Solar Water Heating

Recommended Action
Install solar thermal collectors on the roof of your facility to reduce steam pool heating requirements. This will reduce pool energy consumption by 30%.

Assessment Recommendation Summary			
Energy 10^6 Btu	Cost Savings	Implementation Cost	Payback (years)
1,293	$18,600	$87,700	4.7

Estimated Incentive Summary		
BETC[1] Tax Credit	Net Cost	Net Payback (years)
$29,400	$58,300	3.1

[1] *Oregon Department of Energy Business Energy Tax Credit*

Background
Currently, your facility uses steam-water heat exchangers to heat hot water for two swimming pools, locker room showers and one spa. The steam is generated off-site via a natural gas steam boiler and delivered to your facility. You are charged a cost per pound of steam entering the facility.

The US Department of Energy states that the most cost effective use of solar energy is solar pool heating. Solar heating systems incorporate the following: solar collectors transfer sun energy to the circulated pool water, pump, filter and flow control valve. Solar heating systems are cost competitive with other pool heating systems, but require no ongoing fuel cost to operate. What's more, solar water heating systems typically last more than twenty years in operation. A solar pool heating system can be designed to work with the existing pool heating configuration. When the sun shines and solar collector water temperatures exceed the pool water temperature, a valve automatically diverts water from existing steam heat exchangers to the solar collectors.

Data Collected Summary
During our site visit, we collected the following natatorium general information:

- Heat source: OSU Steam Plant
- Steam cost: $0.017 per pound of steam (60 psi)
- Average ambient (indoor) temperature: 85.5 ºF
- Lap pool water temperature: 80.5 ºF
- Lap pool surface area: 4,500 sq ft

- Dive pool water temperature: 83.5 ºF
- Dive pool surface area: 1,800 sq ft

Savings Analysis

Savings result by reducing the amount of steam required to heat pool water. A solar water heating evaluation software tool, RETScreen International[1] is used to determine your site's solar potential, develop installation recommendations and estimate system cost. Values obtained through the use of RETScreen are incorporated in the analysis below and noted as such. Additionally, for simplification, both pools are combined in this analysis. Pool water temperatures have been conservatively averaged and pool surface areas are combined.

Energy savings are taken directly from the RETScreen analysis. Using historical NASA weather data for your geographic region and swimming pool data specific to your facility, RETScreen estimates months of solar water heating possible for your facility. The tool then estimates the potential amount of energy offset by using solar collectors based on collector efficiency and collector area. As a general industry rule, the solar collector area usually equals the surface area of the heated pool. More collector capacity may be added, increasing implementation costs, while increasing annual savings.

ES = Energy Savings
= 1,293 x 10^6 Btu/yr (RETScreen)

Energy cost savings are calculated by multiplying Energy Savings by the Incremental Energy Cost (steam cost) offset by solar energy.

EC = Energy Cost Savings
= ES x IC
= 1,293 x 10^6 Btu/yr x \$14.40/10^6 Btu
= \$18,600/yr

Where,

IC = Incremental Energy Cost (Btu)
= SC ÷ h_{60} x 1,000,000 Btu/10^6 Btu
= \$0.0170/lb ÷ 1,180 Btu/lb x 1,000,000 Btu/10^6 Btu
= \$14.40/10^6 Btu

Where,

SC = Steam Cost
= \$0.0170/lb

h_{60} = Enthalpy of Steam at 60 psi
= 1,180 Btu/lb

[1] RETScreen International can be downloaded for no charge through the US Department of Energy – Energy Efficiency and Renewable Energy website under solar water heating, or at www.retscreen.net/ .

Cost Analysis
RETScreen also calculates this recommendation's implementation costs (before incentives), summarized in the following table.

Implementation Summary				
Source	**Quantity**	**Units**	**$/Unit**	**Cost**
Solar Collector	588	m^2	$60.00	$35,280
Piping Materials	70	m	$6.00	$420
Collector Support Structure	588	m^2	$50.00	$29,400
Plumbing and Control	1	Project	$300	$500
Collector Installation	588	m^2	$20	$11,760
Solar Loop Installation	70	m	$30	$2,100
Training	4	hours	$60	$240
Contingencies	10	%	$79,700	$7,970
Total				**$87,700**

Note the following with respect to the above tabulated values:

- RETScreen uses metric units: 1 m = 3.28 ft
  1 m^2 = 10.76 ft^2
- Collector area (588 m^2) equals the combined pool surface area (6,300 ft^2)
- Collector Support Structure: This calculation assumes the collectors will be mounted on a flat roof. Your facility has adequate flat roof space for collector installation.
- Piping Materials refers to piping, pipe supports, fittings, insulation and jacket
- Plumbing and Control refers to the interconnection plumbing between the solar loop, pump, heat exchanger and pool.
- Installation: Unit values assume that most of the collector installation can be performed at a non-specialized hourly rate.
- Training: Facility personnel will require a few hours of system training by a solar water heating expert.
- We assume no changes are required of the existing water pump system: i.e. the existing heat exchanger pumps will serve the solar collector system and there is no increase in pump energy.

You may be eligible for the Oregon Business Energy Tax Credit (BETC) if the project reduces system energy use by at least 10% (as written, system energy use should be reduced by 30%). As a public entity your facility cannot take the full incentive for renewable resource projects (50% of project cost). Instead, you may take advantage of a "pass-through" option, which allows you to transfer the 50% tax credit to a pass-through partner in exchange for a lump sum cash payment, equal to 33.5% of project costs, after applying other incentives. (Renewable resource tax credit details are still being finalized by the Oregon Department of Energy as of this writing). The BETC will reduce implementation costs as follows:

BETC = Business Energy Tax Credit
= TC x 0.335
= $87,670 x 0.335

= $29,400

Where,

TC = Total Implementation Cost
= $87,700

The following table summarizes implementation costs before and after incentives.

Incentive Summary	
Description	Cost
Pre-incentive Cost	**$87,700**
Business Energy Tax Credit	($29,400)
Total after Incentives	**$58,300**

After incentives, savings will pay for implementation in 3.1 years.

The Oregon Department of Energy also operates an Energy Loan Program to promote energy conservation and renewable energy projects. Low interest rates (4.9-5.3%) would allow you to pay back the $58,300 implementation cost (plus interest) in 3.5 years, using the associated energy cost savings.

Notes

The Oregon Department of Energy requires written agreement prior to project implementation.

Energy Trust of Oregon incentives are not available because your institution does not pay the required NW Natural public purpose charge.

Additional savings associated with greater collector capacity tend to balance the added implementation costs and payback remains about the same.

We recommend you engage a solar water heating company to perform a professional feasibility study of your facility.