Invented is a method of making combustion air for a fossil fuel burner, as a coal burning power plant, oil refinery or gas fired household appliance. Combustion air is made from solar, wind, biomass, hydropower or geothermal. A staged progression using lower cost greenhouses, or flatplates, or solarponds, feed warm air to higher cost concentrator solar collectors. Wind energy, biomass, geothermal energy heat and compress combustion air. Hydropower also heats and compresses combustion air. Solar evaporation from salt or impure water creates water or local rain for the hydropower system. Combustion air thus is made economically hot, compressed and high velocity, and placed into a heavily insulated pipes for long distance transmission to a distant power plant.
FIGURE 13
FIGURE 18
USE OF RENEWABLE ENERGY LIKE SOLAR, WIND, GEOTHERMAL, BIOMASS, AND HYDROPOWER FOR MANUFACTURING COMBUSTION AIR FOR A FOSSIL FUEL BURNER AND FIREBOX

PRIOR ART

[0001] Methods of making hot and warm air from renewable energies abound. Commonly referred to as solar, wind, biomass, or geothermal, or tidal energy; renewable energy can make hot air, compress air, and blow air. Nix in U.S. Pat. No. 5,308,187 (issued May 3, 1994) outlines a method of reducing fuel consumption for a fossil fuel burner. Air is pre-heated by solar energy, using a parking lot like surface. The transparent clear covering heats an opaque thermal conducting mass. This thermal conducting mass then transfers heat to underground pipes. The hot air is sucked into a firebox in a coal burning power plant. The pre-warmed air reduces the amount of fuel that needs to be burned. The invented device improves upon Nix, to include higher temperatures, and higher compression of the air. This makes for a more efficient combustion, reducing the amount of carbon dioxide created, and also reduces drastically the amount of fossil fuels needed.

[0002] Cottle in U.S. Pat. No. 608,755 (issued Aug. 9, 1898) shows an early application of solar concentrated heat. A tracking reflector concentrates sunlight into a window to heat rocks to a high temperature.

[0003] McCabe in U.S. Pat. No. 3,757,516 (issued Sep. 11, 1973) illustrates how geothermal energy can be utilized. A fluid is moved through a geothermal formation to make a hot saturated vapor.

[0004] Rigolot in U.S. Pat. No. 3,757,517 (issued Sep. 11, 1973) shows a power plant that uses stored compressed air for off-peak power.

[0005] Gaydos in U.S. Pat. No. 3,815,574 (issued Jun. 11, 1974) shows a solar collector that is simple in design. Pipes buried in sand, with iron oxide, make a hot fluid. The sand is underneath a clear glass surrounded by an insulating box.

[0006] Rushing in U.S. Pat. No. 3,845,238 (issued Oct. 22, 1974) shows a tension frame solar reflector, which can be used to reflect more sunlight onto a solar collector, thus increasing heat.

[0007] Glickman in U.S. Pat. No. 3,903,700 (issued Sep. 9, 1975) shows a sunshine powered hydroelectric power plant. The expansion of a working fluid drives a pump for water. The water, when flowing downwards, generates electrical power.

[0008] Sadan in U.S. Pat. No. 3,966,541 (issued Jun. 29, 1976) shows a method of concentrating salt brines with ponds that evaporate water with solar energy. The result is to optimize recovery of chemicals.


[0012] Jahn in U.S. Pat. No. 3,998,206 (issued Dec. 21, 1976) shows a point focus type parabolic solar collector, or dish type. A tracking mechanism points the parabolic at the sun, which then reflects the concentrated sunlight onto a spherical boiler with a shield, creating very high temperatures.

[0013] Arthur in U.S. Pat. No. 4,010,614 (issued Mar. 8, 1977) illustrates a power plant that pumps water uphill using solar energy. The water when traveling downhill generates electrical power.

[0014] Coleman in U.S. Pat. No. 4,026,267 (issued May 31, 1977) illustrates a solar energy apparatus that uses lens to focus solar radiation unto fiber optics. This is used to heat a heat sink for thermal storage.

[0015] Drew in U.S. Pat. No. 4,038,964 (issued Aug. 2, 1977) shows a parabolic solar collector that uniquely has an interior flat plate solar collector. Thus, the solar collector is able to capture not only direct sunlight, but also indirect sunlight (like from clouds). The entire assembly is covered by glass, thus is able to trap short-wave solar radiation.

[0016] O’Neill in U.S. Pat. No. 4,069,812 (issued Jan. 24, 1978) shows a prismatic, line focus, fresnel lens solar concentrator. Light is focused onto a heat transfer pipe.

[0017] Scragg in U.S. Pat. No. 4,070,861 (issued Jan. 31, 1978) shows a solar reactor combustion chamber, where concentrated sunlight is used to combust a chemical. The heat and pressure then drives a turbine.


[0019] Bennett in U.S. Pat. No. 4,080,957 (issued Mar. 28, 1978) shows a solar collector that boils a liquid inside an evacuated enclosure.

[0020] Fletcher in U.S. Pat. No. 4,091,798 (issued May 30, 1978) shows a non-tracking solar energy collector system, where reflectors reflect light onto a system of vacuum jacketed receivers.


[0023] Keith in U.S. Pat. No. 4,141,185 (issued Feb. 27, 1979) shows a flat plate solar collector with an interior evacuated passageway with cavities.


[0025] Korr in U.S. Pat. No. 4,159,629 (issued Jul. 3, 1979) shows a huge solar collector floating on top of a floating boat. The water allows for effective tracking of heavy and large solar collectors. An island in the middle has pipes carrying the working fluid from and to the solar energy focus.

[0026] Seidel in U.S. Pat. No. 4,167,856 (issued Sep. 18, 1979) shows a solar thermal power plant using an open-air circuit. The solar energy drives a compressor and a gas turbine. Optionally, fuels can be burned in a combustion chamber.

[0027] Wood in U.S. Pat. No. 4,171,876 (issued Oct. 23, 1979) shows a large curved solar parabolic using a plurality of straight rod-like elements. A tracking support structure supports the reflector in the correct orientation to the sun.

[0029] Sommer in U.S. Pat. No. 4,172,443 (issued Oct. 30, 1979) shows a tower with a plurality of mirrors focusing the sun’s rays to the top of the tower. Generated are very high temperatures.

[0030] Zentzi in U.S. Pat. No. 4,177,120 (issued Dec. 4, 1979) shows the art of converting coal to a gas via solar energy.


[0032] Penny in U.S. Pat. No. 4,220,136 (issued Sep. 2, 1980) shows a line focus type parabolic solar collector that also is able to absorb solar radiation with an interior flat plate solar collector.

[0033] Braun in U.S. Pat. No. 4,211,212 (issued Jul. 8, 1980) shows how solar energy can be used to drive an absorption cycle refrigeration system.

[0034] Margen in U.S. Pat. No. 4,227,511 (issued Oct. 14, 1980) shows a solar collector system that tracks the sun while floating on a liquid. The liquid also acts as thermal storage of the sun’s heat.


[0036] Stone in U.S. Pat. No. 4,251,135 (issued Feb. 17, 1981) shows a tension frame solar planar reflector. The triangular shape frame can be used as a heliostat for focusing the sun’s rays on top of a tower.


[0038] Finch in U.S. Pat. No. 4,259,836 (issued Apr. 7, 1981) shows a solar power plant using an open gas turbine circuit. The solar power plant has a compressor, a solar heater, a combustion chamber and a turbine and generator for heating compressed air.

[0039] Jubb in U.S. Pat. No. 4,262,484 (issued Apr. 21, 1981) shows a gas turbine, which uses compressed air heated by solar energy.


[0041] Synder in U.S. Pat. No. 4,276,122 (issued Jun. 30, 1981) shows how solar energy can be used to distill water.


[0043] Hutchison in U.S. Pat. No. 4,297,198 (issued Oct. 27, 1981) shows a trough line focus type solar collector. Unique is a stressed skin monocoque construction.


