

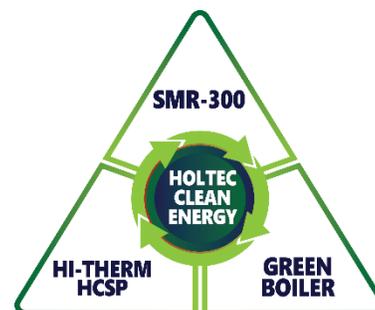
Quick Facts Issue #03:

On the Benefits of Employing Holtec's Clean Energy Triad in a Nuclear Plant's Exclusion Zone



BOOSTING THE ELECTRIC POWER OUTPUT, EFFICIENCY AND RELIABILITY OF NUCLEAR PLANTS WITH ENERGY CAPTURED FROM THE SUN

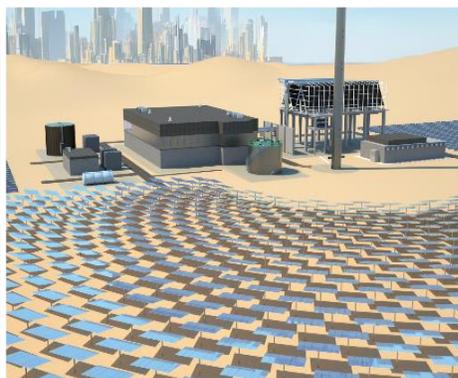
Large Exclusion Zones around nuclear plants offer the opportunity to add additional generation capacity by installing SMR-300s, which are extremely compact (~30 acres for two units) and, even better, require no *exclusion zone around them*. Thus, most of the land in the Exclusion zone can be used to collect solar energy in Holtec's HI-THERM hybrid concentrated solar power (HCSP) system. This paper addresses the notion of installing the Holtec Clean Energy Triad consisting of SMR-300s, the HI-THERM HCSP, and the Holtec Green Boiler, all *within the Exclusion Zone*. The HI-THERM HCSP serves to collect the high-temperature thermal energy from the Sun (and a small amount of DC electrical power by the strategically placed PVPs) depositing it in the Green Boiler which is a massive thermal energy storage system with a built-in heat exchanger. The three constituents of the Clean Energy Triad are illustrated on this page with reference to the Quick Facts memos that describe them (available on Holtec's website).



The Clean Energy Triad



SMR-300™: Small Modular Reactor
[QuickFacts Issue #01]



HI-THERM™ HCSP (Hybrid concentrated solar power) plant
[Quick Facts Issue #21]



Holtec Green Boiler™
Long-Duration Thermal Energy Storage Device
[Quick Facts Issue #11]

