Building a more eco-friendly pool

The Lopez Swim Center project has been designed with considerable concern for the sustainability of our surrounding rural environment. A great deal of research has gone into designing and building a low-maintenance, sustainable facility.

Heat Pumps

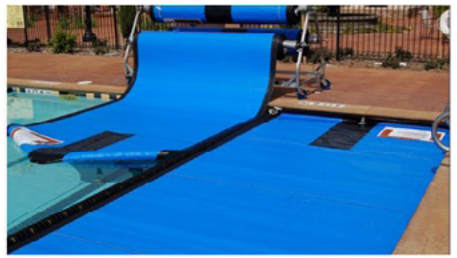
Despite their higher upfront cost, FLIP has made a commitment to use electric heat pumps, as opposed to more commonly used propane-fueled heaters, because of their decreased energy use and lower carbon footprint. Heat pumps will be used for heating the pool water, and for space heating inside the dome and the shower house. With no combustion, heat pumps do not release carbon emissions directly into the atmosphere. Overall, carbon emissions will decrease as electricity supply to the Swim Center is offset by renewable energy generation, a possible future addition to the site.[1]

Variable Frequency Drives (VFDs)

VFDs monitor and modulate the pump speeds needed based on variances in filtration needs throughout the day. This VFD adaptation to demand reduces pool pump energy use by 35% to 70%. Most of the savings is derived from the pump's ability to reduce the motor's rpm, thus reducing energy use. A typical 1½-horsepower pool pump draws about 2,000 watts and runs at 3,450 rpm. By reducing the pump speed and flow, the wattage draw reduces greatly. For example, if the pump speed is reduced from 3,450 rpm to 2,400 rpm (a 30% reduction in speed), the wattage drops from 2,000 watts to 593 watts (a 70% reduction in power).[2, 3]

Thermal Pool Covers

Evaporation is the largest source of energy and water loss for pools. Covering a pool when not in use is the most effective means of reducing pool heating costs. Heating costs are lowered based on both retention of water heat, and the heating and treating of water needed to replace the evaporated water. Energy savings of 30% to 45% are possible.[4]



Pool covers conserve water by reducing the amount of make-up water needed by 30% to 50%. With reduced evaporation, chemical use is also reduced, by 35% to 60%. When the dome isn't in place, covers keep dirt and other debris out of the pools, keeping them cleaner, longer.

Ultraviolet (UV) Disinfection

UV is one of the most environmentally friendly, low-maintenance pool disinfection methodologies available today. UV is an added level of disinfection that complements the disinfecting effectiveness of chlorine by destroying bacteria, and biologic and chemical by-products that chlorine alone cannot destroy.

UV disinfection utilizes a cutting-edge, non-chemical process that uses high-intensity germicidal UV light rays to disrupt the DNA or RNA of targeted organisms such as algae, bacteria, viruses, cysts, and protozoa, and sanitizing water, air, and surfaces that may be contaminated.[5] The highly concentrated electromagnetic energy also destroys organic matter, eliminating the formation of dangerous chlorine by-products that chlorine alone cannot destroy.[6]

Medium-pressure UV creates the healthiest environment by disinfecting with a broad range of wavelengths and higher intensity, which kills cryptosporidium, giardia, and other bacteria and biological by-products, as well as trichloramines which create the unhealthy pool air that smells of chlorine.

The Myrtha pool system utilizes 45% less energy over its lifecycle compared to a pool constructed by conventional techniques (concrete and tile) and saves more than 30% compared to a welded stainless project.

Myrtha Pools

Myrtha pools have a lower carbon footprint than traditional concrete/gunite pools and come with a 25-year warranty, which is 10 times longer than the industry standard. The Myrtha pool system utilizes 45% less energy over its lifecycle compared to a pool constructed by conventional techniques (concrete and tile) and saves more than 30% compared to a welded stainless project.[7] Myrtha has enabled mapping of Myrtha Pools to the LEED V4 standard to highlight the characteristics of their processes and products.