[0047] Goldstein in U.S. Pat. No. 4,318,393 (issued Mar. 9, 1982) shows a porous surface receiver placed on top of a tower. Heliostats focus the sun’s rays onto the receiver. Atmospheric air is used as the working fluid.


[0050] Moore in U.S. Pat. No. 4,328,791 (issued May 11, 1982) shows a tank for storing solar heat, which is supplemented by a fossil fuel burner and firebox.

[0051] Mori in U.S. Pat. No. 4,340,812 (issued Jul. 20, 1982) shows a light energy collection apparatus to focus the sun’s rays into fiber optics.

[0052] Whiteford in U.S. Pat. No. 4,358,183 (issued Nov. 9, 1982) shows a solar reflecting panel with a tensioning frame.


[0055] Drost in U.S. Pat. No. 4,394,859 (issued Jul. 26, 1983) shows a central solar energy receiver on top of a tower which uses fin shaped slats. Heliostats focus the sun’s rays onto the receiver.


[0060] Assaf in U.S. Pat. No. 4,475,535 (issued Oct. 9, 1984) shows a solar pond which is segregated.

[0061] Snoek in U.S. Pat. No. 4,481,774 (issued Nov. 13, 1984) shows a solar canopy over a canal. The uprising of solar heated air drives large turbines.

[0062] Kitzmiller in U.S. Pat. No. 4,514,914 (issued May 7, 1985) shows a method of converting a typical electric or gas clothes dryer to be powered by solar heat.

[0063] Slemmons in U.S. Pat. No. 4,515,151 (issued May 7, 1985) shows a fiber reinforced concrete solar collector.


[0065] Sankrithi in U.S. Pat. No. 4,581,897 (issued Apr. 15, 1986) shows a solar power collection apparatus that uses heliostats that focus the sun’s rays onto a tethered aerostat.


[0067] Bronstein in U.S. Pat. No. 4,596,238 (issued Jun. 24, 1986) shows an interiorly tensioned solar reflector, which forms a line focus parabolic collector.


[0069] Moore in U.S. Pat. No. 4,649,899 (issued Mar. 17, 1987) shows a turntable frame to track the sun and to point solar cells at the sun.
Butler in U.S. Pat. No. 4,671,025 (issued Jun. 9, 1987) shows a greenhouse roof construction method.

Hisken in U.S. Pat. No. 4,786,205 (issued Nov. 22, 1988) shows a method of conserving water in remote locations.

Kurashima in U.S. Pat. No. 4,786,795 (issued Nov. 22, 1988) shows a method of tracking the sun by floating solar cells on top of a liquid.

Tindell in U.S. Pat. No. 4,841,731 (issued Jun. 27, 1989) shows a solar powered system where hydrogen and oxygen are combusted, thus to drive a turbine. Photovoltaic cells drive an electrolysis generator, which manufactures hydrogen and oxygen from water.

Wright in U.S. Pat. No. 4,875,298 (issued Oct. 24, 1989) shows a pre-heater for a clothes dryer. Valves are used to either draw air from solar heated attic space, or from ambient air to the air inlet of the dryer.

Vanzo in U.S. Pat. No. 4,910,963 (issued Mar. 27, 1990) shows a solar energy system utilizing cyrogenic hydrogen and oxygen. Solar energy is used to power the electrolysis and cyrogenic cooling equipment.

Andersen in U.S. Pat. No. 4,979,494 (issued Dec. 25, 1990) shows a parabolic dish type solar collector used to cook food.

Bronicki in U.S. Pat. No. 4,942,736 (issued Jul. 24, 1990) shows how solar energy can heat a gas for a gas turbine using a rotating ceramic.

Travis in U.S. Pat. No. 5,068,675 (issued Oct. 22, 1991) shows a method for destructive distillation of kerogen. A large reflector, on tracks, focuses the sun’s rays onto a boiler.


Pitt in U.S. Pat. No. 5,161,520 (issued Nov. 10, 1992) shows a solar powered steam generator for pumping ground water for rural areas.

Vitale in U.S. Pat. No. 5,228,293 (issued Jul. 20, 1993) shows a solar to electric power conversion system using a stirling cycle. An auxiliary fossil or biomass heater can be used to supplement.


Rogers in U.S. Pat. No. 5,325,844 (issued Jul. 5, 1994) shows a lightweight tracking solar collector of the point focusing type. Numerous plates focus the sun’s rays via a bicycle wheel type structure.

Bellac in U.S. Pat. No. 5,384,489 (issued Jan. 24, 1995) shows a wind powered electricity generating system with a thermal fluid heated by a heater.

Bharatham in U.S. Pat. No. 5,417,052 (issued May 23, 1995) shows a hybrid solar central receiver. The power plant also uses molten salt as the heat transfer medium. Air is pre-heated for a gas compressor.

Moore in U.S. Pat. No. 5,444,972 (issued Aug. 29, 1995) shows how a solar central receiver can manufacture steam for a turbine. Alternatively, fossil fuel can be used.


Edelson in U.S. Pat. No. 5,454,853 (issued Oct. 3, 1995) shows use of energy sources like wind, solar, hydro, or off peak conventional power to manufacture steel.

Nix in U.S. Pat. No. 5,488,801 (issued Feb. 6, 1996) shows how a solar powered photovoltaic fan can cool a solar greenhouse, and move air.

Johnson in U.S. Pat. No. 5,551,237 (issued Sep. 3, 1996) shows a method of producing hydroelectric power, where solar, produced steam is used to displace water operating a hydro turbine.

Ross in U.S. Pat. No. 5,685,151 (issued Nov. 11, 1997) shows a method of concentrating solar heat using sodium chloride. A concentrating parabolic dish type collector focuses the sun’s rays onto the fluid.

Bronicki in U.S. Pat. No. 5,704,209 (issued Jan. 6, 1998) shows a method of compressing and heating air for an externally fired gas turbine. Solar energy can also supplement. Steam is generated.


Shuler in U.S. Pat. No. 5,734,202 (issued Mar. 31, 1998) shows a method of generating electricity utilizing a re-circulating air tunnel. The kinetic energy of the wind stores energy for electrical power generation.


Cohn in U.S. Pat. No. 5,857,322 (issued Jun. 12, 1999) shows a hybrid solar and fuel fired electrical system.

Falbel in U.S. Pat. No. 6,019,319 (issued Feb. 1, 2000) is typical of flywheel technology, where energy is stored in a rotating mass.

Steinmann in U.S. Pat. No. 6,141,949 (issued Nov. 7, 2000) shows a process for using solar energy in a gas and steam power station.

Bronicki in U.S. Pat. No. 6,321,539 (issued Nov. 27, 2001) shows a retrofit for reducing the consumption of fossil fuel by a power plant using solar energy. Compressed air is heated by solar energy, driving a turbine. Hot gases create steam.

Bellac in U.S. Pat. No. 6,484,506 (issued Nov. 26, 2002) shows a solar power enhanced combustion turbine. Air is cooled by solar energy.

Merswolke in U.S. Pat. No. 6,672,054 (issued Jan. 6, 2004) shows a wind powered hydroelectric power plant. Wind turbines create compressed air. Large storage tanks are used to regulate high-pressure liquid flow to a turbine electric generator.

Lawheed in U.S. Pat. No. 6,672,064 (issued Jan. 6, 2004) shows a system for converting solar energy to electric and thermal energy.

Keeton in U.S. Pat. No. 6,676,837 (issued Jan. 13, 2004) shows a solar powered aeration system that can keep lakes aerated for aquaculture.


Mehos in U.S. Pat. No. 6,739,136 (issued May 25, 2004) shows a hybrid solar fossil fuel receiver, which combines pre-heats the air-fuel mixture. A heat exchanger provides heat for the hybrid arrangement.


