# Potential benefits of inertial fusion energy justify continued R&D

February 20 2013

The potential benefits of successful development of an inertial confinement fusion-based energy technology justify investment in fusion energy research and development as part of the long-term U.S. energy R&D portfolio, says a new report from the National Research Council. Although ignition of the fusion fuel has not yet been achieved, scientific and technological progress in inertial confinement fusion over the past decade has been substantial. Developing inertial fusion energy would require establishment of a national, coordinated, broad-based program, but achievement of ignition is a prerequisite.

"The realization of inertial fusion energy would be a tremendous achievement capable of satisfying the world's ever-growing need for power without major environmental consequences," said Ronald Davidson, professor of astrophysical sciences at Princeton University's Plasma Physics Laboratory and co-chair of the committee that wrote the report. "These possibilities form an extremely compelling rationale to continue R&D efforts toward this goal."

Inertial fusion energy technology (IFE) would provide an essentially carbon-free energy source with a practically unlimited supply of fuel. IFE relies on a process in which a fuel pellet the size of a pinhead is compressed by an external energy source, raising the temperature and density enough that the nuclei of the some of the fuel atoms fuse together, releasing nuclear energy. The aim is ignition, in which the fusion energy produced by the initial compression causes the remaining fuel to undergo fusion.

"The fuel used in the fusion process is lithium and deuterium; deuterium is derived from water and therefore virtually unlimited," explained Gerald Kulcinski, associate dean for research and director of the Fusion Technical Institute at the University of Wisconsin, Madison, who served as co-chair of the report committee. "And unlike nuclear fission plants, it would not produce large amounts of high-level nuclear waste requiring long-term disposal. The potential is for a sustainable energy source that could power the Earth for millions of years."

U.S. research on inertial confinement fusion has been supported by the National Nuclear Security Administration (NNSA) of the U.S. Department of Energy. NNSA's objective is nuclear weapons stockpile stewardship, but much of the R&D is also applicable to IFE development. There are several external energy source or "driver" technologies under development: lasers, particle beams, and pulsed magnetic fields. NNSA's National Ignition Facility, located at Lawrence Livermore National Laboratory, recently completed a National Ignition Campaign aimed at achieving ignition. While much was learned in the process, ignition was not attained. In view of this result, the committee concluded that a range of driver technologies should continue to be pursued, rather than choosing a single technology at this time.

Provided by National Academy of Sciences