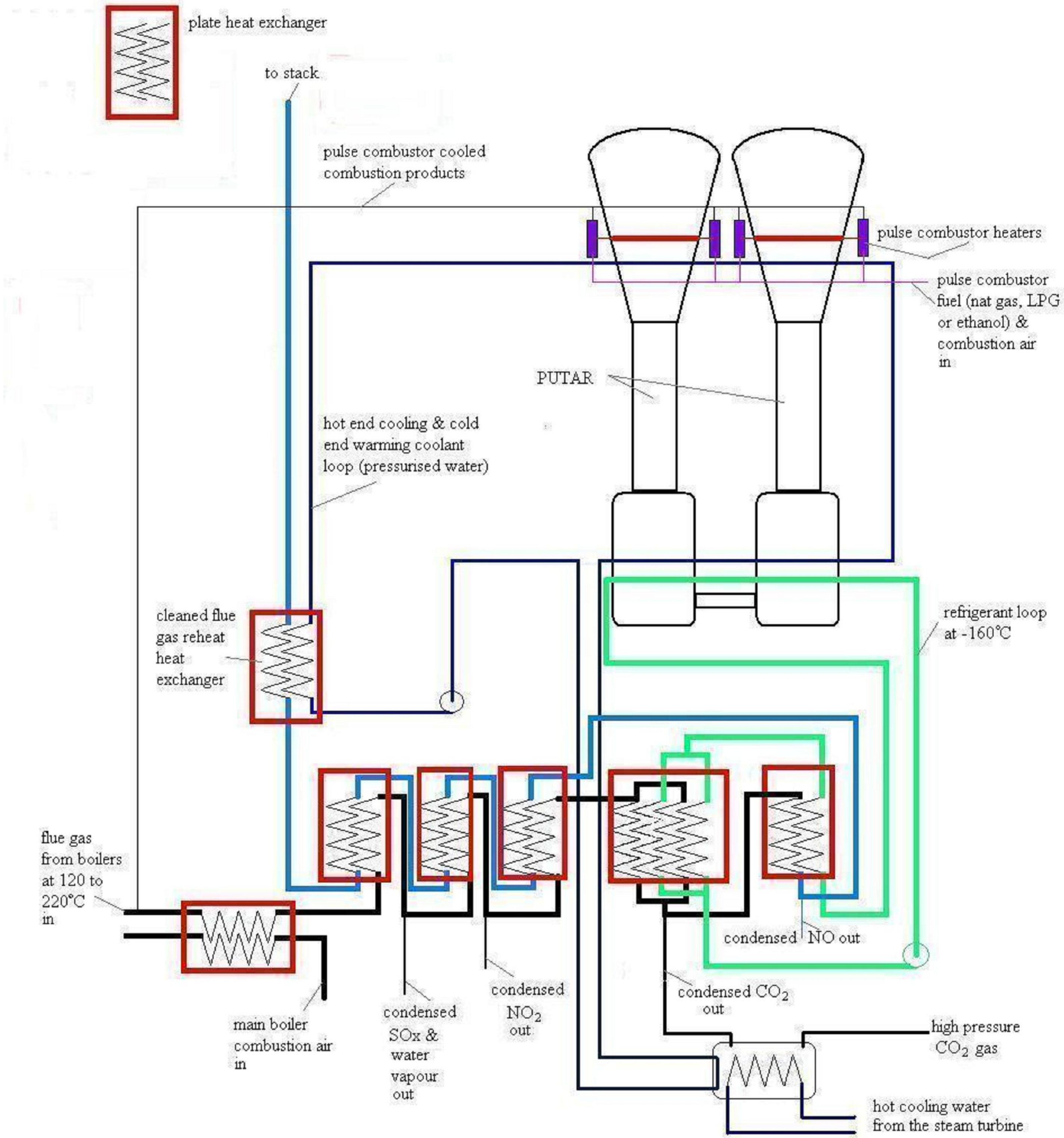
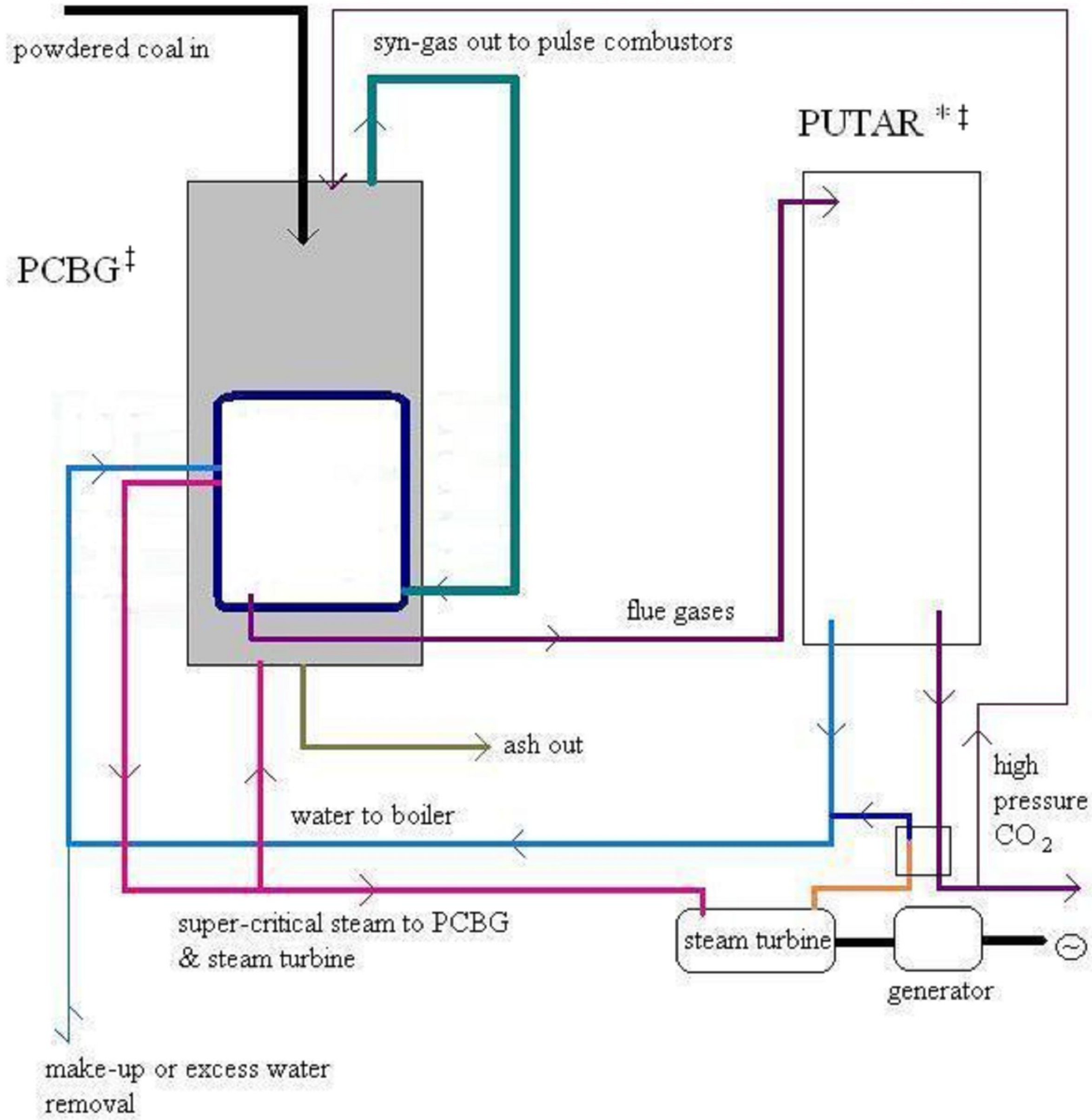


