Project	BFW	Plant type	Key Driver
Power Generation – Dominican Republic	80 m³/h	Thermal power	100% makeup, chemical elimination
Energie Steiermark (Graz, Austria)	Double-pass RO + EDI	Energy utility	Eliminate regeneration & downtime
Moerdijk Waste-to-Energy	3 × 12 m³/hr	WtE plant	Supercritical purity
Xinjiang Lanshan Tunhe (China)	~220 m³/hr	Captive power / cogeneration	Energy efficiency
Con Edison – East River Repowering	~1,530 m³/hr	Thermal power	Benchmark large-scale BFW reference

4.6 DM Retrofit Case: Valley View Generation Station

Plant capacity**: 100 MW**

Original system: Portable mixed-bed DM

Issues:

- Frequent regeneration
- 15–20% downtime
- High chemical handling

Results:

- Existing RO retained
- Mixed-bed DM replaced with EDI (2 × 50%)

Outcomes:

- 99% availability of continuous boiler-grade water
- Complete elimination of regeneration chemicals

4.7 Dm Retrofit Economics: Broad Roi Framework

Industry-reported outcomes:

- 90–95% reduction in chemical consumption
- Complete elimination of regeneration wastewater
- Lower manpower and supervision intensity
- Improved availability and operational stability
- Better thermal efficiency
- No downtime or regeneration time lost
- Standby unit is eliminated

Financial perspective (Indicative):

- Retrofit CAPEX: Comparable to major DM refurbishment
- Payback period: ~2–3 years (site dependent)

- ROI driven primarily by:
  - Chemical elimination
  - ZLD cost reduction
  - Higher water recovery
  - Elimination of proprietary resin
  - procurement

Why Greensteam™ By Srp

GREENSTEAM™ is engineered for boilers, operators, auditors, and lifecycle economics.

- EPC-led system engineering approach
- Designed for real raw water variability
- Integrated with ZLD philosophy
- Retrofit and greenfield capability
- Execution across PSU, power, steel, refinery and ZLD project
- Cost optimisation without performance compromise

Separation Recovery Purification

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