



NEW HVAC ZERO MIXING CONCEPT. For Significant Non-renewables and GHG Emissions Reduction on Residential, Commercial, Institutional Large Real Estate Assets and Industrial Batch Processing.

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Modern design for today's building HVAC-systems is based on engineering fundamentals (ASHRAE Standards) that promote system water mixing and consequently foster inefficient small temperature differential system operation between boiler supply and system return. This type of operation not only limits boiler(s) performance but also affects optimal building heat distribution and the overall system efficiencies as a whole. New **ZERO MIXING** concept and the integration of patented **Smart Buffer Tank (SBT)** completely change the nature of operation by looking into the heart of the systems and providing technical solutions to an unchecked number of existing deficiencies greatly impairing thermal performance. The **SBT** and the **ZERO MIXING** concept it embraces is a new patented thermal storage reservoir with proven laboratory test outstanding results of improving HVAC-system thermal efficiency and boosting installed heat/cooling production capabilities. **SBT** storing-intelligence innovation eliminates hydronics overall water mixing, allowing system to run at much higher temperature differential, reducing the consumption of costly non-renewables [such as natural Gas and Electricity], improve system availability, operability, and minimizing equipment maintenance. Since it truly maximizes building Annual Fuel Utilization Efficiency (AFUE), CO₂ emissions reduction provides relief on imposed carbon tax levy and improve business cash flow from carbon trading opportunities.

Other HVAC-systems such as Heat-pumps, Solar-thermal, Combined Heat & Power, Batch-thermal processes, or Chilled-water systems can equally benefit from SBT-retrofits since their thermal efficiencies are also largely affected by WATER-MIXING and the resulting effect in the water return temperature during their reheating process.

Building Heating Solution:

- Improve system energy efficiency (AFUE) up to 50% on conventional HVAC systems,
- Double heating and cooling plant capacity with minimum added CAPEX,
- Double hot water production capacity by replacing existing commercial buffer with the new SBT,
- Reduce up to 40% HVAC related electricity usage (16% of building energy cost),
- Reduce operational wear-and-tear maintenance cost by eliminating boiler over-firing/cycling, very common in poorly designed boiler plants,
- Improve operations' cash flow by reducing the use of non-renewable resources, associated carbon tax levies and CO₂ emissions trading,
- Reduce oversize equipment for new facilities – heating, ancillary equipment, pumping distribution and piping network sizing (on both primary and secondary loops), and lower capital investment cost, as well as future energy bills and maintenance costs relevant to operations.

Solar Thermo Solution:

- Maximize panel solar adsorption. SBT thermal storage/ZERO MIXING concept; along with new DBBS' digital control strategy for high delta temperature operation, maximizes panel energy output at any outdoor condition, increasing solar fraction and therefore reducing supplemental boiler heat.
- Minimize system-hydraulic and pumping equipment oversize on newly designed facilities, slashing capital investment cost by half, and improving project feasibility. SBT integration enables higher temperature system/storage differential $\Delta T \approx 40^\circ\text{C}$, compared to customary $\Delta T \approx 10^\circ\text{C}/20^\circ\text{C}$.

Combine Heat and Power (CHP) Solution:

- The SBT/ZERO-MIXING concept integration into the CHP-storage system improves overall plant thermal efficiency by eliminating heat-transferring diminishing-returns due to water mixing during the reheating and storing process operation,
- Since CHP produces both heat and power simultaneously, with daytime power demand usually offsetting heat energy demand periods, efficient thermal storage needs to be readily available during daylight power generation hours. SBT allows cogeneration by-product excess heat to be efficiently stored at a much higher temperature differential, offering larger thermal mass (with greater opportunity for energy capture) than a similar commercial tank with the same dimensional characteristics.

Industrial Application Solution:

SBT improves batch process thermal efficiency by eliminating water mixing during storage and release operation. This alone can greatly increase process output economy in industrial settings that are so dependent on heat-production processing and storing. Suggested SBT and flat-plate heat exchanging configurations favour more efficient full force-convection heat-transfer operation with much higher temperature differential between exchanging fluids (for greater energy-density transportation), doubling the thermal storage capacity of a conventional tank.

Existing Retrofit Market and the SBT Offering

Energy conservation enhancements for Calgary's large-building infrastructure, after initial construction, is not often considered due mostly to the perceived low energy-efficiency benefits of existing HVAC retrofitting options. Decision makers are always concern with the large upfront capital needed for installations and believe that energy retrofits are too expensive with long payback and low ROI. Most common retrofits include the replacement of old equipment for newly more efficient products, building insulation improvements, and lighting, for a combined AFUE improvement as high as 17%. More expensive retrofits, with much higher AFUE, include solar-PV/solar-thermal, geothermal systems, and Cogeneration-combine Heat and Power (CHP).

Most building energy efficiency retrofits rely on structural changes that barely improve Annual Fuel Utilization Efficiency (by 5-17% at best). Post retrofitted building still run on an inefficient-ineffective water mixing operation platform that limits not only heat output capacity but also distribution operation. The SBT/ZERO-MIXING retrofit eliminates WATER-MIXING operation truly busting system core performance by improving continuous boiler high efficiency operation ($\approx 95\%$) and building terminal equipment for distribution.

DBBS Energy Efficiency retrofit is a low-cost/low-risk proposition with the potential for much higher overall system AFUE improvement and greater financial results (with higher NPV, ROI and shorter payback).