All of the above art show that all the components necessary for the invented device exist. Existing power
plants, as coal burning power plants, smelters, oil refineries, and other industrial plants can be converted economically to renewable energies using the mentioned patented technologies. All of these technologies can be employed to pre-heat air for combustion. When air is pre-heated, and compressed and piped long distance to a fossil fuel burner, not as much fossil fuel is necessary to burn in an industrial firebox. Alternatively, commercial and residential buildings can be converted to integrate pre-heated, compressed hot air so as to reduce fossil fuel consumption. Typical appliances like gas hot water heaters, gas clothes dryers, or furnaces can be converted to integrate make-up air for combustion, where the make-up air is manufactured from renewable energies. The disclosed invention device shows a new and novel method of creating combustion air for use by mankind.

SUMMARY OF INVENTION

The invention device improves upon Nix, U.S. Pat. No. 5,308,187 (issued May 3, 1994). Nix claims a system of heating air with solar energy and for supplying air to a coal power burner. However, the system described only supplies air in the low temperature range. To adequately power a large-scale power plant, a coal burning power plant will need temperatures on upwards above 750 °F degrees. Often the interior of a firebox of a coal power plant can approach 1,000 °F degrees. By pre-heating air to high temperatures, it can reduce significantly the amount of coal burned. And also it will reduce the amount of carbon dioxide gases generated, and reduce pollution. Alternatively, the same technology can pre-heat air for common household appliances like a gas hot water heater. This invented device is not unlike a common utility, like underground water, natural gas, fiber optic, electrical power, or other utilities. It is proposed that the color code “deep purple” be assigned for the invented device’s pipes.

It is common knowledge that hot air can be made from solar energy. Hot air made from solar energy in the low temperature range (100 to 200 °F degrees) is fairly inexpensive. Often times apex heat of a greenhouse or house attic can be sucked into a pipe. However, when hot air is manufactured in the 750 °F or hotter range, concentrating solar collectors can be very expensive. What is proposed is a system of different types of solar collectors, each designed to gradually heat air, in stages. This will make production of hot air more economic. Whichever type of solar collector, that is the most cost effective for a particular temperature range, is used. More lower cost solar collectors pre-heat the air for higher cost solar collectors.

The goal of the invented device is to employ various energy sources, like wind, solar, geothermal, tidal energy, or biomass energy, to manufacture hot air for combustion 24 hours a day, year long. The concept is to develop various modular systems, which then can be picked and chosen, depending on local economics and land use. For example, if the site for the large power plant has extensive solar energy, but lacks hydropower or wind energy, then solar collectors can be emphasized. If however, the region is stormy, with lots of rainfall, then hydropower and wind energy can be emphasized. Developed, are approximately, but not necessarily, 100 ft by 100 ft land area size modules. Each module is of one type of solar, wind, or geothermal, biomass, or hydropower (or other renewable energy) systems. Each module is tailored to that particular degree range to manufacture hot air. Whenever is most cost effective is built. For example, greenhouse air is cost effective for warming air in the 100 °F degree range, but ineffective at producing temperatures in the 500 °F degree range. Each step of the way, air is pre-warmed by the module. The greenhouse air could pre-heat air to a higher temperature solar collector, flat-plate or concentrator type. This allows for the use of lower cost low temperatures solar collectors, thus downsizing the need to spend more money on higher cost high temperature solar collectors.

In order to power a large coal burning power plant, or other fossil fuel line boxes, it will be necessary to utilize large amounts of land area. It is proposed that these solar collectors be constructed on top of “brown land” or land that has been environmentally wrecked, like a coal strip mine. It is proposed that recycled materials, such as recycled glass or fly ash, be used in the construction. As the coal is stripped from the land, this solar collecting “farm”, would be built on top. This step can be done as part of the land reclamation process. A parking lot like solar collecting paving, for example, can be placed on top of the coal strip mine. Underneath pipes transport hot air from solar collectors. The paving acts as mounting for solar collectors or wind turbines. The paving also acts as a “hot blanket”. The goal is to keep underground pipes and ground hot. Often times the amount of sunlight falling on a coal strip mine is several times more than the electrical power generated. Often times the amount of sunlight falling on a lake behind a hydro-dam is several times more than the electrical power generated.

The net result is hot, compressed and high velocity air is manufactured for combustion. These underground pipes are not typical; they will need insulation. These pipes when transporting hot air, are surrounded by thick insulation, and are buried in dry insulating soil. The goal is to use renewable energy to 1) heat air, 2) compress air, and 3) make air high velocity. Thus the energy is captured and blown at the fossil fuel burner. It is common knowledge that when air is hot, that air will expand. At sea level, and at 67 °F degrees, air has a density of approximately 0.075 pounds per square foot. However, when air is heated to higher temperatures (at atmospheric pressure), the air can weigh as little as 0.02 pounds per square foot. It is this principle that makes hot air balloons float. The air expands and attempts to consume more volume.

However, when air is heated in an enclosed volume, like a pipe, the air increases in pressure. Alternatively, the air also flows at a higher velocity down the pipe. This is not utilized in a jet aircraft turbine. The pipe will suck, compress, heat and blow. It is proposed that renewable energies be employed to heat air, and also make the air compressed and high velocity, much like a jet aircraft turbine.

In order to capture the heat, the pipes must necessarily be heavily insulated. For example, a one feet diameter pipe will necessarily be surrounded by 2 feet of insulation (above R-100). This insulation will necessarily have to be shielded and made waterproof, in that water via convection can rob the pipe of heat. Thus a double pipe system is proposed. The interior pipe can be made of metal, much like that used for water pipe. The metal pipe is surrounded by insulation. The exterior pipe is then made of cement or concrete. Wherever practical, recycled materials are used.

The net result is the energy is transported via three methods: 1) heated air, 2) compressed air, and 3) high velocity air. At the fossil fuel burner the energy is recovered from the air. The heated air is used to warm and make hot the fossil fuel. The energy from compression is recovered at the fossil fuel burner, much like that of a spring being recoiled. Finally, the velocity of the air is recovered. When air travels down a
pipe, much like a water pipe, the kinetic energy can be measured in foot-pounds. One foot-pound of traveling mass would be a pound of air, traveling one foot. It takes several cubic feet to make one pound of air, at atmospheric pressure. Compressing the air helps to create a pound of air in a smaller volume. This compression also increases the temperature. The key is when fuel is mixed with the hot, compressed and high velocity air, the fuel-air mixture is effective for combustion. By transporting energy via this method, it avoids more expensive heat transfer methods as melted salts, or hot oil, or steam pipes. Air is a cheap heat transfer fluid, commonly available. If for example, there is a leak of heat transfer fluids, it would be expensive to replace. Air on the other hand is inexpensive to replace.

[0116] One major concern is when air is heated and compressed that it not cause the pipes to start melting or cracking from the extreme pressure and heat. Air should not travel faster than the speed of sound in pipes. Air should not be higher pressure that now commonly used for water pipes. Consequently, it is proposed that air not be heated more than 750°F degrees, or compressed more than ten atmospheres. But these temperature ranges can be exceeded with special pipes and materials.

[0117] It is common knowledge that a coal burning power plant can suck in tens of thousands of cubic feet of air in a minute. A coal burning power plant can potentially suck in 10,000 to 100,000 cubic feet of air in a minute. That is a lot of air. In order to deliver the same amount of pounds of air, large insulated pipes would be necessary. It is possible to use upwards to ten separate 3 feet diameter pipes for the pre-heated air to meet the demand of a large coal burning power plant. With insulation each of these pipes can approach ten feet in diameter, with close to 3 feet of insulation surrounding 3 feet diameter hot air pipes.

[0118] Presently, power plants must necessarily use parasitic electricity to power large blowers that feed the flames of a firebox. With these insulated pipes, that parasitic energy for these blowers would be unnecessary.

