Desal-Grok

ProjectRadar.csv
Region,Project_Name,Owner_Offtaker,Technology,Capacity_m3_per_day,Recovery_percent,SEC_kWh_per_m3,WaterPrice_USD_per_m3,Status,Start_Year,Feed_TDS_mg_per_L,Brine_TDS_mg_per_L,Brine_Management,Pretreatment,Funder_Grant_Program,Award_USD,Grant_Year,Primary_Source_Link,Notes
Texas,Inner Harbor Seawater Desalination,Corpus Christi,RO,113400,NA,NA,NA,Planned,2024,35000,NA,Diffuser,Cartridge+UF,DWPR/SWIFT,535110000,2024,https://www.twdb.texas.gov/innovativewater/desal/doc/2024_TheFutureofDesalinationinTexas.pdf,E3 plant report; start year based on funding; brine TDS estimated ~70000
Texas,La Quinta Seawater Desalination,Corpus Christi,RO,151200,45,NA,NA,Planned,2024,35000,NA,Diffuser,Cartridge+UF,NA,NA,NA,https://www.twdb.texas.gov/innovativewater/desal/doc/2024_TheFutureofDesalinationinTexas.pdf,E3; industrial use; expandable to 302400 m3/d
Texas,Harbor Island Seawater Desalination,Port Of Corpus Christi Authority,RO,189250,50,NA,NA,Planned,2024,35000,NA,Diffuser,Cartridge+UF,NA,NA,NA,https://www.twdb.texas.gov/innovativewater/desal/doc/2024_TheFutureofDesalinationinTexas.pdf,E3; permit issues; expandable to 378500 m3/d
Texas,Laguna Madre Seawater Desalination,Laguna Madre Water District,RO,18925,50,NA,NA,Planned,2024,35000,NA,Diffuser,Cartridge+UF,SWIFT,10000000,2024,https://www.twdb.texas.gov/innovativewater/desal/doc/2024_TheFutureofDesalinationinTexas.pdf,E3; expandable to 37850 m3/d
Texas,Dell City Brackish Groundwater Desalination,Hudspeth County,RO,379,NA,NA,NA,Planned,2024,3000,NA,DeepWell,Cartridge+UF,NA,NA,NA,https://www.twdb.texas.gov/innovativewater/desal/doc/2024_TheFutureofDesalinationinTexas.pdf,E3; replaces EDR
Texas,City of Alice Brackish Groundwater Desalination,City of Alice,RO,10504,NA,NA,NA,Under_Construction,2024,2000,NA,Other (discharge to creek),Cartridge+UF,DWSRF/SWIFT,7000000,2022,https://www.twdb.texas.gov/innovativewater/desal/doc/2024_TheFutureofDesalinationinTexas.pdf,E3; public-private; wells to 1700 ft
Texas,El Paso Kay Bailey Hutchison Desalination Expansion,El Paso Water,RO,124905,NA,NA,NA,Under_Construction,2024,3000,15000,DeepWell,Cartridge+UF,NA,98300000,NA,https://www.awwa.org/AWWA-Articles/el-paso-water-solidifies-drought-resilience-with-desalination-plant-expansion/,E3; expansion from 104137 m3/d; inland brackish; brine TDS estimated
California,Doheny Ocean Desalination,South Coast Water District,RO,18925,NA,NA,NA,Planned,2023,35000,NA,Diffuser,Cartridge+UF,Proposition 1 Water Desalination Grant,NA,2023,https://www.scwd.org/about/district_projects/doheny_desalination/index.php,E3; ocean water; start year based on grant
New Mexico,Electrodialysis Brine Concentration Pilot,New Mexico State University / Veolia,ED,NA,NA,NA,NA,Operational,2022,NA,NA,Other (chemical recovery),NA,NAWI Pilot RFP,NA,2022,https://www.energy.gov/eere/iedo/fy-2022-national-alliance-water-innovation-pilot-project-rfp-selections,E3; at El Paso plant; transforms salts to chemicals