Outdoor/Open-Air Pool

An outdoor/open-air pool (approximately mid-May to mid-September) eliminates the need for air-conditioning and dehumidification entirely during summer.

Air-Supported Dome (approximately mid-September to mid-May)

The equipment of the chosen manufacturer, Arizon, uses 5 to 7 hp motors, as opposed to off-the-shelf equipment that uses motors up to 50 hp. The Arizon equipment results in a 40% to 70% reduction in energy usage.[8]

Arizon's Air-Rotation technology evenly distributes heat in the space: corner to corner and top to bottom, reducing heat loss through the dome by pulling heat down from the roof. This optimized air circulation is coordinated with the dome's air-support system. This design also helps reduce operating costs and provides a more comfortable environment in the dome.

The Arizon skylight system admits natural light into the dome during the day, reducing the need for artificial lighting. Using a combination of opaque and translucent fabrics, the Arizon skylight system provides a "best of both worlds" approach: the opaque fabric helps insulate the dome, reducing heating and cooling costs, while the translucent fabric provides pleasant natural light, reducing operating costs.

Less surface area and building enclosure volume equal more efficiency. Due to the designed slope of the roof profile, an air-supported building will feature significantly less surface area than most conventionally built structures of the same height; thereby there is less unnecessary interior space which would otherwise require additional energy to heat or condition.

FLIP redesigned the showerhouse building to accommodate the integration of a solar energy system that could offset conventional utility use. Future funding will unlock the purchase and installation of this equipment.

Regenerative Media Filters (Rmfs)

Research shows that RMFs save water, chemicals, filter room space, and electrical power, while maintaining a high standard in water quality and clarity.9 RMFs utilize perlite, an inorganic and safe powder, as the filter media. Perlite can be flushed to waste without a separation tank; thus is more environmentally "green."

A major advantage of this system is saving water, as there is no backwashing. This process conserves not only water but prevents costly chemicals from being flushed down the drain. For heated pools, an added benefit is that the systems are not expending energy to reheat the pool due to the addition of cooler replacement water10 or incurring added chemical costs for treating the replacement water. RMFs operate with a lower total dynamic pump-head energy demand, which may result in a lower horsepower motor, thus saving energy to drive the pool pump motor and a reduction in the carbon footprint.

Well

The Lopez Swim Center has its own well, which will serve two purposes: provide water for the Center's use and also provide potable water for the Lopez School. Water-conservation measures for the pools, which include recirculation, use of pool covers, and high-tech filtration and sanitation systems, will greatly reduce the need for replenishing the water. It's estimated that the pools will only need to be completely refilled on a five-year schedule.

The lack of a reliable and high-quality water supply has been a problem for the Lopez Island K-12 School for many years. FLIP and the Lopez Island School District have established a water-sharing agreement, which will expand the District's Group A water system to include the Swim Center's well. Located on the swim center site, this well will provide a source of safe and reliable drinking water for the school. This agreement will resolve the school district's water issues while saving FLIP capital costs.

Robotic Pool Cleaners

By slowly moving around the pool, collecting and removing debris and other containments, a robotic pool cleaner will keep the pools cleaner, reducing the need for additional chemicals.

Future Renewable Energy Systems

FLIP redesigned the showerhouse building to accommodate the integration of a solar energy system that could offset conventional utility use. Future funding will unlock the purchase and installation of this equipment.

Reduced Pool Temperature

Originally, the wellness pool was going to be kept at 92°F. However, additional research shows that temperatures of 85°F to 86°F are sufficient for planned programming use. Operating the pool at this reduced temperature will save energy and lower operating costs while improving comfort level for the greatness number of users. The lower water temperature will also reduce evaporation.

