IF YOU BUILD IT:

Solar-powered skating rink could be game changer

BY ED RABINOWITZ

When Jacques Mouchet discusses the use of technology in ice skating rinks, he says the future is now.

The 73-year-old president and founder of Singapore-based Sun Ice Energy has decades of successful technical innovations under his belt. But perhaps none is more revolutionary than the world's first zero-carbon ice skating rink, cooled 100% by solar energy, and currently under construction in Singapore.

The seeds for the project were planted two years ago when Mouchet's 13-year-old daughter, a competitive figure skater, was unable to skate during the summer. Many municipally owned rinks were being forced to close during the warmer months due to the soaring cost of power.

"Energy is the main expense for a skating rink," Mouchet says. "I was in Europe last summer, in Switzerland, Germany and France, and so many rinks were closed because of the cost of energy. I started Sun Ice then because I wanted to do more for sustainability."

The technology behind the company's groundbreaking project is built around Phase Change Material (PCM), an organic substance that releases/absorbs enough energy to provide useful heating/cooling during a phase change, for example, when a liquid is frozen and then melts. The melting, or change that takes place, results in energy transfer at a constant and stable temperature, which is captured by the system to cool an environment. The solution has a lifespan of 50 years and costs 20 times less than batteries over its life cycle.

"PCM has been around for a long time, but nobody ever thought about using it for an ice skating rink," Mouchet says. "We've solved that problem."

In a nutshell, solar panels on a skating rink's roof capture the sun's energy, which is transferred to a standard hybrid inverter. That energy is used to power a standard rink chiller that cools the glycol solution — 50 percent water and 50 glycol — before transferring the solution to a network of pipes in close contact with large, plastic, rectangular — and patented — containers four inches thick. The containers are laid inside the ice rink floor, between an insulating material XPS layer and the concrete floor supporting the ice sheet. The PCM is frozen to minus 0.4 degrees Fahrenheit.

When the rink air is regulated between 50 to 60 F at four feet from the ground, the resulting rink ice sheet is stable at 21 F.

Michael Saddler, global sales manager for

Jacques Mouchet

Sun Ice, explains that while solar panels can be placed across the entire roof of a skating arena, less than half of that power is required to charge the Sun Ice PCM system. With roughly three hours of sun per day, the energy that is produced is stored to maintain the desired latent temperature of the PCM. The stored PCM-stable temperature in the containers will last for several days without having to be recharged. A four-inch-thick layer of PCM can keep a rink ice floor cool for two to three days.

"You have also this huge surplus of extra solar power that can be used to sell back to the grid, or store in lithium batteries to use for facility lighting and circulating pumps," Saddler explains. "And standard equipment that must run 24 hours a day to keep a normal arena cool will generally suffer more maintenance and overheating issues than our system. As an example, we only need the water chiller to be operated one-third of the time at nominal power, compared to a traditional rink working at variable power 24/7, thus extending its life by up to 20 to 30 years. We estimate the electricity savings on cooling the slab alone is approximately $350,000 per year for an ice rink operator."

The system also enables the ice temperature to be readily adjusted, allowing for efficient use of the skating rink. For example, while an ice temperature of 24 to 29 degrees is considered good or "softer" for figure skating, a temperature of 17 to 23 degrees is preferred for a "harder" ice hockey surface.

"If the operator of a rink knows that in three hours time ice hockey players will be skating, he can prepare the ice for them by adjusting the temperature," Saddler said. "And if the rink will be used for figure skating, they can change the ice for that purpose."

The patented technology has been on display at energy conferences, and reaction thus far to the proposed solar-powered ice skating rink has been positive.

"People say it's fantastic," Mouchet says. "It's a game changer. But they want to see it working. Nobody is going to build a 30- by 60-meter skating rink without seeing it working."

To that end, a proof of concept — a five-meter by five-meter ice skating rink — is being built at the company's Singapore factory. The scaled-down version, scheduled for completion in July 2023, will be 100% powered by solar panels and built to the same specifications as a standard-sized rink.

Once it's completed?

"We're going to beat the drum," Mouchet says. "We're going to call everyone and tell them we have a solution to saving energy."

And saving energy, Mouchet says, is critical. Consider that U.S. electricity costs increased by 14.3 percent from 2021 to 2022, according to Consumer Price Index data released by the U.S. Bureau of Labor Statistics. The price of electricity jumped from 13.66 cents per kilowatt-hour in 2021 to 15.07 cents in 2022. The U.S. Department of Energy reported in February 2023, the average electrici-

Workers smooth over the rink floor to make a perfect seal.

ty rate in the U.S. increased to about 23 cents per kilowatt-hour. In Singapore, the current electricity cost is 30 cents per kilowatt-hour.

"Ten years ago, nobody was thinking about saving energy," Mouchet says. "Today, it's getting more and more expensive. In the future, skating rinks will become so expensive, energy-wise, that many of them will close. Today, some rinks are economically unstable. This technology could well become a lifesaver for ice sports."

Initial costs to build a 100% solar-powered Olympic-sized ice skating rink as designed by Sun Ice, according to Mouchet, include approximately $1.8 million for electrical insulation of solar panels that can be bought locally. The price for the PCM layer, while coming down, is about $1.5 million. All other costs are similar to a traditional ice skating rink.

"The payback," he says, "is in about five years. But because electricity costs are going to increase, in the coming years, [payback] will be an even shorter time frame."

Mouchet says several governments, as well as private operators around the world, are "keenly awaiting" the proof of concept to be completed and then replicated around the world. The goal, he says, is to have an Olympic-sized ice skating rink commissioned and built based on the new technology in the next 12 to 18 months.

"There are many U.S. cities in the Sun Belt, and many cities in Asia, that want to host the Winter Games," Mouchet says. "Skating is progressing rapidly in the southern part of many continents. And the more sun, the more ice we can make."

Above, glycol cooling pipes charge the system. Below, Sun Ice Energy's patented floor units, which contain phase change material, are being covered by concrete as part of the construction of the proof of concept rink.