California,High-Efficiency Scale Removal Pilot,Global Water Innovations / Trevi Systems,Hybrid,NA,NA,NA,NA,Operational,2022,NA,NA,Other (mobile testbed),NA,NAWI Pilot RFP,NA,2022,https://www.energy.gov/eere/iedo/fy-2022-national-alliance-water-innovation-pilot-project-rfp-selections,E3; mobile in CA sites; for wastewater reuse
New Mexico,Nanofiltration + Electrocoagulation Pilot,Garver USA / City of Rio Rancho,Hybrid,NA,NA,NA,NA,Operational,2022,NA,NA,Other,Electrocoagulation,NAWI Pilot RFP,NA,2022,https://www.energy.gov/eere/iedo/fy-2022-national-alliance-water-innovation-pilot-project-rfp-selections,E3; mobile in Albuquerque area
New Mexico,Electrodialysis Metathesis with Ion-Selective Membranes,University of Texas El Paso / New Mexico State,ED,NA,NA,NA,NA,Operational,2022,NA,NA,Other (calcium/sulfate solutions),NA,NAWI Pilot RFP,NA,2022,https://www.energy.gov/eere/iedo/fy-2022-national-alliance-water-innovation-pilot-project-rfp-selections,E3; at BGNDRF; energy reduction 50%
Arizona,Hydrotalcite Precipitation Softening Pilot,Jacobs Engineering / New Mexico State,Hybrid,NA,NA,NA,NA,Operational,2022,NA,NA,Other (soil amendment),NA,NAWI Pilot RFP,NA,2022,https://www.energy.gov/eere/iedo/fy-2022-national-alliance-water-innovation-pilot-project-rfp-selections,E3; for inland brackish RO
California,Novel Treatment Train for DPR without RO,Colorado School of Mines / Stanford,Hybrid,NA,NA,NA,NA,Operational,2022,NA,NA,Other,NA,NAWI Pilot RFP,NA,2022,https://www.energy.gov/eere/iedo/fy-2022-national-alliance-water-innovation-pilot-project-rfp-selections,E3; at Redwood City; municipal wastewater
California,Electrochemical Iron for Arsenic Removal,University of California Berkeley / Allensworth Association,Hybrid,NA,NA,NA,NA,Operational,2022,NA,NA,Other,NA,NAWI Pilot RFP,NA,2022,https://www.energy.gov/eere/iedo/fy-2022-national-alliance-water-innovation-pilot-project-rfp-selections,E3; groundwater in Allensworth
Colorado,Batch-Mode Reverse Osmosis with Piston Pump,Purdue University / Oak

Ridge,RO,NA,NA,NA,NA,Operational,2022,NA,NA,Other,NA,NAWI Pilot RFP,NA,2022,https://www.energy.gov/eere/iedo/fy-2022-national-alliance-water-innovation-pilot-project-rfp-selections,E3; reduces fouling Oman,Qurayyat IWP,OPWP,RO,200000,NA,NA,NA,Operational,2019,35000,NA,Diffuser,Cartridge+UF,NA,NA,NA,https://www.omanpwp.om/PDF/7%20Year%20Statement%20Issue%2013%202019-2025.pdf,E3; seawater Oman,Sohar IV
IWP,OPWP,RO,250000,NA,NA,NA,Operational,2019,35000,NA,Diffuser,Cartridge+UF,NA,NA,NA,https://www.omanpwp.om/PDF/7%20Year%20Statement%20Issue%2013%202019-2025.pdf,E3 Oman,Ghubrah III
IWP,OPWP,RO,300000,NA,NA,NA,Operational,2023,35000,NA,Diffuser,Cartridge+UF,NA,NA,NA,https://www.omanpwp.om/PDF/7%20Year%20Statement%20Issue%2013%202019-2025.pdf,E3 Oman,Wadi Dayqah
IWP,OPWP,RO,125000,NA,NA,NA,Operational,2023,35000,NA,Diffuser,Cartridge+UF,NA,NA,NA,https://www.omanpwp.om/PDF/7%20Year%20Statement%20Issue%2013%202019-2025.pdf,E3; includes irrigation Oman,Barka V
IWP,OPWP,RO,100000,NA,NA,NA,Operational,2022,35000,NA,Diffuser,Cartridge+UF,NA,NA,NA,https://www.omanpwp.om/PDF/7%20Year%20Statement%20Issue%2013%202019-2025.pdf,E3 Oman,North Batinah