[0119] With the air already pre-heated, it will necessitate the relocation of existing heat exchangers and economizers. These insulated pipes do not eliminate the function of heat exchangers or economizers, but reallocates their function. For example, with air already hot before going to the firebox, the slow rotating economizer can now heat air for another purpose. Pre-boilers, which pre-heat the main boilers water to the triple point, can have the air pre-heated by the air from the economizer, instead. (The triple point is the exact temperature and pressure where water is still liquid and steam). This triple point water is highly pressurized. When placed into tubes buried in the coal power plants firebox, the heat from the combustion and hot air flashes the water to make steam. The high-pressure steam in turn drives the turbines to make electrical power. The goal is not to have exhaust travel out the stacks above 300 F degrees, but recover the heat usefully. Exchangers and economizers will necessarily have to be reengineered in function.

[0120] It is envisioned that pre-heated combustion air may necessarily have to be piped from long distances, not unlike long distance water pipes or electrical power lines, or long distance pipelines. Thus it is proposed that large diameter transmission lines for combustion air be developed. These transmission pipes could potentially pipe heated air 750 F, at 10 atmospheres, and upwards toward 1,000 feet per second. Key to these transmission lines is to avoid placing them in moist soil. Water can potentially rob the underground pipes of heat, thus cooling the interior hot air. But the concept of long distance transmission for combustion air is feasible.

[0121] Part of the reason for heavily insulating the pipes is that the air when it travels through the pipe, it creates friction. The air molecules bounce off the surface of the interior of the pipes. The higher pressure, the more the air molecules bounce. The friction creates additional heat, thus heating the pipes even more. The pipes are not only heated from the heat of the hot air, but also from the friction of the air moving against the pipe surface. The goal is to make air so it flows laminar, not turbulent. Like a clarinet when played, the pipes when cold will provide great resistance. But when the pipes are hot, the resistance to the moving air will be greatly decreased. The purpose of the insulation is to make sure the pipes remain hot, once made hot. Hot pipes make the moving mass of the compressed air more slippery, or increase the viscosity. Cold pipes can act much like ice blocking the flow of water. Cold pipes can make the air flow more turbulent, while hot pipes can make the air flow more laminar. At startup, some of the heat from the air will necessarily be used to make the pipes hot. It will take some energy to make the pipes hot, but once the pipes are hot, the pipes will stay hot from the thermal mass. The hot pipes should be an effective method of energy transfer. When air travels at 100 to 1000 feet per second, it means that hot air can be manufactured from renewable energy farms several miles away. It may be possible to transmit combustion air 50 to 100 miles away. For example, when air travels at 100 feet per second, the air will travel 6,000 feet within one minute, or about a mile a minute, or 60 miles per hour.

[0122] The ambient air when sucked into the invented device does not have to be dry air. It can be moist air, saturated, like humid vapor. Greenhouse air can be moist from plants and evaporation of water. Thus air sucked in from the greenhouse can be moist and humid. Sucking into the invented device moist saturated air makes for more efficient heat transfer. Water has a greater mass, or specific heat than dry air. The water thus can carry heat better. In effect, the invented device uses both water and air for heat transfer. The added water also helps in the combustion of fossil fuel.

[0123] Another feature of the invented device is the air can be processed so as to include more oxygen. A greenhouse makes air oxygen rich from photosynthesis. Oxygen producing plants. The air can be sucked in from the greenhouses with this oxygen rich atmosphere. It is common knowledge that plants make oxygen from breaking down carbon dioxide in air via photosynthesis. The addition of moisture and oxygen to the combustion air is another method of energy transfer. The invented device thus transfers energy five ways, instead of just three: 1) heat, 2) pressure, 3) high velocity, 4) water vapor and 5) oxygen.

[0124] Solar energy can also be used to modify, the local climate beneficially. With large amount of paving, and large amounts of solar collectors, the invented device will create a huge watershed. The water from the watershed can be captured by hydro-dams. The captured water can then be used by the greenhouses, or by agriculture. The watershed will also help generate hydropower, which in turn can be used to make additional combustion air.

[0125] Of noteworthy consideration, there is a huge underground aquifer of salt/alkaline water underneath the American West (and also African Sahara). This water is deep underground, below sea level. Wells, for pumping this water to the
surface can drill down to access it. By using solar and wind-powered pumps, this salt/alkaline water can be pumped to the surface. Once pumped to the surface, this salt/alkaline water can be placed in basins or ponds. The water is evaporated by sunlight, helping to modify the local climate, thus increasing the local rainfall and morning fog. This adds moisture to the region, but also helps drought protect the local area. The added moisture helps local agriculture, greenhouses, and also adds fresh water to hydro-dams. Commonly referred to as heliohydroelectric technology, the use of underground salt/alkaline water resources can help create additional combustion air. For example, a small hydro-dam can compress ambient air via rotation of a hydro-turbine and fan/blower/impeller combination. A second water hydro-turbine can generate electrical power. The resulting electricity heats a heating element, which in turn makes the hot air from the other hydro-turbine hot. This is not unlike a giant hair dryer. The condensation of morning fog and rainwater (that was generated by the heliohydroelectric evaporation ponds) thus converts to heat, compressed and high velocity combustion air. Thus artificial local rainfall can be created to make combustion air.

[0126] Optionally, wind energy can be used to make combustion air. Wind turbines can generate electrical power, which in turn can power a resistive electric element. This element can then heat ambient air for combustion in a “hot air oven”. The wind turbine can also power blowers/impellers/fans, which blow the air through the hot air oven. Flywheels can be coupled to the blower, thus when wind is unavailable, the stored rotational energy of the flywheel will keep the air moving.

[0127] The burning of biomass can also help create combustion air. The biomass, perhaps from the greenhouses, would heat combustion air via an exchanger. This would provide combustion air when solar or wind energy is less available. Unique is the concept of a remotely located biomass combustor that could be located miles away from a large power plant. The concept of use of exhaust to pre-heat air for combustion is not new, but what is new is the concept of creating combustion air from a large distance away.

[0128] Optionally, geothermal energy can be utilized to manufacture combustion air. A rotating compressor would inject air into a hot geothermal formation via injection pipes. A second pipe would extract the hotter air, and then drive another turbine. This “energy recovery turbine” would then drive the rotating compressor. The resulting hot air is piped via insulated pipes to the distant power plant.

[0129] Optionally, hydrogen fuel can be made from solar, wind, or biological energy sources. Thus, potentially fossil fuels could be replaced by hydrogen. All of these steps make for a complete energy system to convert a large-scale coal burning power plant (or other fossil fuel fire boxes). Coal plants can be very polluting. By converting the power plants to renewable energy, it will eliminate the need for additional coal strip mining. It will also help extend the life of existing coal strip mines, making for a very economically combination. It will also help reduce the cost and size of air pollution equipment.

[0130] It should be noted that each of these modules are incrementally installed. In the first year, 10% of the power plant heat could be powered by renewable energy. The next year 20% of the heat load would be converted. Each incremental step is built within a period of time. As each incremental step is built, it is revenue producing almost immediately, thus helping financing the project. For large coal burning power plants, it will take several years to convert. During that period the cost of capital can be recovered, before the next module is built. Incremental steps help recover the cost of construction sooner. This invented device is a retrofit to almost any fossil fuel burning power plant. Its primary intent is for “external combustion engines”, like steam plants, or hot water heaters. It is not intended for “internal combustion engines”.

[0131] All of the above make for a complete energy system that can be retrofitted to almost any fossil fuel burner. Worldwide, nearly 97% of mankind’s energy comes from combustion of oil, gas or wood, or coal. Practically, any firebox can be retrofitted with this device. In its simple form, a wood stove can suck air from an exterior solar flat plate collector. When air is sucked from outside, it is already hot, not cold, from the solar collector. It means not as much firewood has to be chopped to heat a room. Another example is a hot water heater. When air is sucked or blown into the firebox of a natural gas hot water heater, it makes the water hot. However, at night or winter, small amounts of fossil fuel can be burned to make up the heat difference. Thus, pre-heated air from solar energy can supplement fossil fuels.

