

# National Ignition Facility & Photon Science

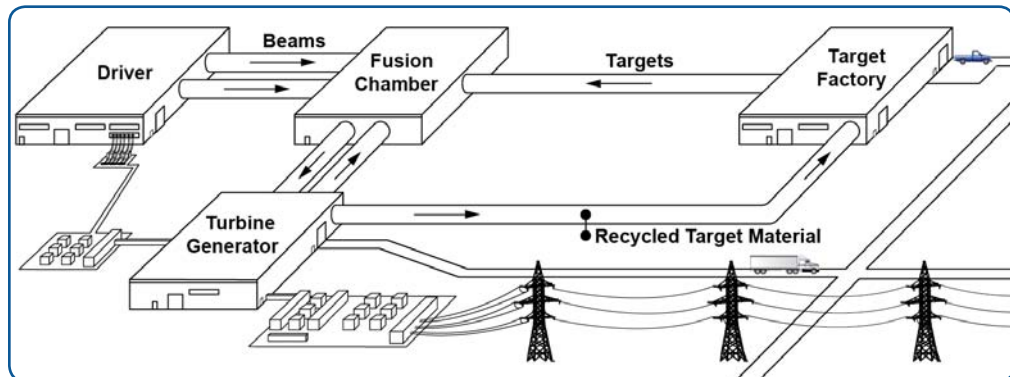
## The Promise of Limitless Energy

Harnessing the energy of the sun and stars to meet the Earth's energy needs has been a decades-long scientific and engineering quest. While a self-sustaining fusion burn has been achieved for brief periods under experimental conditions, the amount of energy that went into creating it was greater than the amount of energy it generated. There was no energy gain, which is essential if fusion energy is ever to supply a continuous stream of electricity. If it is successful, the National Ignition Facility will be the first inertial confinement fusion facility to demonstrate ignition and a self-sustaining fusion burn. In the process, NIF's fusion targets will release 10 to 100 times more energy than the amount of laser energy required to initiate the fusion reaction.

The nuclear power plants in use around the world today utilize fission, or the splitting of heavy atoms such as uranium, to release energy. A fusion power plant, on the other hand, will generate energy by fusing atoms of deuterium and tritium—two isotopes of hydrogen, the lightest element. Deuterium can be extracted from seawater, and tritium will be produced by the transmutation of lithium, a common element in soil. When the two atomic nuclei overcome their natural tendency to repel one another and fuse under the intense temperatures and pressures in the NIF target capsule, a helium nucleus is formed and a small amount of mass lost in the reaction is converted to a large amount of energy according to Einstein's formula  $E=mc^2$ .

### Fusion Power Plant

An artist's concept of a future inertial fusion power plant.



### Electricity from Fusion

The fusing of hydrogen atoms from water in fusion power plants may someday supply almost limitless electricity.



A fusion power plant would produce no greenhouse gas emissions, operate continuously to meet demand, and eliminate the need for spent fuel storage that fission power plants must address. A fusion power plant would also present no danger of a meltdown.

Because nuclear fusion offers the potential for virtually unlimited safe and environmentally benign energy, the U.S. Department of Energy (DOE) has made fusion a key element in the nation's long-term energy plans.

NIF will not be used to produce electricity, but NIF experiments will bring fusion energy a major step closer to being a viable source of virtually limitless energy. The timing is fortuitous. Estimates are that over the next 75 years, the demand for energy will be more than three times what it is today. ■

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## Inside the National Ignition Facility

(from top)

The target chamber,  
with a fusion target  
shown at the center and  
enlarged; another  
view inside the NIF  
target chamber;  
the NIF laser bay.

