Brine Treatment Technology Map

**Brine Pre-Concentration Step**

- **EDR**
  - Electrically driven membrane process
  - Removes ions (95% monovalent, 50 to 85% divalent)
  - SEC 6.73 kWh/m³ (Depends on Feed TDS)

- **FO**
  - Concentration gradient driven permeable membrane process
  - Removes Water
  - SEC 0.84 kWh/m³
  - SECu 65.4 kWh/m³
  - SECtot 29.91 kWh/m³

- **MD**
  - Up to 180,000 mg/L

- **MED**
  - Up to 250,000 mg/L
  - -95%

- **MVC**
  - Temperature gradient driven permeable membrane process
  - Removes Water
  - SEC 0.84 kWh/m³
  - SECu 65.4 kWh/m³
  - SECtot 29.91 kWh/m³

**Evaporation**

- **ca. 90% Recovery**

  - **MD**
    - Flash evaporation in series
    - SEC 3.68 kWh/m³
    - SECu 77.5 kWh/m³
    - SECtot 38.56 kWh/m³

  - **MED**
    - Multiple stages distillation process
    - SEC 2.22 kWh/m³
    - SECu 69.52 kWh/m³
    - SECtot 33.50 kWh/m³

  - **MVC**
    - Increased vapor pressure increases condensation
    - SEC 14.86 kWh/m³

**Crystallization (Drying)**

- **ca. 40 to 70% Recovery**

  - **CRYST**
    - Supersaturation by heating the mother liquor
    - 52–66 kWh/m³

  - **Spray Dryer**
    - Drying droplets with hot gas current
    - >15 m³/h
    - >52 kWh/m³

**Centrifuge**

- **Solid Salt**

**60 to 70% ZLD CAPEX & OPEX**

**Typical Brine Contributors**
1) Desalination Industry
2) Heavy Industry
3) Oil & Gas Industry
4) Food & Beverages Industry
5) Mining Industry