[0132] Pre-heated air from renewable energies has applications more than just coal burning power plants. It can be used for household appliances like clothes dryers, hot water heaters, furnaces, building exchange air, food drying, cooking food, water distillation or to power an absorption cycle air conditioner/refrigerator. Combustion air can be useful for oil refineries in processing gasoline, plastics, or fertilizers. By integrating solar and other renewable technologies, it allows for oil, gas and coal to be used more as a material, than as a fuel. The addition of renewable energies to industrial process heat will help extend existing geologic resources of oil, coal and gas, and also help reduce the need for high cost exploration. In effect, the invented device will aid, not replace, the existing fossil fuel industry. The invented device helps reduce air pollution, and also drastically reduces carbon dioxide emissions.

[0133] Key to developing the invented device is economics. Key is to integrate “dual economics”. A greenhouse, for example, not only creates warm and moist oxygenated air, it also produces plants, biomass and food. The greenhouse becomes self-financing, giving combustion air as a bonus. A solar pond, of salt water, captures solar heat. The salt water also creates moisture. The overhead inflatable greenhouse over the solar pond can recover the moisture via distillation. The condensate from the cooler greenhouse creates fresh water. The fresh water then is “sold”. A flat plate farm can be the roof of a warehouse. Wind farms can also be a cattle pasture. Thus, the land can be more productive and more economic. A hydro-dam allows for fish farming. The net result is overall reduction in the cost of manufacture of combustion air.

[0134] It should be noted that to make solar, wind and other renewable energy equipment take energy to construct. It takes energy to make energy. Thus renewable energy can be used to manufacture renewable energy equipment. Solar energy is used to make solar collectors, for example. Local manufacturing of combustion air equipment adds to the local employment and tax base. It also reduces transportation cost and helps dispose of recycled materials. The invented device is a collection of renewable energy systems, wind, solar, hydro-power, geothermal, biomass and potentially tidal energy. Each is focused on making combustion air for a fossil fuel
burner. Each is focused on making air hotter, more pressurized, and moving at a higher velocity, 24 hours a day, year round. The key is to make the air via the most economical approach.

[0135] It is proposed that a graduated system be developed, where each module feeds to the other module. Proposed are modules of fixed size and shape, which are “picked and chosen”. For example, greenhouses will pre-warm the air that is blown into solar ponds (of salt water), or the greenhouses can pre-warm air to heated “sandboxes” with glass across, or more efficient solar flat-plates. The warmer air is then blown into more expensive concentrating solar collectors, like line-focus or evacuated solar tubes with a vacuum. By pre-heating the air with lower cost solar collectors, it helps reduce the size, cost and mount of more expensive high temperature solar collectors. The pre-heating of air in a gradual manner, stage by stage, means air can be blown into “very expensive” solar furnaces from less expensive modules. Thus not as many “very expensive” solar furnaces need to be built.

[0136] These “very expensive” solar collectors can be of various types: towers with heliostats, parabolic dishes, line-focus solar troughs, and so on. These very large solar furnaces can float on a turntable of water, or air, or can rotate to face the sun on steel tracks. By pre-heating the air from one system to another, whichever is most economic, it allows for a cost effective total system.

[0137] Key is to capture as much of the sunlight usefully and efficiently as possible. When a solar system allows most of the sunlight to fall on the ground, it is wasteful of land area. When solar collectors only capture a portion of sunlight, it allows a lot of heat to escape. This will unnecessarily require more land area to do the same job. Achieving 8.5% to 90% capture of solar radiation is essential to reduce the land area necessary to do the same job.

[0138] Key to movement of combustion air would be blowers, impellers, and fans. These will necessarily have to use solar, wind, geothermal or biomass energy. (Some fossil fuels can be used to keep a constant pressure, such as from a biodiesel powered blower.) The invention device proposes compressor modules of various types, perhaps 10 feet by 100 feet each in land area. Wind turbines can drive an electric blower. When the wind blows, the combustion air is blown and compressed. Solar photovoltaics can also power an electric blower. Solar heat can, also, boil a fluid like freon to drive a turbine. Stirling cycle engines can capture heat from biomass to drive a fan. Alternatively, hydropower or geothermal or biomass can also power a blower. Each of the 100 ft by 100 ft land area modules would have their own compressor/blower/fan. Thus a greenhouse would have a biomass compressor module, which then blows the air into a solar sand box collector, for example. The solar pond module would have a wind-powered compressor, which blows the air into a flat-panel module. The thermal powered compressor could use solar heat to boil a working fluid, like alcohol, steam, ammonia or freon to drive a turbine. Each step of the way, various compressor modules blow and compress the air. Each renewable energy module has its own compressor. The downstream lower cost modules pre-heat the air for more expensive upstream modules.

[0139] It is proposed that the pipes be sized so that the airflow rate will be about 100 cubic feet per minute per module. As the air is heated and compressed, the air has more “enthalpy” (Enthalpy being defined as the total of all energy: compression, heat, velocity, water vapor and oxygen). At cold startup, the air will necessarily move slowly, but as the system warms, the air moves faster, and is more slippery, or increases viscosity. Proposed is a system of greenhouses, sandboxes, solar ponds, flat-plates, evacuated tubes, line focusing parabolic trough solar collectors, point focusing parabolic dish solar collectors. Each step of the way, the air is made hotter and more compressed. Each module has its own compressor module, sucking the air from the downstream module and blowing and compressing the air to the upstream module. Each compressor module can have a flywheel attached to the blower/fan/impeller, thus allowing for storage of energy in the form of a rotating flywheel. When solar or wind energy is not available for the blower/fan/impeller, the flywheel will move the air.

[0140] The entire system of modules has considerable amount of thermal mass. It will take a considerable amount of time and solar energy to make the entire system of pipes and energy collectors “hot”. This is referred to as “startup energy”. However, once hot, the modules will stay hot, even at nighttime or winter. By integrating hydropower, wind energy and geothermal or biomass, it guarantees that the combustion air will be delivered to the fossil fuel power plant, 24 hours out of the day, 7 days out of the week, year round. Wind energy tends to be very available during storms and during nights, exactly when solar energy isn’t available. Hydropower turbines can make combustion air during periods when solar or wind energy isn’t available. Geothermal or biomass energy, if available, can supplement. By going to multiple sources of renewable energy, and by integrating a large thermal mass, it will guarantee that combustion air will remain available on demand, 24 hours a day, year round, even during storms and at nighttime.

[0141] Each solar farm will be a compilation of several sub-modules. The goal is to generate air at 750 F degrees, 10 atmospheres, and at 100 cubic feet per second per module. These pipes would range in size from one-inch diameter to one-foot in diameter. The solar farms would then collectively compress air into long distance transmission pipes. The transmission system would further compress and move air, perhaps upwards to 1000 cubic feet per second. The transmission pipes would be heavily insulated and be of larger diameter. Larger compression blowers/fans/impellers (powered by renewable energy) would suck and compress. The transmission pipes are not dissimilar in function to pumping water. For example, to pipe combustion air over a mountain, electric blowers/fans/impellers would push the combustion air uphill over the mountain. As the combustion air flows downhill, turbines would recover the downward kinetic energy. The downhill side recovers the energy in the form of electricity, and the upside gets the energy. Thus the downhill side helps “pump” the uphill side. This process is not unlike what is done today for pumping water over mountains.