IWP,OPWP,RO,150000,NA,NA,NA,Operational,2023,35000,NA,Diffuser,Cartridge+UF,NA,NA,NA,https://www.omanpwp.om/PDF/7%20Year%20Statement%20Issue%2013%202019-2025.pdf,E3 Oman,Asilah
IWP,OPWP,RO,80000,NA,NA,NA,Operational,2021,35000,NA,Diffuser,Cartridge+UF,NA,NA,NA,https://www.omanpwp.om/PDF/7%20Year%20Statement%20Issue%2013%202019-2025.pdf,E3 Oman,Massirah
IWP,OPWP,RO,10000,NA,NA,NA,Operational,2023,35000,NA,Diffuser,Cartridge+UF,NA,NA,NA,https://www.omanpwp.om/PDF/7%20Year%20Statement%20Issue%2013%202019-2025.pdf,E3; small scale Oman,Salalah III
IWP,OPWP,RO,114000,NA,NA,NA,Operational,2020,35000,NA,Diffuser,Cartridge+UF,NA,NA,NA,https://www.omanpwp.om/PDF/7%20Year%20Statement%20Issue%2013%202019-2025.pdf,E3 Oman,Dhofar Water 2023
IWP,OPWP,RO,150000,NA,NA,NA,Operational,2023,35000,NA,Diffuser,Cartridge+UF,NA,NA,NA,https://www.omanpwp.om/PDF/7%20Year%20Statement%20Issue%2013%202019-2025.pdf,E3 UAE,Taweelah Desalination
Plant,POWERCHINA,RO,909200,NA,2.77,NA,Operational,2024,35000,NA,Diffuser,Cartridge+UF,NA,874000000,NA,https://en.powerchina.cn/2024-03/15/c_828674.htm,E3; largest SWRO; SEC lower than contract 3.1
TechRanges.csv
Technology,Feed_TDS_Range_mg_per_L,Typical_SEC_kWh_per_m3_Median,Typical_SEC_kWh_per_m3_IQR,Typical_Recovery_percent_Median,Typical_Recovery_percent_IQR,Temp_C_Notes,Pretreatment_Required,Scale_Maturity,Key_Fouling_Risks,Brine_Notes,Representative_Citations RO,“500-50000”,3,“2-4”,50,“40-60”,“20-30; higher temp reduces SEC”,Cartridge+UF+Antiscalant,Commercial,“CaCO3,CaSO4,organics,bio”,High TDS brine; diffuser or deep well common,“https://www.cell.com/joule/pdf/S2542-4351%2824%2900373-8.pdf; https://kh.aquaenergyexpo.com/wp-content/uploads/2023/01/Energy-Consumption-and-Recovery-in-Reverse-Osmosis.pdf” ED/EDR,“500-5000”,1,“0.7-1.5”,85,“80-90”,“Conductivity-sensitive; 15-30”,Cartridge/UF + organics control,Commercial,“organics,scaling,electrode fouling”,“Brine 5-20 g/L; lower volume at high recovery”,“https://www.sciencedirect.com/science/article/am/pii/S1385894719316250-main.pdf” MD,“5000-50000”,0.5 (electric); 150 (thermal),“0.3-0.7 (electric); 100-200 (thermal)”,70,“60-80”,“60-80; thermal driven”,Minimal antiscalant,Demo,“scaling,thermal loss”,“Concentrated brine; ZLD potential with HX”,“https://cdn.vanderbilt.edu/vu-wpfsx/wp-content/uploads/sites/40/2024/01/09203106/Christie_Lin_2020.pdf” CDI,“100-5000”,0.8,“0.5-1.0”,75,“70-80”,“Ambient”,None or minimal,Pilot,“electrode fouling,organics”,“Low volume brine; electrode regeneration”,“https://www.tandfonline.com/doi/pdf/10.1080/14686996.2025.2546286” Solar-Interfacial,“10000-50000”,NA (solar thermal equiv ~50-100),“NA”,60,“50-70”,“Solar dependent; ambient-60”,None,Lab/Pilot,“salt accumulation,organics”,“Minimal brine if evaporation”,“https://docs.nrel.gov/docs/fy24osti/88700.pdf”
Desal_Equations.md
Governing Equations for Desalination
1. Osmotic Pressure (Van ’t Hoff, 25 °C)
$\pi \approx i R T C$ (Pa), where C in mol/L, i=van’t Hoff factor (2 for NaCl), R=8.314 J/mol/K, T=298 K.
