

THERMAL RECOVERY UNIT SYSTEMS (TRU)

By

Commercial Energy Savings Plus LLC.

Ten years ago Commercial Energy Savings Plus (CESP) set out to turn the page on conventional wisdom and designs in the heating, ventilation and air conditioning (HVAC) industry and create a heating and cooling system which would breakthrough all the barriers which kept efficiency ratings down. A unit so smart, it would virtually learn from its own mistakes and attempt to get better every cycle thereafter. A system which would work with the environment instead of against it and a system which would use pollutants and emissions as a fuel instead of releasing them to add to global warming.

We are pleased to announce that we have accomplished what we set out to do. However to better understand the technology which is the driving force of the system, we must understand the background and the hurdles we needed to overcome.

Anyone who is familiar with the HVAC industry will agree that change is a subject not often broached at large companies and technology grows at a snail's pace at best. For example, if you walk a computer trade show in September what you observed is old news by March. While in contrast if you attended an HVAC trade show forty years ago, you will most likely see the same units if you were to visit one next week. The only difference may be a slight increase in efficiency which were mostly driven by minimum requirements of the Government. One of the greatest leaps in technology of the HVAC industry did not even come from the industry but from computer companies. However, this leap has been marketed in a grand scale while its bark is much bigger than its bite. The smart thermostat is perhaps one of the biggest developments in the HVAC industry. While it was a good attempt in reducing utility bills, the truth is the teaching thermostat is nothing more than a glorified on and off switch. A thermostat cannot be any more than that, a thermostat can only turn your heating and air conditioner on when required and off when satisfied. It cannot actually change the efficiency of the heating and cooling equipment, if your heating system is 80% AFUE a thermostat no matter how smart, cannot make it operate at 100%. All a smart thermostat does is turn your equipment off when you are not home or asleep and back on when you return or awake. While this may or may not save fuel due to thermal recovery, insulation issues and weather conditions, it is far from the breakthrough it was marketed as.

Our company placed the emphasis on making the equipment smarter not the switch that turns it on and off. Commercial Energy Savings plus integrated the latest in Artificial Intelligence (AI) and learning technology directly into their heating and cooling system. Upon a request from a standard thermostat, our TRU unit actually starts evaluating the current indoor

and outdoor conditions, the time of day, the season upon dozens of other criteria's and conditions. It then derives a solution for the best way to heat or cool the building and satisfy the request. After the operational cycle the system will calculate how efficiently and effectively that sequence was able to accomplish the goal. Upon the next request the system will attempt to use the mechanical components to do it a little better each following cycle. This methodology actually changes and increases the efficiency of the unit every time a heating or cooling cycle is requested. So just like a child learns and becomes smarter and better as they age, so does the TRU system.

The next issue to be addressed was the 100% wall on fuel combustion. It has long been written in stone that a fuel such as natural gas or liquid propane has a caloric/ thermal value when most efficiently burned will always yield that amount and associated by-products (emissions or flue gas) for example an 80% AFUE furnace will convert a Therm or (100,000 BTUH) of natural gas into 80,000 BTUH of usable heat and 20,000 BTUH of waste gases that pollute the air. **The TRU unit through groundbreaking extraction methods is able to convert that 20,000 BTUH waste with all the sensible and latent thermal energy associated with the emissions into useful usable energy to heat the building while yielding a discharge back into the environment with 90% less greenhouse gases and a 100% reduction in thermal pollution. In addition to achieving efficiencies over 165% AFUE. The TRU virtually uses the one time discarded waste as a sort of fuel, that when mixed with ambient air, is able to achieve almost double the efficiency of a standard HVAC unit.**

Another topic to be breached was the enormous amount of untapped thermal energy surrounding us all day long. It appeared the HVAC industry overlooked all the available thermal energy present all around the world on a daily basis. **While the industry attempted to capture heat underground through expensive means of geothermal, they seem to have missed the energy right in front of them. Meaning that, besides for outer space which is absolute zero or minus 455 degrees Fahrenheit, there is a tremendous amount of heat for the taking throughout the world.** Even at the coldest spots on earth like the Antarctic which can dip to 120 below zero, there is still 335 degrees of thermal heat energy ripe for the taking if technology allows. The TRU system uses both ambient thermal heat and solar thermal heat in tandem through proprietary methods to transfer the most usable heat from outdoors to indoors in a method never seen before to dramatically reduce utility cost to both heat and cool the building. Unlike most renewable sources which work besides conventional HVAC equipment when the sun is out or the wind is blowing. The TRU approach is using green renewable methods to make the conventional mechanical components operate in harmony with these new techniques and at efficiencies only once dreamed of by HVAC engineers.