[0142] At the end of the transmission pipes, the combustion air is then utilized. It then can supplement the heat load of a coal burning power plant, a gas burning power plant, smelter or an oil refinery, or for other industrial heat. It can alternatively, be placed under streets and sidewalks for use by commercial or residential users. Retrofitting each fossil fuel burner will require re-engineering, but can be done. The non-radioactive portion of a nuclear power plant can be converted to use hot and compressed air to make steam for a turbine. Heat exchangers can be moved around so as to use the combustion air. Oil refineries can have a special piping system installed for the combustion air.
[0143] Once at the site where combustion air is used, there are tricks of the trade to make the air more hot and compressed. For example, one turbine could be attached to a second turbine. The first turbine compresses the air into the firebox, while the second turbine recovers the energy from the exhaust of the firebox. One turbine drives the other. This is not unlike how aircraft air conditioning systems work. The added pressure “squeezes” the hot air, making it more compressed and thus hotter. It is not unlike the principle of the hydraulic ram, where down flowing water is used to pump some water uphill. Other tricks of the trade can be invented on using the combustion air. For example, at coal burning power plant, existing coal carrying pipes can be converted to combustion air. A pair of tubes can be aimed at each other, where two flows of the combustion air collide with each other. The trapped coal is then ignited and atomized. The coal burning power plant firebox is converted to a “positive pressure” firebox, instead of the now common practice of being a “negative pressure” firebox. An energy recovery turbine at the exhaust of the firebox can recover some of the kinetic energy of the air, thus powering the compressors. Another trick to the trade is metals can be pre-heated for a smaller, or oil pre-heated for an oil refinery. Each of these approach will require further engineering, and some testing, but can be done. Hot air is very useful, especially if compressed.

[0144] It is an object to heat air with solar energy.

[0145] It is an object to compress the air with solar energy.

[0146] It is an object to add moisture to the air for better heat transfer from greenhouses.

[0147] It is an object to add oxygen to the air, so as to aid combustion, from greenhouses.

[0148] It is an object to heat from wind energy.

[0149] It is an object to compress air with wind energy.

[0150] It is an object to manufacture hot air from a hot geologic formation.

[0151] It is an object to use a rotating compressor and an energy recovery turbine to move air through the hot geologic formation.

[0152] It is an object to pipe hot air for combustion via an insulating pipe system to a fossil fuel burner firebox.

[0153] It is an object to manufacture hot air for combustion from hydropower.

[0154] It is an object to use a hydropower turbine to drive a compressor to blow air for combustion.

[0155] It is an object to use a hydropower turbine to power a generator to heat an electric element to heat air for combustion.

[0156] It is an object to pump salt/alkaline water to the surface to create evaporation ponds.

[0157] It is an object to use evaporation ponds to increase local rainfall, so as to drive hydropower turbines to make combustion air.

[0158] It is an object to use solar distillation to increase the amount of local water.

[0159] It is an object to drive hydropower turbines, and provide water for greenhouses, from solar distillation.

[0160] It is an object to burn biomass to create hot air for combustion.

[0161] It is an object to pipe heated combustion air long distance from biomass burning.

[0162] It is an object to move air at high velocity in a piping system.

[0163] It is an object to heavily insulate the pipes, so as to keep air hot.

[0164] It is an object to use hot and compressed and high velocity air so as to aid combustion of fossil fuels.

[0165] It is an object to collect hot and compressed and high velocity air, and place into a system of long distance transmission pipes.

[0166] It is an object to heavily insulate the pipes and bury them in dry soil, so as to keep pipes hot.

[0167] It is an object to use solar, wind, and other renewable energies to blow and compress combustion air over long distances.

[0168] It is an object to reduce fuel consumption in a firebox by pre-heating combustion air.

[0169] It is an object to reduce air pollution and reduce carbon dioxide emissions from combustion of fossil fuels.

[0170] It is an object to store thermal heat in thermal mass, so as to provide hot and compressed and high velocity air 24 hours a day, 7 days a week, year round; even during night or winter storms.

[0171] It is an object to help finance the construction of the energy “farms” by integrating “dual economies”, where for example, greenhouses make food, while making heated combustion air, solar ponds make distilled water while making heated combustion air, or for example, solar flat plates collectors can be the roof of liveable space.

[0172] The foregoing objects can be achieved by developing a system of modules, each tailored for the most economic method of manufacturing hot combustion air.

[0173] The foregoing objects can be achieved by assembling modules into farms, each designed to pre-heat for another module.

[0174] It is an object to use combustion air at a coal burning power plant, gas cogeneration plant, oil refinery, or for industrial uses like smelting metals.

[0175] It is an object to use combustion air for residential applications and commercial applications, like hot water heaters, furnaces, clothes and food dryers, wood stoves or other appliances.

[0176] It is an object to create a new underground public utility, like underground gas, electric, fiber-optic, or water utilities.

[0177] It is an object to create a similar system for residential and commercial buildings.

[0178] It is an object to convert existing household appliances like natural gas hot water heaters, gas dryers, furnaces, etc to use pre-heated combustion air made from renewable energy.

[0179] It is an object to use the thermal mass embedded to pipes to store solar heat for combustion air.

[0180] It is an object to provide combustion air 24 hours a day, year round.

[0181] It is an object to preheat, compress and blow air into a firebox using fossil fuel, with the air made from renewable energy sources.

BRIEF DESCRIPTION OF FIGURES

[0182] FIG. 1 illustrates a general overview of the invented device. Shown is a converted coal burning power plant. Hot, compressed and high velocity combustion air is manufactured by various energy sources including solar, wind, hydropower, biomass, and geothermal energy. Shown also is a heli-hydroelectric pond for supplying additional rainwater.

[0183] FIG. 2 illustrates a greenhouse to make combustion air. The greenhouse also adds moisture and oxygen.
FIG. 3 illustrates a typical low efficient solar collector. Shown is a sand box solar collector with a back sun reflector.

FIG. 4 illustrates a typical solar salt pond with a water distilling greenhouse on top. The same arrangement can be used to distill water from impure water.

FIG. 5 illustrates a typical flat plate solar collector using a vacuum.

FIG. 6A and FIG. 6B illustrates an innovative evacuated tube type solar collector.

FIG. 7 illustrates a typical trough type solar collector or a line focus type solar collector using a parabolic reflector.

FIG. 8 illustrates a typical dish type solar collector or a point focus type solar collector using a parabolic reflector.

FIG. 9A and FIG. 9B illustrates an innovative solar smelter using a half shell parabolic with a half circular planar solar reflector tilted in front. The solar reflector assembly is placed on top of a turntable with a solar oven in the center. The sun’s rays are focused on the solar oven, thus manufacturing combustion air.

FIG. 10 illustrates a typical solar tower with heliostats.

FIG. 11 illustrates a method of making combustion air using wind turbines.

FIG. 12 illustrates a method of making combustion air from geothermal energy.

FIG. 13 illustrates a method of making combustion air from biomass.

FIG. 14 illustrates a method of making combustion air from hydropower. Also shown is the use of heliodynamic energy storage.

FIG. 15 illustrates a centrifuge blower powered by solar and wind produced electricity. Also shown is a flywheel for rotational energy storage.

FIG. 16A and FIG. 16B illustrate a pipe for carrying combustion air for long distances.

FIG. 17 illustrates a method of long distance transmission of combustion air.

FIG. 18 illustrates a method of conversion of an existing coal burning power plant firebox to incorporate combustion air made from renewable energy.

FIG. 19 illustrates a method of conversion of an existing commercial or residential building to incorporate combustion air made from renewable energy.

DETAILLED DESCRIPTION

FIG. 1 illustrates an overview of the invention device. Shown is a system for manufacturing hot and compressed air for a distant power plant, like a coal burning power plant (1). Located next to the power plant could be large wind turbines (3), which power centrifuge compressors (2). From the surrounding region, various energy sources (4,5,6,7) create combustion air, and put the air into a heavily insulated pipe system (8) for long distance transmission. Along the way extra centrifuge compressors, with flywheels (9), can be located to compress and move the combustion air through the transmission system. Solar farms (4) with various types of solar collectors make and concentrate combustion air. Various types of solar collectors can be employed: solar greenhouses, sandbox solar collectors, solar ponds, evacuated tube type solar collectors, line focus and point focus type solar collectors, heliostats with towers, solar smelters, and so on. Wind energy (5) can be employed to power centrifuge compressors and also heating elements to make combustion air. Biomass burning (6) can dry and combust biomass, and then make additional combustion air for long distance transmission (8). Also, geothermal energy (7) can also be employed to make combustion air. Hydropower (10) can be used to make combustion air. Illustrated also is solar aeration (11) for keeping the pond aerated for fish. Solar photovoltaics (12) can alternatively be floated on top of the lake, creating additional electrical power. Illustrated also is a heliodynamic pond (13), where underground salt/alkaline water is pumped to the surface using wind turbines and solar cells (14). The pond uses the sun’s energy to evaporate water for additional local rainfall, thus providing more water for the hydro dam (10). Optionally, solar energy can be used to manufacture electricity for mining of minerals, like manganese, gold, silver, iron from the salt/alkaline water via electrolysis (15). The net result is manufacture of combustion air for a distant power plant 24 hours a day, year round.