POOLS (WELLNESS POOL + LAP POOL) HEATING COMPARISON

	WELLNESS POOL PROPANE				WELLNESS POOL HEAT PUMP			LAP POOL PROPANE				LAP POOL HEAT PUMP			TOTAL ANNUAL COST COMPARISON	
	Wellness Pool		*2 gallons/hr*		Wellness Poo	7kW/hr		Lap Pool		2 gallons/hr		LAP POOL	7kW/hr			
MONTH	PROPANE	# hrs	Gallons/day	Gallons Annually	HEAT PUMP	Kw /day	Kw Annually	PROPANE	# hrs	Gallons /day	Gallons Annually	HEAT PUMP	Kw /day	Kw Annually	PROPANE	HEAT PUMP
Jan	$ 2,104	16.0000	32	992	$ 367	112	3472	$ 5,519	41.90	83.80	2598	$ 962	293.3	9092.3		
Feb	$ 1,715	14.4000	29	806	$ 299	100.8	2822	$ 4,436	37.30	74.60	2089	$ 773	261.1	7310.8		
Mar	$ 1,668	12.7000	25	787	$ 291	88.9	2756	$ 4,228	32.10	64.20	1990	$ 737	224.7	6965.7		
Apr	$ 1,318	10.4000	21	624	$ 230	72.8	2184	$ 3,216	25.20	50.40	1512	$ 561	176.4	5292		
May	$ 970	7.4000	15	459	$ 169	51.8	1606	$ 2,161	16.40	32.80	1017	$ 377	114.8	3558.8		
Jun	$ 680	5.3000	11	318	$ 118	37.1	1113	$ 1,324	10.40	20.80	624	$ 231	72.8	2184		
Jul	$ 505	3.8000	8	236	$ 88	26.6	825	$ 784	6.00	12.00	372	$ 137	42	1302		
Aug	$ 623	4.7000	9	291	$ 109	32.9	1020	$ 1,134	8.60	17.20	533	$ 198	60.2	1866.2		
Sep	$ 966	7.6000	15	456	$ 168	53.2	1596	$ 2,183	17.10	34.20	1026	$ 379	119.7	3591		
Oct	$ 1,494	11.3000	23	701	$ 260	79.1	2452	$ 3,703	28.10	56.20	1742	$ 646	196.7	6097.7		
Nov	$ 183	14.4000	29	864	$ 320	100.8	3024	$ 4,750	37.30	74.60	2238	$ 828	261.1	7833		
Dec	$ 2,115	16.1000	32	998	$ 369	112.7	3494	$ 5,550	42.20	84.40	2616	$ 968	295.4	9157.4		
	$ 14,341			**7532**	**$ 2,788**		**26363**	**$ 38,988**			**18357**	**$ 6,797**		**64250.9**	**$ 53,329**	**$ 9,585**

** data generated by Green Planet Supply, Hydro Royal Heat Pumps 9/29/22*

AIR-INFLATED DOME HEATING COMPARISON

NATURAL GAS*	cost	PROPANE	cost	#2 OIL	cost	ELECTRICITY	cost	HEAT PUMP	cost
20,944 therm	$ 33,280	22,919 gallons	$ 53,860	16,069 gallons	$ 66,413	492,205 kW-hr	$ 54,143	105,725 kW-hr	$ 15,932

**not available on Lopez Island*

End Notes

1) https://www.energy.gov/energysaver/heat-pump-swimming-pool-heaters
2) https://www.nrel.gov/docs/fy12osti/54242.pdf
3) Department of Energy, Measure Guideline: Replacing Single-Speed Pool Pumps with Variable Speed Pumps for Energy Savings A. Hunt and S. Easley Building America Retrofit Alliance (BARA) May 2012
4) https://www.energy.gov/energysaver/swimming-pool-covers
5) https://www.poolspanews.com/facilities/maintenance/technical-guide-to-using-uv-sanitation-on-swimming-pools_o
6) https://iopool.com/en/2022/06/30/what-are-the-advantages-of-uv-water-treatment/
7) https://www.myrthapools.com/en/magazine/myrtha-pools-its-green-to-be-flexible/
8) https://arizonbuildingsystems.com/energy-efficiencies/
9) https://www.parksandrecbusiness.com/articles/2009/09/03/regenerative-media-filtration
10) https://www.evoqua.com/siteassets/documents/products/filtration/aq-defender-ds.pdf