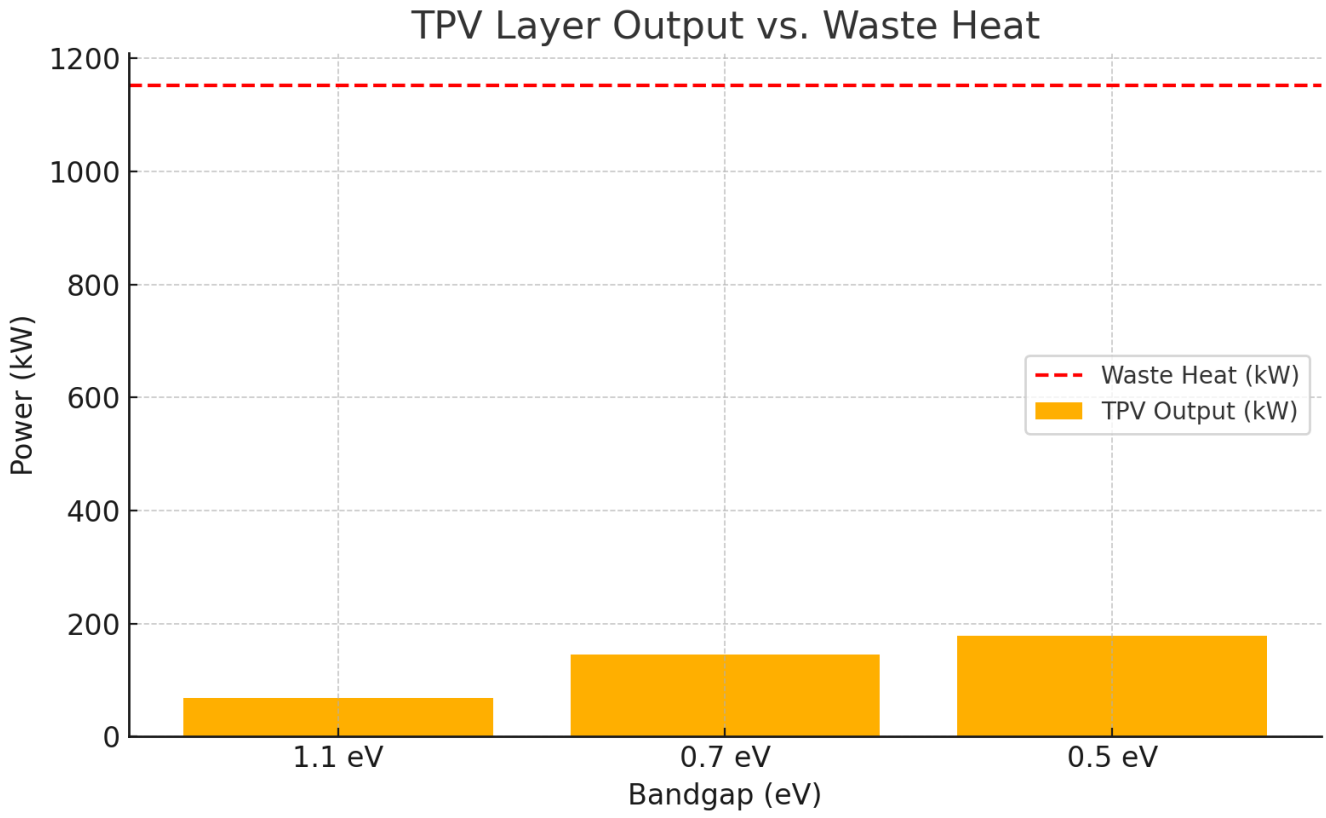
Ghost Reactor: Photon-Core Energy & Propulsion System

1. Abstract

The Ghost Reactor is a photon-core fission system that bypasses traditional steam-based power cycles. It uses a thermophotovoltaic (TPV) array to directly convert thermal radiation into electricity. Excess unconverted heat is absorbed by a molten lead loop for backup generation and thermal stability. The system supports both photonic and ion-based propulsion modes, enabling long-duration deep space travel without refueling.

2. Photon-Core & TPV Energy Harvesting

The core acts as a blackbody radiator, emitting high-temperature photons. Layered TPV cells tuned to specific bandgaps convert these photons to electricity. Bandgaps of 1.1 eV, 0.7 eV, and 0.5 eV cover the majority of the emitted spectrum. Simulation logs show TPV output reaching 250 kW at nominal reactor temperature (1500 K).



