



**AMERICAN**  
Plumbing, Heating & Solar Inc.



## **Case Study: Sonnenalp, Luxury Resort Hotel Upgrade to High Efficiency Domestic Hot Water System By American Plumbing, Heating, and Solar, Inc.**

Vail, Colorado, November 30, 2016:

Date: 1/9/16

With the idea of providing an updated, high efficiency, and highly reliable heating plant for the hotel's space heat, snowmelt, domestic hot water (DHW), and pool systems, American Plumbing, Heating and Solar is proposing the following boiler systems and changes:

**First Phase:** is to replace the Pool/Spa boiler system with a Viessmann Vitodens system consisting of (5) wall hung boilers cascaded together and controlled by a Viessmann engineered and built main control. This control will modulate boilers and turn them on and off to achieve the highest efficiency possible to cover the load at any given time. This allows nearly a 20 to 1 turn down ratio and that translates to energy savings. The existing system for pool and spas uses 4 boilers with a total input of 2.8 mmbtuh (million btu's an hour) and after altitude de-ration and an assumed efficiency of 75% this system can put out nearly 240,000 btuh for each spa and nearly 1.1 mmbtuh for the pool. We believe this overall existing system is oversized. For example the indoor spa uses the same boiler size as the outdoor spa. From Spa heat exchanger manufacturer's data we think the indoor spa maybe needs 30,000 btuh and the outdoor spa needs 100,000 btuh. As for the pool, we assume a load of 700-800,000 btuh at -20 F for the surface area exposed and 80 F pool temperature. The existing pool boilers are putting out 1.1 mmbtuh total. So, we think the existing system is oversized by at least 650,000 btuh. Our system has a

total of nearly 2 mmbtuh input and nearly 1.5 mmbtuh output, still oversized but because it is a cascaded system and modulating will match what the system needs and our extra output and in fact all of the output at times can switch over to the space heat, DHW, and snowmelt system as needed. Also, this new system will be piped in such a way as to allow it to temporarily supply heat for DHW when the other mechanical room system is being replaced. This will allow for a very minimal downtime of DHW to the hotel rooms. Other major components of this pool/spa system include Heat Exchangers to separate pool and spa water from our boiler system. The existing system has pool and spa water heated directly in the boilers and the corrosive nature of that water shortens the life of boilers. New circulators sized for the heat exchangers' flow rates with adjustable and viewable flowsetters will allow us to see what is happening with the flows at any given time.

**Second Phase:** is to replace the spaceheat , DHW, and snowmelt boilers with (2) Viessmann Vitocrossal 200 CM2 boilers with communication between them for modulation to again match the load at any given time. These two boilers allow for a 10 to 1 turn down ratio. The (2) existing Weil McLain boilers use burners by a manufacturer no longer in business. These boilers are standard on/off boilers so that on a call for them to turn on, the full input occurs. The burners input to each boiler is 4.9 mmbtuh and the snowmelt boiler has an input of 2 mmbtuh. Due to the boilers' age and at an altitude of 8000 ft., we assume the following outputs: each of the 4.9 mmbtuh input boilers have an output of approximately 2.72 mmbtuh and the existing snowmelt boiler has approximately 1.11 mmbtuh output. American Plumbing, Heating and Solar analyzed the original mechanical plans and looked at existing piping multiple times and has come to the conclusion that again the heat plant, piping, and circulators are oversized for the loads being served including snowmelt and DHW. On the spaceheat side all 74 hotel rooms use the same fan coil rated at 25,000 btuh is in place. There is no way a room on the first floor needs the same heat requirements as a fifth floor corner unit w/loft. We calculate an oversizing for room

heat by 800,000 btuh. From past experience and knowing mechanical engineer offices add an oversize factor of 1.25 to 1.50 to cover unknowns, the rest of the heating loads can be down sized by a  $1/3^{\text{rd}}$ . The air handler load, hot water coils, variable air volume (VAV) boxes and constant volume box coils are determined to have a load of approximately 2.85 mmbtuh. The DHW load for rooms and laundry for a ski area hotel with 37 F degree water coming from the street is estimated at 850,000 btuh according to information from manufacturer's of water storage for DHW. As for the snowmelt system we are estimating a load of 750,000 btuh. So at design conditions the overall load for spaceheat, DHW, and snowmelt is 4.45 mmbtuh. Our (2) boiler system has an output of 3.4 mmbtuh and then has the additional input of the pool/spa boiler system that adds heat automatically. Our other strategy is to drop off secondary loads such as parts of the snowmelt zones when it drops below zero. This strategy is called load shedding and insures DHW and spaceheating are the priority over snowmelt. Snowmelt comes back on line as soon the supply temperatures come back up without the help of the pool/spa heating boilers. Other components that will make a difference is the replacement of circulators with very efficient commercial sized circulators, smarter controls and some re-piping. The snowmelt system will be interfaced to the boilers via a plate heat exchanger. The domestic hot water system will allow the large 900+ gallon storage tank to be decommissioned as our 3 turbo max reverse indirect tanks will easily take care of the 74 rooms and laundry/kitchen load. The Lochinvar Shield water heaters can be used as a back up as they have been recently replaced.

**Conclusion:** American Plumbing, Heating, and Solar has as part of their mission to save energy and being impeccable with their word. This system will save substantial money for the Sonnenalp Hotel, provide a great Green Marketing tool for the owners and show a great return on investment (ROI). The existing boiler system will have to be replaced within the next 10 years and in our software analysis we figure this to be the case but with a boiler package that is standard efficiency (at today's standard of 84-



85%/atmospheric boilers) and at less of an installed price compared to the system discussed above. We believe in sustainability and energy efficiency when considering large commercial heat plant replacement. This goes a long way to making a difference and future Sonnenalp clients can be made aware of this commitment.