

[ERD Basics](#) [1]

Energy Recovery Devices (ERDs) recover the hydraulic energy in the brine stream to:

- Generate a pressure boost in the feed entering the membrane (HPBs, HP-HEMI)
- Pump additional feed to the membrane (isobaric chambers, HPBs)
- Assist the HP feed pump (Pelton Turbines)
- Generate electricity (Power turbines)
- Generate a pressure boost between membrane stages (HPBs, HEMIs)

Hydraulic Pressure Boosters

- Absolute simplest of stand-alone ERD packages
- Generally the lowest capital and installation costs
- Best Life Cycle Cost (LCC) in SWRO systems up to 5,000 m³/day trains
- Extremely favorable impact on the HP pump and motor cost

HEMI

- Similar to HPBs in most characteristics, but require a small VFD
- For systems above 5,000 m³/day, HEMIs generally have the lowest energy consumption of any ERD
- Unique to all ERDs, the HEMI provides control of feed flow and pressure. This feature allows elimination of expensive VFDs on the HP feed pump and significantly reduces HP pump and motor size
- A much superior LCC compared with all other ERDs

Isobaric Chambers

- ICs generally have good efficiency
- They have a much higher level of complexity and involve significant auxiliary equipment supplied by 3rd parties
- ICs create varying levels of brine and feed mixing. Such mixing raises membrane pressure and reduces permeate quality. It may also reduce membrane life
- ICs show better performance relative to other ERDs with low recovery systems (less than 40%)
- Capital costs tend to be very high; often 300% greater than HPBs of similar capacity

Pelton Turbines

- Very mature technology with an extensive track record
- The turbine units are relatively inexpensive, however, they may require an expensive brine disposal system due to an inability to discharge brine at pressure
- Unlike other ERDs, Pelton Turbines do not reduce the size of the HP pump, thus making them comparatively expensive to the HPB
- Usually considered an obsolete ERD technology

ERD Experience

- HPBs and ICs are widely used in many hundreds of installations
- HPBs are used in the greatest variety of systems, such as military systems, systems requiring very high reliability due to remote locations, systems with minimal onsite maintenance, etc.
- HPBs are generally regarded as the most reliable based on field experience and engineering analysis include fault tree analysis

ERD Capacity

- IC unit capacity is generally limited. One supplier offers a maximum unit capacity of about 50 m³/hr and another has a unit limit of about 200 m³/hr
- HPB unit capacity is about 3,000 m³/hr, resulting in far fewer units for a given plant capacity
- Larger unit capacity is available based on customer requirements
- ICs generally require extensive manifolds and isolation valves

Operational Considerations

- Does the ERD require special protective equipment? ICs generally require extensive additional equipment to prevent damage from seemingly routine upset conditions such as HP pump trips. HPBs and HEMIs require no such protection.
- What are the temperature limits for storage and operation?
- What limits are placed on use of anti-scalants?
- Are startup and shutdown complex operations?

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