plate heat exchanger
to stack
pulse combustor cooled combustion products
pulse combustor heaters
pulse combustor fuel (nat gas, LPG or ethanol) & combustion air in
PUTAR
hot end cooling & cold end warming coolant loop (pressurised water)
cleaned flue gas reheat heat exchanger
refrigerant loop at -160°C
flue gas from boilers at 120 to 220°C in
condensed NO out
condensed CO_2 out
main boiler combustion air in
condensed SOx & water vapour out
condensed NO_2 out
high pressure CO_2 gas
hot cooling water from the steam turbine



Pulse Combustion Boiler - Gasifier flow diagram

*see PUTAR flow diagram for details of this process

‡ patents held by Delafield Pty Ltd & Docklands Science Park Pty Ltd for these processes

The combustion products are fed into a series of heat exchangers and are cooled down by the returning remnant gases from the refrigeration process. Water, SOx and NOx present get condensed out of the flue gas stream as individual components, i.e. the NOx is collected as N_2O, NO and NO_2 separately.

CO_2 is collected as a solid and fed into a series of chambers where it is allowed to pressurise and go into the liquid phase ready for transfer to a sequestration process. The pressurisation process can be assisted with steam earmarked for the condensers in power stations thus saving on cooling water requirements. Also, power station operators no longer need to keep the flue gases above 200 °C to prevent condensation in the chimney stacks and can therefore recover more heat from the fuel.

*The exiting gases now have only about 270ppm of CO_2 as opposed to around 400ppm of CO_2 in the incoming combustion air. For a 1000MW power station this amounts to $210,000 per year in carbon credits (based on the price, of AUD 23.00) over and above what it would generate from the total removal of CO_2 from fuel.

The refrigeration processes is powered by pulse combustion. This enables a very compact and efficient “engine” at one end of the pulse tube that forms the thermo-acoustic refrigerator. There are no moving parts. Modifications to the cold end of the pulse tube further improve the efficiency of this refrigerator. The combination of these improvements can be demonstrated in a prototype, costing some $10-12 M.

The application of this process, together with pulse combustion in the coal burning process, or the burning of natural gas, could result in greenhouse gas free electricity at, or lower than, today’s electricity prices.
Using acoustic technology we expect to gasify brown (or black) coal, then burning the gas using pulse combustion to produce 5.19 Megawatts of electric power per tonne of coal, instead of 1.0 to 2.0 as is current practice at Yallourn, Victoria.
An extra 3.19 Megawatt hours (MWh) of electricity is worth $134 at NEMCO prices.
Carbon dioxide equivalents produced are 1.4 tonnes per tonne of coal. At a capture cost, by liquefaction, of $3.00 per tonne the cost of capture is $4.20 per tonne of coal.
Storage, under the sub-ocean silts and under 3,300 metres of seawater to provide the requisite pressure, if done according to the recommendations of Dr. John Holdren (now chief scientific advisor to President Obama) and team from Harvard University should cost AU$10 per tonne, possibly less, requiring little or no monitoring for endless years, as is required with geosequestration storage in old gas wells and other cavities.
Hence, capture costs are $4.20 per tonne of coal and storage costs $14.00 per tonne of coal. There is produced extra electricity valued at $134 so the process is extremely profitable to undertake, with an obviously short payback period.
The refrigerated gases cool the power station, no water is required, a big saving.

ENDS.

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