# $EM^2$ (General Atomics, USA)

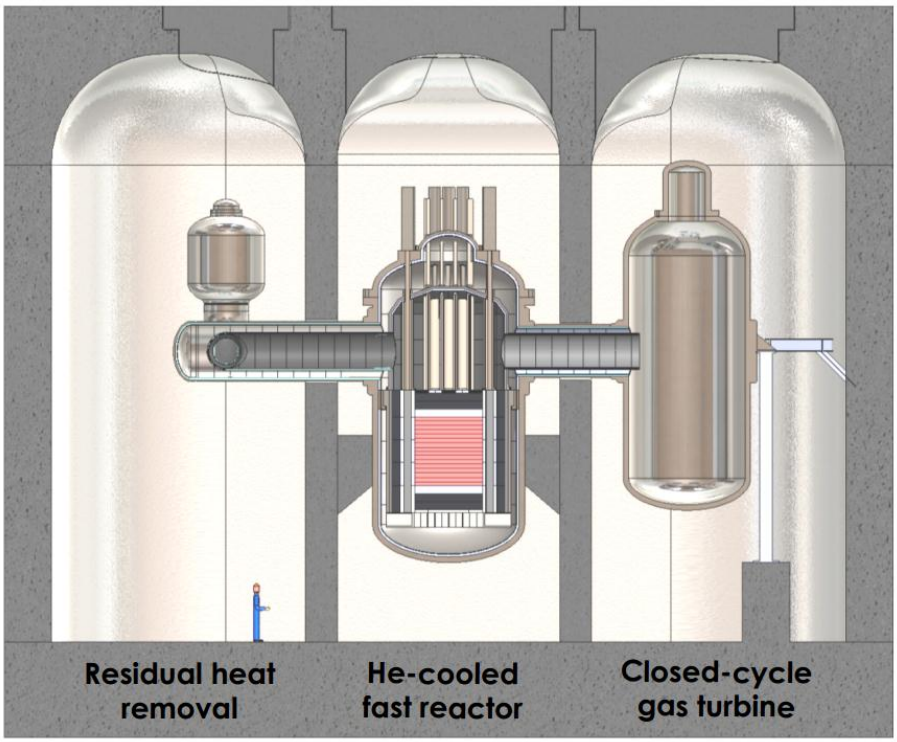


*FIG. 27.Schematic View of $EM^2$*

| | |
|---|---|
| Reactor type: | *High temperature gas cooled fast reactor* |
| Electrical capacity: | *240 MWe* |
| Thermal capacity: | *500 MWt* |
| Coolant: | *Helium* |
| Primary Circulation: | *Forced circulation* |
| System Pressure: | *N/A* |
| Core Outlet Temperature: | *850°C* |
| Thermodynamic Cycle: | *Direct Brayton cycle* |
| Fuel Material: | *Used nuclear fuel* |
| Fuel Enrichment: | *1% $U^{235}$, 1% Pu, MA* |
| Fuel Cycle: | *30 years* |
| Reactivity Control: | *N/A* |
| No. of safety trains: | *N/A* |
| Emergency safety systems: | *N/A* |
| RHRS: | *Passive* |
| Design Life: | *30 years* |
| Design Status: | *Conceptual design* |
| Seismic Design: | *N/A* |
| Predicted CDF: | *N/A* |
| Planned deployment: | *N/A* |
| Distinguishing Features: | *Helium cooled fast reactor; reduces spent fuel inventories* |

**Introduction**

The $EM^2$ is designed as a modification of an earlier high temperature, helium cooled reactor. It is an effort to utilize used nuclear fuel without conventional reprocessing.

**Description of the Nuclear Systems**

The reactor is designed to produce 500 MWt and 240 MWe based on a closed cycle gas turbine. The $EM^2$ is a fast reactor design intended to burn used nuclear fuel and has a 30 year core without the need for refuelling or reshuffling. The spent fuel cladding is first removed and the fuel is pulverized and processed using the atomics international reduction oxidation (AIROX) dry process to remove fission products. The fuel burned in the reactor is recycled upon discharge.

The core contains SiC-SiC clad porous UC plates arranged in a SiC-SiC assembly frame making a fuel assembly. There are 21 fuel assemblies creating one layer and 17 layers stacked on top of each other surrounded by first a BeO layer, then a graphite reflector layer, and a B4C layer all sitting in the core barrel.

In a first generation plant, the fuel consists of about 22.2 t of LEU starter and about 20.4 t of used nuclear fuel. The used nuclear fuel is

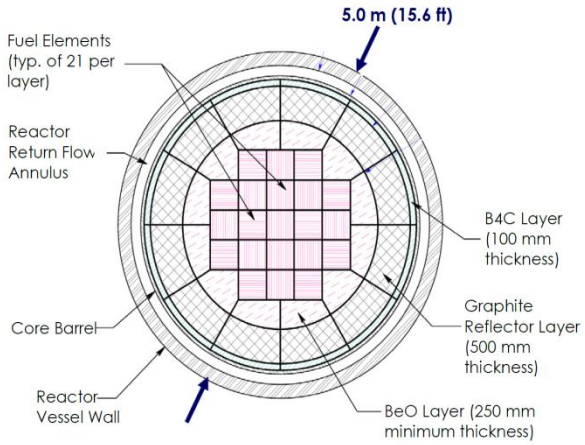


*FIG. 29. Core layout*

roughly 1% $^{235}U$, 1% Pu and mixed actinides (MA), and 3% fission products; the rest is $^{238}U$. The design organization claims that there is no need for uranium enrichment after the first generation reactor, as the discharge from the preceding generation is used for the succeeding generation. Out of each discharge, about 38.5 t is used in the


*FIG. 28. EM2 reactor and gas turbine*

succeeding generation while about 4 t of fission products is removed.

**Description of Turbine-Generator Systems**

Using a gas turbine cycle, the designers claim to achieve 48% efficiency with a core outlet temperature of 850°C. The entire containment is designed to be below grade and sealed for the 30 year core period [10].