Thorcon (Molten Salt Reactor)

Safe: The fuel in a MSR reactor is in a liquid state meaning that in case of the reactor overheating it will automatically shut down passively by draining the fuel from the primary loop needed no human intervention. It has three gas tight barriers between the fuel salt and the atmosphere In case of a primary loop rupture the fuel flows to a drain tank where it is cooled without any dispersal energy or phase change and other concerning fission products like strontium-90 and Cesium-137 go in the same tank since they are chemically bounded to the salt . The reactor is sited 30 m underground.

Nonproliferation: there is nothing that an operator can do to prevent the drain and cooling meaning it’s walkaway safe.

Cheaper than coal: reliable, carbon free, electricity at 3 to 5 cents per kWh depending on scale

No need of having complex refueling systems in solid fuel nuclear power plants. Fuel is in liquid form and it has a major advantage of being able to adjust the composition on the go. No need for excess reactivity to account for because fuel quality is not deteriorating over time. No need to look out for hot spots as in fast breeders because any variations in the fuel salt is quickly mixed away.

Pressure: PWR operate at around 2300 psi which implicates a thick reactor vessels and piping that is specially fabricated for these technologies. If there is a piping failiure many things can occur like spraying radioactivity around the area. The containment structure must take all the decay heat in the core but also kept cool. This fact of operating at high pressures involves many technical issues that must be taken into account when desigining and building the reactor. In Thorcon there is no need for the use of reinforced concrete and expensive containment structures. Instead the containment structure is made of simple steel and it can be manufactured as blocks on a panel line using less than 5 man hours pr ton of steel and assembled in months.

Load following if needed be. Because of the negative temperature coefficient, the plant’s power output wants to adjust to the load.

Realiable means Modular. A 1 GWe plant would be broken down into four 250 MWe modules which work independently of each other meaning that a failiure in one of them would result in the lost of ¼ the plants output.

Each module is made up of two sealed primary loops which are duplexed. One is operating and the other is in standby or cooldown mode. This increasises realiability. In case the frist loop failes it can switch to the other loop in a matter of hours.

Clean: Nuclear carbon footprint is slightly worse than wind and a little better than solar. It is 1/60th that of coal. Like all nuclear plants it virtually does not emite SO2, NOx or any other patrituclte pollution. Thorcons CO2 intenity is calculated to be around 10g CO2 Eq/kWh. Comparing to LWR, this reactor is 40% more efficient. It obtains about 25% of the power from easily mined thorium with no enrichment necessary. Because of this efficiency the MSR reactor produces about 55% of the waste heat of a LWR with the same power output, reducing cooling water requirements by a alike amount. Fissile consumption is half that of standard LWR. Over 32 years a 1GWe ThorCon WILL PRODUCE ABOUT 25 m3 of high level waste. In the Thorcon system, all radioactive material is regularly returned to the Centralized Reccycling Facility (CRF) for decontamination separation, reuse and siposal meaning this burden is shifted to the recycling facility.

Silo Hall

The power plant can be of one or more power modules. There are steel sandwich walls beteween each module and within each module between the silo hall and secondary heat exchanger cell, and between the SHX cell and the steam generating cell. With high probability a problem in one module will be confined to that module. With high probability a problem in one module will be confined to that module.

All of the walls in the nuclear isaldn are steel sandwich construction. Wall cells are 1 m2, center to center and the steel plating is 25 mm thick. The wall are manufactured in aproxximatly 300 ton steel blocks on a paneli line and barged to the site.