Electricity generated by fossil fuels can only serve to make the world warm faster.

Solar power is already cheaper than new fossil fuel power but needs energy storage to form a complete replacement for fossil fuels. Energy storage in molten salt or hydro electric schemes or spinning flywheels may be feasible for large projects but not at the domestic scale where energy is at its most insecure. Battery energy storage is the most obvious method at the domestic level but also enormously expensive. There is another form of energy storage which can radically reduce the amount of domestic battery storage required. This method uses hot water storage to provide the house warming and water heating requirement separately from the lights, motors and electronics loads.

SOLAR ENERGY STORAGE IN HOT WATER

Heating uses an annualised 60% of household energy in Sydney and a lot more than that in winter. A well insulated house would need to have stored perhaps 20 or 30kWh of energy for central heating on a cold, cloudy winter's day and so too expensive for batteries at $700 per kWh (the latest Powerwall battery cost). To cope with several such days in succession figure on several times this amount. Hence independence of both the gas and electricity grids in town doesn't yet make economic sense, particularly since almost all houses are so poorly insulated. However there is a solution which doesn't involve large amounts of batteries.

The solution is to store energy for heating as heat. Hot water storage (45 to 90 Celsius operating range) can store 52 kWh per 1000 litres, water is cheap so most of the cost is the tank. This can be both a cheap unpressurised tank for hydronic heating and a normal mains pressure tank for the domestic hot water service. The tank needs to be well insulated of course but insulation is cheap. If the tank is mounted within the heated space then all the tank heat loss goes to heat the space and none is wasted. Of course, you need somewhere to put such a tank and 1000 litres weighs 1 tonne.

Hot water running through wall-mounted radiators is used all over the world for central heating. A small pump is required to push the hot water around with thermostats regulating the room temperature and there are no noises or drafts. Hot water at 90 Celsius is too hot to use in wall mounted radiators so a tempering valve mixes in cold water to reduce the temperature but without any energy loss.

The economic source of the energy used to heat the water is photovoltaic (PV) panels. Solar thermal panels or evacuated tubes are now much too expensive both in terms of their system cost (a header tank is required for summertime water replenishment and in colder climates a heat exchanger and anti-freeze are required or alternatively the system must be drained every night) and maintenance issues (most repairs involve climbing on to the roof).

A heat pump would appear to be an economical way of turning the solar electricity into heat as they have an efficiency of perhaps 350% (since they move, rather than generate, heat) but watch out for the standby power that some of these units use to keep their crankcases warm enough to stop the refrigerant condensing in cold

weather. This power can amount to 15% of the operating power but is present all the time, not just when the unit runs. If you turn it off to save energy, then you need to allow perhaps 4 hours to warm up and evaporate the refrigerant before you can actually run the unit again.

Hot water energy storage systems are compact due to the very high heat capacity of water, can be expanded in capacity for basically the cost of the extra tank and store energy directly in the form that is most required in the cooler parts of the world. Of course batteries are required to run your lighting and TV but such loads are a tiny part of your power bill compared to heating. LED lighting, the TV, fridge, microwave, induction cooktop and PC are all considerably more efficient than they were 20 years ago.

In summer the PV can run air conditioners directly, particularly if some PV is turned to face west to provide power until sunset. Once installed, PV with suitable energy storage will fullfill the old nuclear energy promise of "energy, too cheap to meter".

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from
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