FIG. 2 illustrates the use of a greenhouse (16) to warm combustion air, and to add moisture and oxygen (17) from plants (18) grown inside the greenhouse (16). Optionally, a wind turbine (19) can provide heat in the winter. A solar, wind (or biomass) powered centrifuge compressor (20) sucks the combustion air from the greenhouse (16) and puts it into an insulated pipe system (8) for long distance transmission to a distant power plant (1).

FIG. 3 illustrates a low cost method of making combustion air. A sandbox is filled with dark sand (22). The sand (22) is surrounded by insulation (23). On top is glass, or clear glazing (24), which traps sunlight (25). Illustrated also is a planar solar reflector (26), which increases the amount of sunlight (25) entering the sandbox. This is a low efficient, but cost effective method of making combustion air. Pipes (21) embedded in the sand (22) transfer the heat from the sand (22) to the combustion air. The combustion air is then placed in an insulated pipe system. The combustion air can be alternatively pre-heated by air from the greenhouse.

FIG. 4 illustrates the use of a solar pond (27) with a greenhouse (30) on top. The salt water (28) traps solar radiation, and is hot. Beneath are embedded pipes (29), which remove the heat from the salt water (28) for combustion air. Alternatively, the moist air inside the greenhouse (30) can make distilled water (31). The condensate water (31) can be trapped via a gutter (32) and then drained. The distilled water can then be used to grow plants, or to add water to a nearby lake. The solar pond (27) can heat air from a greenhouse, or from the sandbox solar collector, making it even hotter. A similar arrangement can make distilled water from impure or polluted water, along with making combustion air.

FIG. 5 illustrates the use of an evacuated flat plate solar collector. The vacuum (34) helps to trap sun’s rays (33) making heat. Underneath the glass (35) are pegs, or clear marbles (36) to help keep the glass (35) from collapsing from the earth’s atmosphere. The dark solar absorption plate (37) gets hot from the solar radiation (33), and thus transfers it to a thermal mass (38). The thermal mass (38) then conducts heat to the embedded pipes (39). The pipes (39) then manufacture combustion air. An insulating box (40) encloses the solar collector. A frame (41) holds the solar collector at the optimum angle. The evacuated flat plate solar collector can make air even hotter from a greenhouse, sandbox solar collector or solar pond.
FIG. 6A and FIG. 6B illustrates the use of an innovative evacuated tube type solar collector. Shown in FIG. 6A is a cross sectional view. A clear glass tube (43) contains a vacuum (44). On the interior is a pipe (45) with fins (46) for trapping solar radiation (47). The pipe (45) can be made of metal. The pipe (45) manufactures combustion air. FIG. 6B illustrates a longitudinal view of an innovative evacuated tube type solar collector. A glass tube (43) contains a vacuum (44). Inside the glass tube (43) is a pipe (45) with fins (46) to trap solar radiation (47). Innovative are open ends on both sides of the glass tube (43). At both ends are stoppers (50) with two holes (48, 49). The first hole (48) is for the pipe (45). The second hole (49) is for a vacuum line, which allows for a vacuum pump (42) to suck air out of the evacuated tube type solar collector (43). The vacuum pump (42) helps to maintain a vacuum inside the tube (43) for long periods of time. The purpose of open ends with stoppers (50) is to allow numerous evacuated tube type solar collectors to be ganged together in series. The evacuated tube type solar collector can make combustion air hotter from a solar greenhouse, a sandbox solar collector, a solar pond or other type of low temperature solar collectors. These are highly efficient.

FIG. 7 illustrates the use of line focus parabolic solar collectors (51). Mounted a tracking frame (52), actuators point the parabolic surface (53) so it focuses the sun’s rays onto a target (54). Embedded inside the target (54) is a pipe, which manufactures combustion air. The line focus parabolic solar collector (51) can make air even hotter from a greenhouse, a sandbox solar collector, a solar pond, an evacuated flat plate solar collector, or a tube type solar collector.

FIG. 8 illustrates the use of point focusing parabolic dish type solar collectors (55). The sun’s rays (56) reflect off the surface of the parabolic dish (57). A tracking frame (58) points the dish (57) at the optimum sun’s angle (56). The sun’s rays (56) thus concentrate onto the target (59). The target (59) then manufactures very hot combustion air. It can make air hotter from a greenhouse, a sandbox solar collector, a solar pond, an evacuated flat plate solar collector, a tube type solar collector or other types.

FIG. 9A and FIG. 9B illustrates an innovative solar smelter (60) using a half shell parabolic reflector (61). The parabolic floats on top of a turntable (62), which can use compressed air (63). Optionally, the turntable (62) could float on water. The sun’s rays (66) focuses onto a “solar over” (64) buried in the earth, and in the center of the turntable (62). The solar oven (64) manufactures very hot combustion air. Alternatively, the solar oven (64) can smelt metals, or make steel. Shown in front is a half circular tilt-able planar reflector (65), which reflects sunlight (66) onto the parabolic half shell (61). FIG. 9B shows an overhead view. The smelter makes combustion air very hot from a greenhouse, a sandbox solar collector, a solar pond, an evacuated flat plate type solar collector, a tube type solar collector, a line focus or point focus parabolic solar collector, or other types.

FIG. 10 illustrates a solar tower (67) with heliostats (68). The boiler (69) at the top of the tower (67) manufactures very hot combustion air. The solar tower can make air even hotter from a greenhouse, a sandbox solar collector, a solar pond, an evacuated flat plate solar collector, a tube type solar collector, a point focusing or line focusing solar parabolic, or other types of solar collectors.

FIG. 11 illustrates the use of wind turbines (70) to manufacture combustion air. A centrifuge blower and flywheel assembly (71) blows air into a heavily insulated pipe (72). The centrifuge blower and flywheel assembly (71) is powered by electricity from the wind turbines (70). The flywheel (71) provides movement of the combustion air when wind power is not available. The wind turbines (70) also power a heating element (73) embedded in an underground oven (74). The combustion air after being compressed and heated is injected into a heavily insulated header pipe (75), which in turn transports the combustion air to a distant power plant. The wind system (70) can make combustion air hotter from a greenhouse, a sandbox solar collector, a solar pond, an evacuated flat plate collector, a tube type solar collector, a line focus type solar collector, a point focus type solar collector, or other renewable energies. Wind energy tends to be very available in the winter, when solar energy isn’t.

FIG. 12 illustrates a geothermal well (76) in a hot geologic formation (77). A compressor (78) blows air into another pipe (81) inside the well (76). The cool ambient air is injected into the well (76) and is made hot by the geologic formation (77). Another turbine (79) captures the kinetic energy from the expanded hot air and drives the compressor (78) via a shaft (80). The combustion air is then placed inside a heavily insulated pipe (82) for long distance transmission to a distant power plant. Alternatively the combustion air from the geothermal well (76) can be made hotter by employing high temperature solar collectors, wind turbines or other renewable energy.

FIG. 13 illustrates the use of biomass burning (83) for making combustion air. A firebox (84) burns and dries biomass. The exhaust goes into an air-to-air exchanger (85), which in turn makes combustion air. The combustion air then is placed into a heavily insulated pipe (86) for long distance transmission to a distant power plant. The biomass incinerator (83) can also make air hotter from a greenhouse, a sandbox solar collector, a solar pond, an evacuated flat plate solar collector, a tube type solar collector, or other renewable energy. The biomass incinerator (83) can supplement solar or wind heat in the winter, when these energy sources are not available.

