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Alternative Nuclear Power: Pebble Bed Reactor

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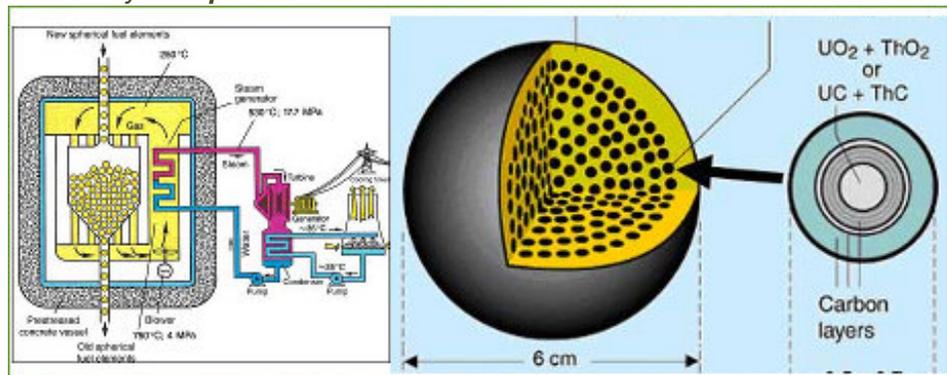
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This article is part of a series on alternative possibilities in nuclear power. Previously at EcoGeek: [Alternative Possibilities in Nuclear Power](#)

Pebble Bed Reactor

The pebble-bed reactor was supposed to be another intrinsically safe, and "melt-down proof" design. "Pebble bed reactors are helium-cooled, graphite-moderated reactors in which the fuel is in the form of tennis ball-sized spherical "pebbles" encased in a graphite moderator. New fuel pebbles are continuously added at the top of a cylindrical reactor vessel and travel slowly down the column by gravity, until they reach the bottom and are removed." Cooling uses an inert gas such as

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helium, rather than a liquid, which simplifies many of the reactor systems.

"The use of helium and graphite allows the reactor to burn the fuel efficiently and to operate at much higher temperatures than conventional light water reactors." Since the pebble bed reactor was already designed to operate at very high temperatures, and since its cooling medium was a gas, rather than a liquid, the control systems for a pebble bed reactor could be much simpler. The largest problems that need to be dealt with for a boiling water reactor - overheating and coolant boiling away - are not concerns for a pebble bed reactor. The pebble bed also produces less power as the temperature rises, so the design is effectively self-limiting.

The pebble bed design offers some operational advantages, such as allowing the reactor to operate constantly without needing to be shut down periodically for refueling. As each pebble makes its way through the system and is drawn out at the bottom of the reactor, it can be tested and either reinserted at the top of the reactor (the average pebble would cycle through the reactor about ten times before it was expended) or withdrawn if it was spent. New fuel pebbles could also be added when needed to keep the reactor operating.

Early experimental work with pebble bed reactors was carried out in Germany beginning in the 1960s. Pebble bed reactors were thought to be a promising next step in reactor design. But several issues operational made the pebble bed design less than ideal. Contaminated graphite dust is created from the pebbles from friction as they move down through the reactor. Tests carried out with dummy pebbles also found overheating conditions inside the reactor. The volume of radioactive waste from a pebble bed reactor is larger than that from other designs, which presents more of a problem when dealing with spent pebbles. And decommissioning the reactor may have higher costs because of the radioactivity of the reactor components.

Because of these problems, the [German project was abandoned](#) by the 1980s, and rights to carry on the work were obtained by a series of South African companies. However, after years of development, the work on developing a pebble bed reactor has pulled curtailed<, and the company is now concentrating solely on high-temperature industrial applications (such as coal gasification) for the technology. At present, China remains the only country working on developing pebble bed technology.

Links: [Bulletin of the Atomic Scientists](#)
[European Nuclear Society](#)
[Pebble bed reactor \(Wikipedia\)](#)

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