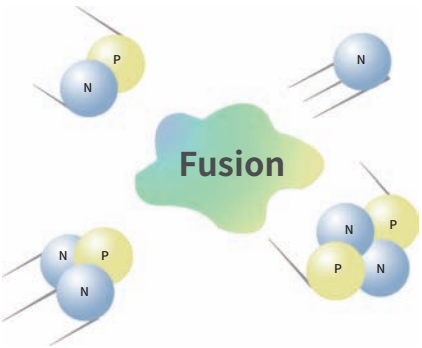
Compact Controlled Fusion Technology

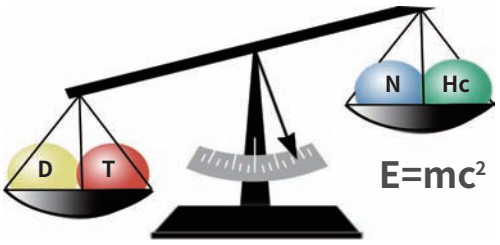
Nuclear fusion is the process wherein deuterium and tritium fuse into helium, releasing extensive amounts of heat which is then converted into electricity; today, scientists and engineers are working diligently to control these atomic reactions as a future source of energy.

Nuclear Fusion Fundamentals

As deuterium and tritium energetically collide, the normal electrostatic repulsion forces between their positive charges are overcome, causing their nuclei to fuse into heavier elements. The mass of the resulting nuclei is not equivalent to the initial isotopes because some has been converted into energy according to $E = MC^2$.

Three conditions must be fulfilled to achieve fusion: high temperatures, sufficient fuel particle density and adequate confinement time.





The Fusion Advantage

- **High Efficiency**: Controlled nuclear fusion releases almost million times more energy than chemical reactions such as coal, oil or gas combustion.
- **Abundant Fusion Fuel**: The Earth's oceans contain about 0.03g deuterium in 1L of seawater, potentially supplying global energy needs for over 10 billion years.
- **Clean Energy:** Fusion does not emit atmospheric greenhouse gases or toxic, long-lived radioactive nuclear waste.
- **High Safety Coefficient** : As natural disasters, human error and hazardous situations occur, fusion reactors could rapidly shut down to prevent a catastrophic accident.

Research Direction

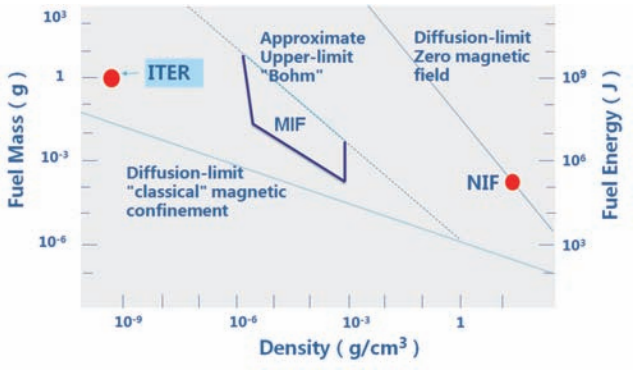
Today, mainstream fusion research is focused on large-scale devices such as magnetic-confinement tokamaks and inertial confinement lasers. However, the investment costs of these large-scale projects are extensive and remote from commercial application.

Within the past decade, scientists have adopted alternative methods to construct compact nuclear fusion devices. Compact nuclear fusion units have many distinct advantages: low cost, short assembly period, high safety coefficient and site flexibly. Therefore, ENN selected the compact fusion device as our key research and development direction.

Fusion Applications

As a disruptive technology, compact controlled nuclear fusion would radically change the energy supply system such as:

- **Commercial Electricity**: fusion will replace traditional combustion-based power plants and fission reactors that may pollute the environment.
- **Distributed Energy**: compact fusion reactors could be used for distributed energy applications.
- **Commercial Ship, Submarine and Spacecraft Energy Supply**: compact fusion devices with low mass, small volume and high efficiency would be a suitable energy source for vessels with limited space and travel long distances.



Technical Pathway

Magneto-inertial fusion (MIF) is a pathway to develop the compact fusion technology. MIF uses the magnetic fields to confine plasmoid and compress it to fusion condition. MIF combines features of inertial confinement fusion and magnetic confinement fusion. Its advantages include:

- The plasma density is lower in MIF versus ICF. Utilizing this method, premonitory pulsed device cost could be reduced using a simpler design.
- The target size of MIF is between a centimeter and a decimeter, several magnitudes above ICF. This is a significant advantage for commercial electricity applications.
- Because MIF incorporates several methods to compress plasma, the reaction rate is higher than MCF. Therefore, the ENN Energy Research Institute is considering the exploration of MIF as a major development direction.

Development Pathway

ENN is assembling a professional team of global experts to accelerate compact fusion research and development. Within the next two to three years, our objective is to identify key technologies in plasma physics, theoretical calculation simulation, engineering design, plasma diagnosis and system integration, and build a prototype of compact fusion reactor, optimizing its performance for five to six years. After ten years of accumulated engineering experience and experiment data, we intend to build a compact fusion reactor for research and build a commercial demonstration facility within twenty five years through innovative technologies and partnerships.

Tel: 0316-2597090 Fax: 86-316-2596907 E-mail: nyyjy@enn.cn HR E-mail: careers@enn.cn