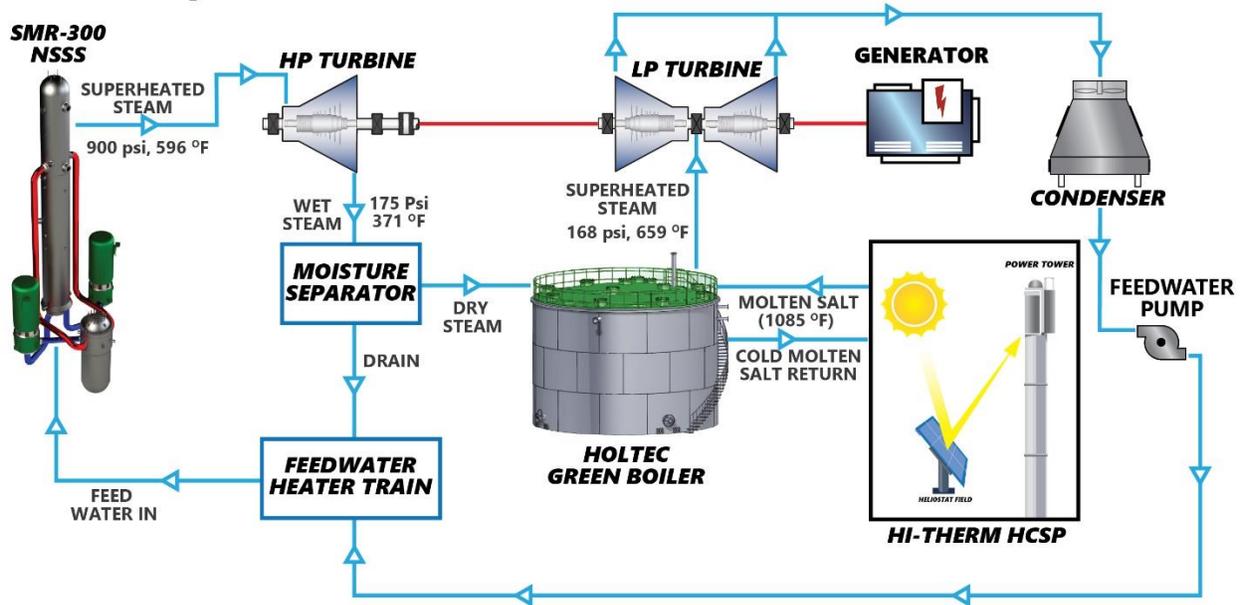
TWO APPROACHES TO DEPLOY THE CLEAN ENERGY TRIAD IN THE EXCLUSION ZONE

A straightforward approach is to run the SMR-300 plant and the HI-THERM HCSP plant separately. The HI-THERM HCSP equipped with the Green Boiler energy storage system provides steam to a turbogenerator. The HI-THERM HCSP also provides a small amount of DC power from its PVPs.

Another approach is to use the stored heat in the Green Boiler to reheat the SMR-300 cycle steam. If the land area available for solar power collection is sufficient then the SMR-300 plant may dispense with the

classical steam-to-steam Reheater (a pesky and expensive equipment) altogether as shown in the schematic below, which illustrates the power cycle with the Green Boiler replacing the Reheater altogether!

SMR-300 | HOLTEC GREEN BOILER HYBRID POWER CYCLE



A NUMERICAL EXAMPLE OF SMR-300 USING WITH SOLAR HEAT FROM THE GREEN BOILER

The schematic above shows the steam flow rates and temperatures in the case where the SMR-300 steam exiting the High-Pressure Turbine is heated by passing it through the suitably sized Green Boiler which is supplied by solar heat from HI-THERM HCSP served by a 1000-acre solar field (estimated output 160 MWt on 24/7 basis). As the data in the above schematic shows, the Green Boiler heat is sufficient to obviate any internal reheating and the total power output of SMR-300 plant is increased from 365.9 MWe to 437.4 MWe. If the HI-THERM plant were operated separately from the SMR-300 plant, their combined output would be 426.7 MWe, i.e., 10.7 MWe less than that from injecting the solar heat directly into the SMR-300's steam cycle. Summarizing the benefits of conjugating nuclear with solar:

More Megawatts, Same Fuel - Amplify output without touching the nuclear core. No additional uranium needed — exploiting the high enthalpy heat from the Sun begets additional megawatts.

Black Start Capability - With 24/7 thermal support from the Green Boiler, the plant becomes self-restarting, even in full blackout scenarios; this is a most desirable grid resilience feature.

No Batteries - No Fossil Backups - Say goodbye to battery banks and fossil-fueled auxiliary steam systems. Solar thermal keeps operations humming, cleanly, and efficiently.

Patent Pending US and World Patent Application Nos; PCT/US2024/032921, PCT/US2024/054850, 18451235, 63619047, 63668364, 63671336, 18939701, 63675394, PCT/US2025/36839, 63670371, 63671445, 19262978, 63697991, PCT/US2025/036060, 19257123, 63713314, 63761428

All Quick Facts sheets are available on Holtec's website; they are updated as needed. For the latest version, please visit our website: www.holtecinternational.com

