The Global Nuclear Energy Partnership (GNEP)

GNEP Element: Develop Advanced Burner Reactors

GNEP will develop and demonstrate **Advanced Burner Reactors** (ABRs) that consume *transuranic elements* (plutonium and other long-lived radioactive material) while extracting their energy. The development of ABRs will allow us to build an improved nuclear fuel cycle that recycles used fuel. Accordingly, the U.S. will work with participating international partners on the design, development, and demonstration of ABRs as part of the GNEP.

The ABR recycles used nuclear fuel

The ABR would destroy transuranics in used fuel from nuclear power plants, avoiding the need to accommodate this radioactive, radiotoxic, and heat-producing material in a geological repository for hundreds of thousands of years while it decays.

To "burn" this material, an ABR takes advantage of high-energy or fast neutrons to fission, or split apart, long-lived transuranics. Here, "burn" does not mean incinerate or combust; it means to transmute or convert transuranics into shorter-lived isotopes. As transuranics are consumed, significant energy is released and converted into electricity, thereby producing useful energy from material that would otherwise be waste.

How the system would work

Current light water reactors (LWRs) and ABRs would work well together in an advanced nuclear fuel cycle. LWRs are

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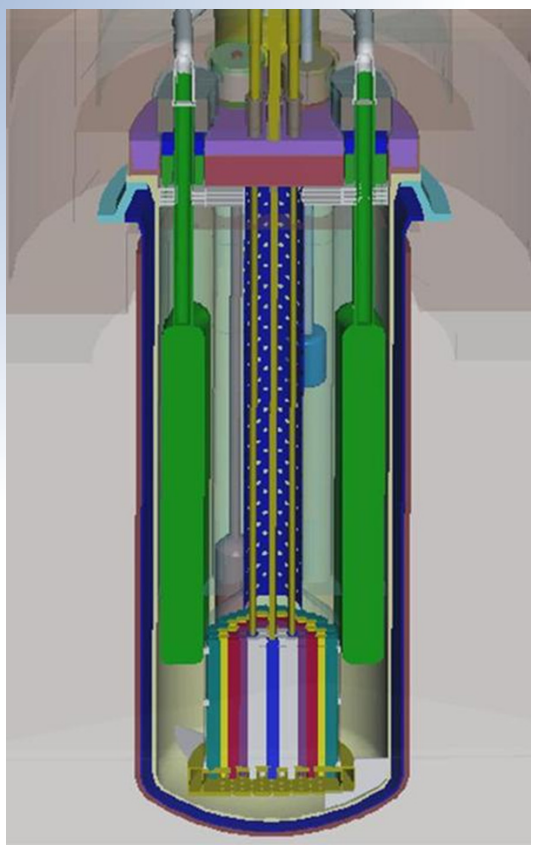

A concept diagram for an Advanced Burner Test Reactor

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net producers of transuranics and ABRs are net consumers of transuranics. Significant prior U.S. investment in *fast reactors* provides a valuable technology base for supporting future development of ABRs. ABRs may be developed in modules to promote economical production. Together, a few modules can be constructed at a single site to produce a plant capable of generating over a gigawatt of electricity, similar to nuclear plants today.

Ensuring safety

Safety design features and operational methods will be incorporated into ABRs to provide public and worker safety while reducing greenhouse gas emissions during electricity generation. A key objective of the ABR program is to obtain design certification from the U.S. Nuclear Regulatory Commission (NRC) for the ABR Standard Plant. Future commercial ABRs would be operated in accordance with NRC licenses.

Showing ABRs can do the job

Fast reactors have been demonstrated, but their use as "burners" requires further testing. Thus, the initiative proposes a two-phased approach.

The first phase emphasizes an Advanced Burner Test Reactor (ABTR). This would prove the concept of effectively burning transuranics, support development and qualification of fuels and materials for the second phase, and test safety to support ABR design certification with the NRC. The ABTR would be about one-tenth the size of a current nuclear power plant, with the goal of being operational around 2014.

The second phase would demonstrate a first-of-a-kind ABR Standard Plant, operational by about 2023. This plant would have approximately the same capacity as current nuclear power plants. Successful demonstration of this ABR Standard Plant could be followed by commercial deployment of more ABRs.

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