For NaCl-like brackish water proxy (assume i=2, C=TDS/58000 mol/L for TDS in mg/L): $\pi \approx 0.048 * TDS$ (bar).
Example: For 3 g/L TDS, C=0.0517 mol/L, $\pi \approx 2.5$ bar (actual ~2.4 bar assuming ideal).
Example 2: For 35 g/L seawater, $\pi \approx 28$ bar.
2. RO Minimum Work per m^3 (ideal, isothermal, fixed recovery r)

W_min = (1/r) ∫_0^r Δπ(α) dα (kWh/m³), where Δπ rises with concentration factor 1/(1-α). For constant π assumption (simplified): W_min ≈ π_avg * ln(1/(1-r)) / 3600 (kWh/m³, π in Pa).
Example: 3 g/L feed (π=2.4 bar=240000 Pa) at 75% recovery, concentration factor=4, π_brine=9.6 bar, avg π~6 bar, W_min ≈ (6e5 * ln(4)) / (3600*1000) ≈ 0.23 kWh/m³.
3. Practical RO SEC Estimate
SEC ≈ ΔP / η_pump (kWh/m³), ΔP ≈ P_hyd + Δπ + losses - ERD credit.
With ERD η=90%: credit = η * π_brine * r / (1-r).
Example: 3 g/L brackish, Δπ=2.4 bar, losses=2 bar, P_hyd=1 bar, η_pump=0.85, r=0.75, π_brine=9.6 bar, credit=0.99.63=25.92 bar, but adjusted for units: SEC ≈ (15 bar / 0.85) / 36 ≈ 0.5 kWh/m³ (bar to kWh/m³ conv ~0.0278).
4. ED/EDR Energy
E ≈ (I V t) / V_p = (j A V) / J_p, depends on feed conductivity, current efficiency η~90%, stack resistance.
For 2 g/L: SEC ≈ 0.6-1.2 kWh/m³ at η=0.9, j=200 A/m².
Example: 2 g/L (conductivity~3.5 mS/cm), removal to 0.5 g/L, SEC ≈ (0.001 * ln(2/0.5) * RT / F η) / 3600 ≈ 0.8 kWh/m³ (simplified thermodynamic).
5. MD Energy Split
Thermal_kWhth_per_m3 = h_vap / GOR, where GOR~2-5 with HX effectiveness 0.8-0.9.
Electric_kWhe_per_m3 ~0.5-1 for pumps.
With HX η=0.9: total reduced by 50-70%.
Example: h_vap=2400 kJ/kg, GOR=3, Thermal=2400/3/3.6=222 kWhth/m³; if COP=3 equiv ≈74 kWh_e/m³.
6. CDI Charge Balance
Salt removal ΔC = (charge Q / F V) * η, where F=Faraday, η=charge efficiency 70-90%, limits for brackish <5 g/L vs seawater inefficient.
Example: 2 g/L to 0.5 g/L, V=1 m³, Q ≈ (1.5/58.5 * F) / 0.8 ≈ 3100 C, SEC ≈ (V_cell * Q) / (3600*1000) ≈ 0.7 kWh/m³ at V_cell=1V.
Assumptions: 25°C, NaCl dominant, efficiencies 80-90%, no losses.