3. Molten Lead Loop & Thermal Capture

Residual heat not captured by TPV arrays is absorbed by a secondary molten lead loop. Lead's high heat capacity and thermal stability make it ideal for space applications. Waste heat is routed through this loop to power backup systems and maintain reactor safety margins.

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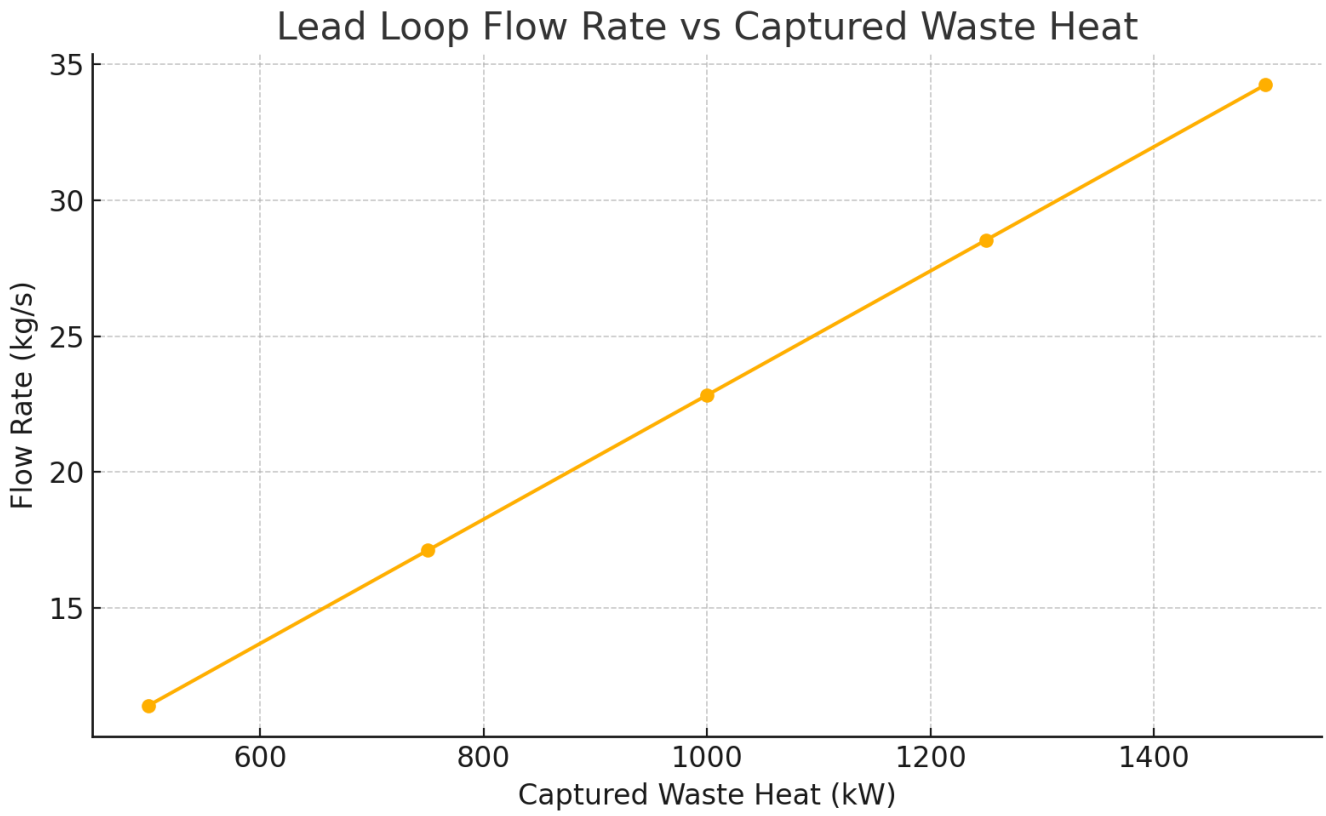
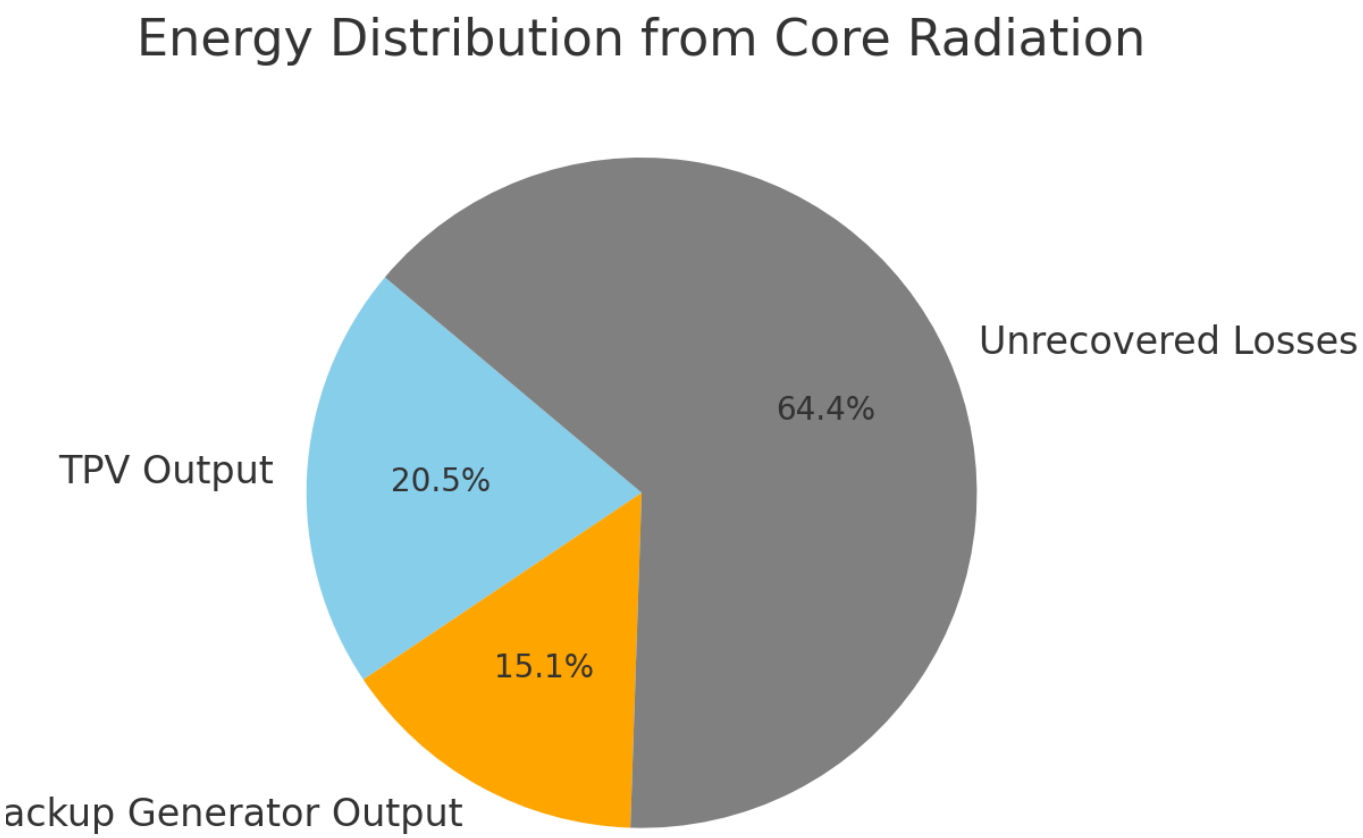


4. Energy Balance & Efficiency

Simulated energy distribution: ~30% electric via TPV, ~10% for photon thrust, and ~60% routed to cooling. Lead loop generators convert some of the thermal energy to power. This efficient distribution minimizes waste and ensures operational safety.



5. Fuel Burn Modeling

Using U-235 with ~200 MeV/fission, the reactor can operate for over a decade with proper power throttling. A 50 kg core provides ~4.1e15 J, supporting multi-year missions with continuous TPV output and ion drive operation.

6. Dual Propulsion Logic

Photon Drive: Directs excess radiation rearward for pure light-based thrust (Isp ~ 30 million sec).
Ion Drive: Uses TPV-generated electricity to power ion thrusters. 1 MW output can yield 20-40 N thrust.

Combined, these enable long-duration missions with propellant-efficient burns and continuous low-thrust cruise.

7. Applications & Conclusion

Ideal for deep space probes, Mars transit vehicles, or long-term orbital infrastructure. Ghost Reactor provides autonomous, fail-safe, high-endurance power and thrust in a single unit. The architecture scales from small probes to crewed missions.