CESP has developed Smart Thermal Solar Convection Cells specifically for this project and to incorporate them into their TRU system. These cells are a fraction in size of conventional solar thermal collectors and were designed to be significantly more efficient by working smarter not

harder. CESP uses the waste of the air conditioning cycle to pre-heat the cells to 120 F then the excess cubic feet per minute of air or (CFM) for the condensing blower to create a positive pressure within the cells. This creates temperatures within the cells of over 300F on partly sunny days and even 200F on winter days when the outdoor temperature is well below zero. This tapping of waste, solar and ambient thermal energy gives the variable heat pump cycle an octane boost never witnessed before, allowing the TRU unit to use this heat in lieu of electricity to move usable thermal energy from one point to another at a fraction of the cost used today by conventional HVAC equipment. TRU also developed a technique of using pressure measurements instead of temperature as the method of determining which cells on an average day would be most efficient to tap the thermal energy out of upon the request from the AI of the TRU unit.

Since CESP has incorporated Thermal Solar Cell technology right into the TRU rooftop unit, there appeared to be obvious synergies. The best place for a solar system of any kind is on the roof and the easiest and most economic method is by simply removing the old unit and dropping on the new TRU rooftop unit. There would be no additional wiring or piping, no extra duct work etc. Simply an exchange from an inefficient rooftop package unit to a modern marvel of technology. **CESP even created a roof curb adapter which allows any unit no matter the brand to be lifted off and a new TRU package heating and cooling unit to be placed on the same old roof curb facing south on all applications with no roof modifications required.** Obviously by facing the unit south on all applications the TRU can benefit from the most direct solar effects all year long.

Unlike anything the HVAC or utility industry has ever seen, the TRU unit works against conventional wisdom. This means when the outdoor conditions are very warm, the old way to interpret this was your cooling bills would be much higher and the same to be true for heating when the temperature outside was extremely cold. However the TRU units work with these extremes to its advantage, instead of working against the environment it works with it. the TRU takes a much different approach, it sees all that thermal energy as a free fuel to be tapped and used to deliver air conditioning to the building even more efficiently and less expensive on an extremely hot day then say a day when the outdoor temperature is 70F. **This also means the more you require cooling the less expensive it becomes. The same holds true for heating a building, by using the waste or emissions of the combustion process as sort of fuel, the more the furnace burns the natural gas the less expensive it is to heat the building.**

With the introduction and emphasis on the green renewable energy movement, CESP must overcome a stigma that consumers have been programed to believe, that higher efficiency or green technologies must cost more than low efficient and conventional equipment. For example, when purchasing a hybrid automobile, installing photovoltaic solar systems, geothermal HVAC units etc. Let us imagine for a moment that with State, Federal and Local Rebates, Tax Incentives and Carbon Credits the TRU package rooftop unit actually cost less than

a conventional 80% rooftop unit to purchase and install. **In addition that the TRU unit cost a fraction of the utilities to heat and cool their buildings. Furthermore they would reduce the release of greenhouse gases by 90% and reduce thermal pollution by 100%. Why would anyone choose to pay more to purchase an inferior HVAC unit. Cost more to heat and cool their building and increase instead of decrease their carbon foot print. CESP believes everyone would be green if it cost less instead of more to do so. Cost is usually the single most important driving factor in these decisions.**

It has been determined that each 5 ton TRU rooftop package unit would be equivalent to installing a \$50,000 photovoltaic solar system on building's roof. While it may be impossible to convince a building owner to purchase \$200,000 worth of photovoltaic panels. It should be very attractive to the same business owner to replace their four old HVAC rooftop units with equivalent TRU rooftop systems. Especially if it cost them less than purchasing a conventional system of 80% AFUE and they would pay for themselves in a short period time, usually less than two years with the unprecedented efficiencies.

CESP believes there is a very bright future for its TRU technology and rooftop package units. Currently there are several large HVAC manufacturing companies have showing an interest in mass producing these systems globally. In addition, **CESP has received three issued patents on this technology, has four more pending and is in the process of filing an additional five patent applications.**

CESP is also convinced these units could be exactly what environmentally conscience states such as California have been waiting for and would like to work with state and local building officials to spread this groundbreaking technology.

Furthermore CESP has been working with the Dept of Energy (DOE) and National Renewable Energy Laboratory (NREL) to lead and implement this technology in field test throughout the USA to further exploit this groundbreaking renewable technology.