

## Energy Requirements

**RSL Membranes™** operate as a dead-end filtration system. Most conventional membranes operate as a cross flow membrane. Figure 1 displays the two concepts.

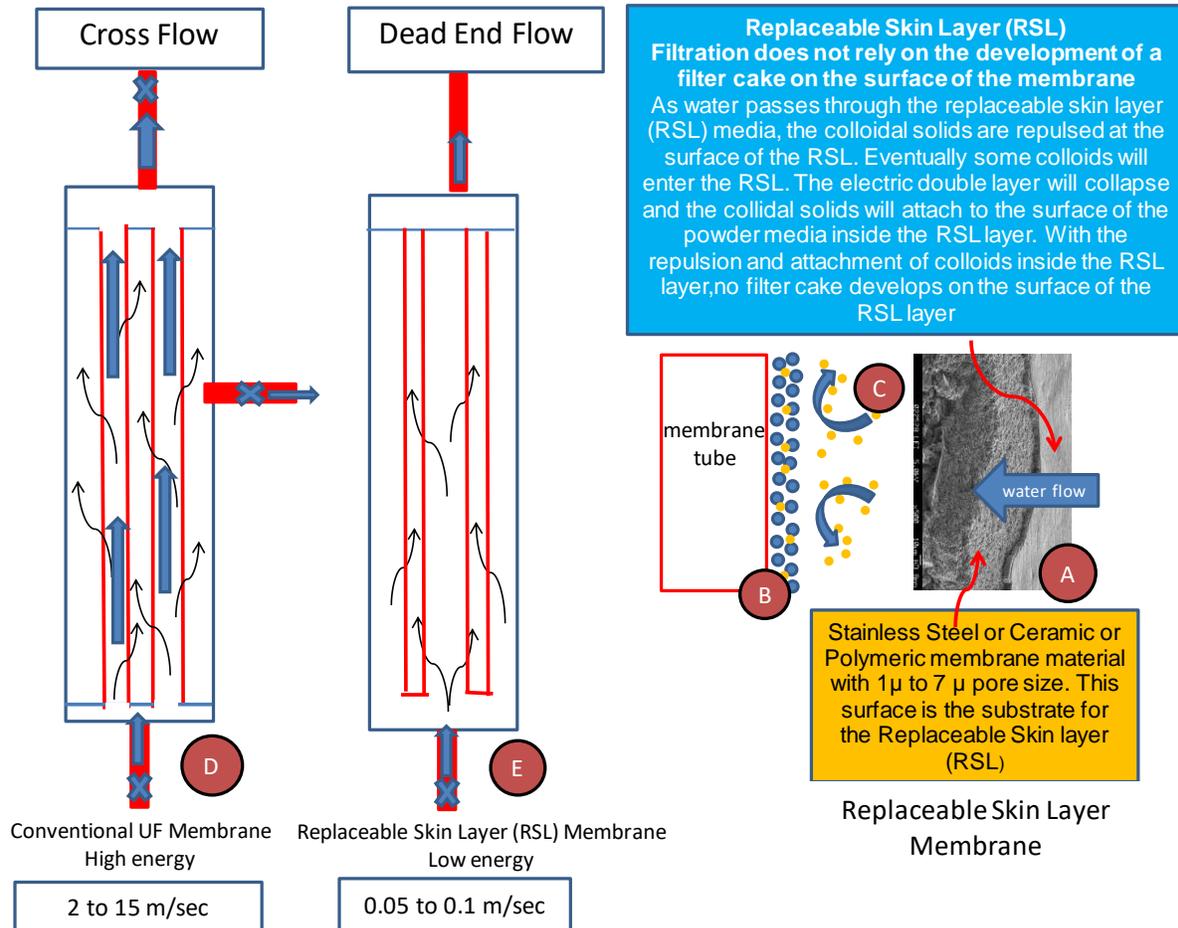


Figure 1: Dead End Filtration vs Cross flow filtration

In addition, the application of the **RSL™ Powder**, increases flux rates dramatically compared to conventional membranes. The maximum pressure in the operating filtration cycle is 70 kpa (10 psi) compared to 300 kpa (40 psi) and 500 kpa (70 psi) for conventional pressure membranes. The combination of these energy reducing features creates a valuable energy cost reduction as shown in Table 1 and 2.

Table 1: Energy Consumption Calculation for 5 MGD (865 m3/hr) Produced Water Treatment Facility Using RSL Membranes

Electricity Demand for treatment of Produced water		volume=		855		m3/hr			
	Quantity	flow rate	press (m)	% used	efficiency	Ps (Kw)	Kw/M3/hr		
P201	Raw water pump	1	780	m3/hr	10	98%	0.8	26.037	0.03
P204	RSL Slurry Pump	4	45	m3/hr	12	42%	0.8	3.066	0.00
P206	Backwash pump	2	30	m3/hr	50	23%	0.8	2.350	0.00
P207	B/W waste tank	10	10	m3/hr	12	50%	0.8	2.044	0.00
COMP1	Air Compressor	1				44%		38.000	0.02
Subtotal									0.06
Miscellaneous									10%
									0.01
Total	kwh/m3	for RSL membranes						0.07	
Total	per day							1458.00	

Table 2 Unit Electricity consumption for surface water treatment plants using conventional UF Membranes

Plant size

MGD	$m^3 day^{-1}$	$kWh MGD^{-1}$	$kWh m^3$
1	3 780	1483	0.39
5	18 900	1418	0.38
10	37 800	1406	0.37
20	75 600	1409	0.37
50	189 000	1408	0.37
100	378 000	1407	0.37

Source: Reproduced from California Energy Commission (CEC) Report (2005).

In addition to the process benefits, there are two other **RSL Membrane™** advantages that create significant energy reductions

1. the much smaller footprint of **RSL Membranes™** makes HVAC energy consumption much less
2. the high recovery of water treated results in significant improvement in energy consumed per m3 treated. Reduced back wash waters, sludge volumes and membrane cleaning requirements reduce energy requirements for pumping

### Research and Development Objectives

1. Develop lower operating pressure requirements facilitating small remote water treatment using manual labour to pour raw water through the **RSL Membrane™** tube.