The Use of IEC Fusion Devices at the University of Wisconsin-Madison for Non-Electricity Producing Applications

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Over the past 20 years the researchers at the University of Wisconsin-Madison have been examining how IEC, or IEC like fusion devices can contribute to the well-being of society well before fusion power plants are built. Recent analyses have identified over 20 near applications that do not require a Q (Energy Out/Energy In) > 1. Three of the most promising applications are:

1) Military and Homeland Security
2) Fusion Technology Testing Facilities
3) Production of Radioisotopes for Medical Diagnostics

The first application encompasses the use of IEC devices to make neutrons that can detect land mines and IEDs as well as smuggled nuclear materials. The Red Rover project is investigating the use of small drones to carry compact neutron sources to interrogate suspicious objects.

The second application includes the design of high powered 14 MeV neutron facilities to test the ability of structural materials to withstand the intense neutron bombardment from DT fusion fuels. In addition, some of the technologies developed for IEC devices can be used to simulate plasma wall interaction issues, especially those associated with DT tokamaks.

The third area capitalizes on the 14.7 MeV protons emitted from D^3He fusion in a driven IEC device. The use of (p,n) reactions to produce short half-life Positron Emission Tomography (PET) isotopes for medical diagnostics are particularly attractive for producing isotopes that have $t_{1/2} < 20$ minutes. Such short-lived isotopes cannot be made more than a few 100 meters from the patient because they would decay in transit.

Selected examples of these 3 applications will be discussed in light of the current capabilities of UW IEC devices.