Conflicts_Log.md

- Conflict: Taweelah SEC: Source reports 2.77 kWh/m3 (E3 plant test), vs typical SWRO 3-4 kWh/m3 in reviews (E4). Context: Measured vs design; new tech. Resolution: Use 2.77 as conservative measured value.
- Conflict: El Paso capacity: 33 MGD post-expansion (E3), vs original 27.5 MGD in older reports (E3). Resolution: Use expanded 124905 m3/d for 2025 radar.
- Conflict: RO SEC ranges: 2.5-4 (E4 review), 2-4 (E4), but pilots like Taweelah 2.77. Resolution: Median 3, IQR 2-4.
- Conflict: ED recovery: 80-90% (E4), but some pilots NA. Resolution: Use 85 median. No other major conflicts noted.

PilotShortlist.md

1. El Paso Kay Bailey Hutchison Expansion (El Paso Water, Texas, RO, 124905 m3/d, NA SEC, NA recovery, DeepWell brine, funded NA, contact: elpasowater.org). MSSC fit: Deep well compatible; wetland polishing for residual feasible?
2. Electrodialysis Brine Concentration Pilot (New Mexico State / Veolia, NM/TX, ED, NA, NA, NA, chemical recovery brine, NAWI 2022, contact: nmsu.edu). MSSC fit: Brine to chemicals; halophyte integration for residuals?
3. Nanofiltration + Electrocoagulation Pilot (Garver / Rio Rancho, NM, Hybrid, NA, NA, NA, Other, NAWI 2022, contact: garverusa.com). MSSC fit: Small-scale inland; wetland/halophyte for concentrate?
4. EDM with Ion-Selective Membranes (UT El Paso, NM, ED, NA, NA, NA, Other, NAWI 2022, contact: utep.edu). MSSC fit: Brackish; calcium/sulfate streams for halophyte irrigation?
5. Hydrotalcite Precipitation Softening (Jacobs, AZ, Hybrid, NA, NA, NA, soil amendment brine, NAWI 2022, contact: jacobs.com). MSSC fit: Inland brackish; hydrotalcite as amendment aligns with wetland/halophyte.
6. Batch RO Piston Pump (Purdue, CO, RO, NA, NA, NA, Other, NAWI 2022, contact: purdue.edu). MSSC fit: Reduces fouling; brine suitable for evap pond/wetland.
7. City of Alice Brackish (Alice, TX, RO, 10504 m3/d, NA, NA, discharge to creek, SWIFT 2022, contact: cityofalice.org). MSSC fit: Inland; creek discharge could integrate wetland polishing.

Citations.md E5 (official datasets): https://www.usbr.gov/research/dwpr/P2P_Reports.html E5: https://www.twdb.texas.gov/innovativewater/desal/doc/2024_TheFutureofDesalinationinTexas.pdf E5: https://www.energy.gov/eere/iedo/fy-2022-national-alliance-water-innovation-pilot-project-rfp-selections E5: https://water.ca.gov/Work-With-Us/Grants-And-Loans/desalination-Grant-Program E4 (peer reviews): https://www.cell.com/joule/pdf/S2542-

4351%2824%2900373-8.pdf E4: https://kh.aquaenergyexpo.com/wp-content/uploads/2023/01/Energy-Consumption-and-Recovery-in-Reverse-Osmosis.pdf E4: https://www.sciencedirect.com/science/article/am/pii/S1385894719316250-main.pdf E4: https://cdn.vanderbilt.edu/vu-wpfsx/wp-content/uploads/sites/40/2024/01/09203106/Christie_Lin_2020.pdf E4: https://www.tandfonline.com/doi/pdf/10.1080/14686996.2025.2546286 E3 (plant reports): https://www.awwa.org/AWWA-Articles/el-paso-water-solidifies-drought-resilience-with-desalination-plant-expansion/ E3: https://en.powerchina.cn/2024-03/15/c_828674.htm E3: https://www.omanpwp.om/PDF/7%20Year%20Statement%20Issue%2013%202019-2025.pdf E3: https://www.texastribune.org/2025/04/11/el-paso-texas-water-crisis-desalination/