FIG. 14 illustrates the use of hydropower to manufacture combustion air. A hydro-dam (87) has two turbines (88, 89). The first turbine (88) compresses ambient air. The second turbine (89) heats the air via an electric generator and resistive heating element. This operates much like a giant hair dryer. As the lake fills with water, the hydro turbines (88, 89) drain the lake (90). The water for the lake can come from the nearby watershed. With the addition of large amount of solar collectors, these also act as a watershed, thus rainwater drained from the solar collector farm can be used to provide hydropower. Innovative can be the floating of photovoltaic cells (94) on top of the lake, thus providing for more electricity. The lake (90) can be aerated by solar powered pumps (95), thus helping fish. Also, shown is a heliodyndroelectric pond (91). Underground salt/alkaline water is pumped using wind or solar energy (92) to the surface to form an evaporation lake. Using solar electricity from photovoltaics, the brine can be mined for metals, like manganese, gold, silver, via electrolysis (93). The mining of metals from the salt/alkaline water helps finance it. The solar evaporation of the water from the salt/alkaline pond (91) increases local rainfall and morning fog, thus providing more water for the hydro turbines (88, 89). Water that is impure can be distilled using greenhouses on top of ponds. Thus, more water is available for the hydro-dam (87). The use of hydropower provides combustion air, when
other renewable energy sources, like wind, solar, biomass, or geothermal, are not as readily available. It helps to provide combustion air to a distant power plant 24 hours a day, year long.

**[0215]** FIG. 15 illustrates a method of moving combustion air through the heavily insulated pipe system. An electric motor (96) is attached to both a flywheel (97) and a centrifuge blower (98). The electric motor (96) is powered by wind energy (99) and solar photovoltaics (100), via an electrical conduit system (101). The flywheel (97) stores the rotational energy. The flywheel (97) moves the combustion air when solar or wind is not readily available. This assembly helps to move, compress, suck and blow air from other renewable energy systems, 24 hours a day, year long. The entire system (96,97,98,99,100,101) moves and compresses combustion air for the heavily insulated pipes.

**[0216]** FIG. 16A and FIG. 16B illustrates a heavily insulated pipe that can be used to move compressed, hot and high velocity combustion air. FIG. 16A shows a cross sectional view of such a pipe. In the interior is combustion air (102). The combustion air is surrounded by a high-pressure metal pipe (103). This pipe (103) is similar to traditional water pipe. The metal pipe (103) is surrounded by quality insulation (104), like verniculite, or high tech glass fiber. A cement pipe (105) encases the interior (102,103,104). This pipe could be made from the power plants fly ash or other recycled materials. The pipe assembly (102,103,104,105) is buried in dry soil, and underground. FIG. 16B illustrates a longitude view of the pipe (102,103,104,105).

**[0217]** FIG. 17 illustrates a method of long distance transmission of combustion air (107). Shown is a mountain range (116) with a heavily insulated pipe (110) of large diameter. Centrifuge electric blowers (111) push the combustion air (107) uphill. On the downhill slope are turbines, which power a generator (112). The generator (112) then puts electrical power into an electric transmission power line (115). The electric power then powers the centrifuge electric blowers (111). Alternatively, turbines attached to a flywheel (113) can be placed along the pipe’s route (110). The flywheel (113) helps to keep moving air through the pipe (110) when renewable energy is not available, thus providing combustion air 24 hours a day, year round to a distant power plant (114). Solar energy (108, 106) and wind energy (109) can be employed to add additional power for pumping.

**[0218]** FIG. 18 illustrates a method of converting an existing coal burning firebox to use combustion air. Shown are electric centrifuge blowers (111), which suck combustion air from the heavily insulated pipes (110). The blowers compress air into tubes (116) previously used to carry coal. The firebox (117) has tubes embedded in the wall (118), which flash pressurized water for steam. The firebox (117) is converted from the typical “negative pressure” to a “positive pressure” firebox. Thus the combustion air is pressurized even more, and thus is made hotter. Some of the tubes (119) are kept for coal, or other fossil fuel. Some fuel is injected and combusted for temperature control. At the exhaust (120) is an energy recovery turbine (121) and also any heat exchangers or economizers (122). Hydrogen, produced from renewable energy, can also be used in the converted tubes (119). The net result is a converted coal burning power plant to be powered almost entirely by renewable energy. Similar steps can be done to convert fireboxes of other industrial applications like an oil refinery, a smelter, or a steam plant.
3. A system for making the combustion air of claim 1, utilizing wind energy, for the firebox of claim 1, said system comprising of: an electric wind turbine, means for powering an electric blower, said electric blower attached to a rotating flywheel; said electric wind turbine, means for powering an electric resistive heating element, said heating element embedded in a hot air oven.

4. A system for making combustion air of claim 1, utilizing geothermal energy, for the firebox of claim 1, said system comprising of: a pipe embedded in a hot geothermal geologic formation; and a second pipe embedded in said geologic formation; means to inject cold ambient outdoor combustion air of claim 1, and means to remove the heated combustion air of claim 1.

5. A system for making combustion air of claim 1 for a firebox of claim 1, utilizing biomass, for the firebox of claim 1, said system comprising of: a remotely located firebox for burning said biomass as wood, peat or other hydrocarbons; and a remotely located heat exchanger for heating said combustion air of claim 1 from the burning of the biomass.

6. A system for making combustion air of claim 1, utilizing hydropower, for the firebox of claim 1, said system comprising of: a hydro turbine for powering a blower, means for compressing said combustion air of claim 1; another hydro turbine and electric generator combination, means for heating the combustion air of claim 1 with an electric resistive element.

7. A lake or salt water for solar evaporation, means to increase local rainfall to power the hydro turbines of claim E.

8. A greenhouse on top of impure water, means for making distilled water for the hydro turbines of claim E.

9. A system of heavily insulated pipes, means for moving the combustion air of claim 1 long distance, to the firebox of claim 1.

10. A system for moving the combustion air of claim 1, to the firebox of claim 1, said system comprising of: a blower, said blower powered by renewable energy as solar, photo-voltaic, wind, geothermal, biomass or hydropower; said blower using a flywheel for storing rotational energy.

11. A system for converting the firebox of claim 1 to burn hydrogen, said system comprising of: utilization of combustion air of claim 1; said hydrogen made from solar, wind, biomass, geothermal, hydropower or other renewable energy.

12. A system for converting the firebox of claim 1, said system comprising of: utilization of combustion air of claim 1; an utility tied electric blower; the burners and tubes converted to carry said combustion air of claim 1; said firebox of claim 1 converted to positive pressure, instead of negative pressure; some of said burners and tubes kept for fossil fuel burning; a slowly rotating energy recovery economizer or heat pipe; an energy recovery turbine at the exhaust of the firebox of claim 1; means for compressing the combustion air and regulating pressure, flow rate, and combustion in the firebox of claim 1.

13. A system for making hot and compressed combustion air for a building, utilizing solar and wind energy, for remotely located fossil fuel burner fireboxes inside said building, said system comprising of: a greenhouse, means for pre-warming, adding oxygen and adding humidity to said combustion air; a solar photovoltaic powered blower attached to a flywheel, means for moving the combustion air twenty four hours a day year long; a solar collector with a vacuum, said solar collector with a vacuum pump, means for heating the combustion air with solar radiation; a thermal conducting thermal mass, said thermal mass made of a heat conducting cement and metal flake mixture, the thermal mass surrounded by an insulating container, the thermal mass with embedded tubes, means for storing the solar heat from the combustion air; a blower with an attached flywheel, said blower powered by wind energy; a heating element, said heating element powered by wind energy; and a system of connecting heavily insulated small diameter pipes inside walls; means for moving the combustion air to said building's fireboxes, for a hot water heater, furnace, dryer, or other converted gas, propane, wood, hydrogen or oil fired appliances.