

Calculating the Life Cycle Cost of Energy Recovery Devices

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A good way to minimize the cost of permeates is to apply Life Cycle Cost (LCC) analysis to every major component in a Seawater Reverse Osmosis (SWRO) system. The LCC of a component involves detailed calculations of capital and installation costs, operating costs (including maintenance and energy costs,) and costs of downtime.

The type of energy recovery device (ERD) can have a substantial impact on the plant's cost of permeate. Some factors include:

- Capital and installation costs
- Costs to engineer and design the ERD (can be very substantial for some ERDs)
- Auxiliary equipment required by the ERD (can be very substantial for some ERDs)
- Foundation, special enclosures, electrical supplies, PLC programming, etc.
- Cost of energy over life of ERD
- Cost of maintenance, both scheduled and equipment failure
- Downtime associated with ERD failure
- Cost of capital (interest charges)

The LCC process involves assigning a net present cash value each major equipment item above. The LCC is simply the sum of the net present value of all above factors, which yields the total cost of ownership of the ERD. The Hydraulic Institute (HI) has published a procedure on LCC analysis for pumping equipment.

Unlike most components in an SWRO system, the type of ERD can greatly affect the LCC of other major components in the system: The following table is an approximate guide:

ERD	Affected system	Comments
<i>Turbocharger</i>	HPP, motor, starter/VFD	Reduces size and cost
<i>HP-HEMI</i>	HPP, motor, starter/VFD	Reduces size and cost
	HPP VFD or feed control valve	Eliminates
<i>Isobaric</i>	HPP, motor, starter/VFD	Reduces size and cost, HPP efficiency reduced from reduced flow
	HP booster pump, VFD	Added equipment
	Manifolds, isolation valves	Added equipment
	HP and LP flow meters	Added equipment
	PLC, startup and shutdown	Increased complexity, increased potential for downtime
	Membrane array	Brine mixing may increased elements and reduced life
<i>Pelton Turbine</i>	HPP motor	Double shaft required, extended base plate for turbine
	Brine disposal	Requires gravity flow brine discharge

Thus, when it comes to ERDs, the LCC analysis can be very complex, especially for those ERDs that require substantial amounts additional equipment.

FEDCO can perform the complex LCCA analysis of ERDs for you next RO system. The results are presented with details of all values and calculations. Such an analysis can save the system builder and end-user thousands or even millions of dollars by optimal equipment selection.