Antimatter

Antimatter is the Bizarro twin of matter, made up of antiparticles that have the same mass as ordinary matter but with opposite atomic properties known as spin and charge. When the opposed particles meet, they annihilate each other and release tremendous amounts of energy as dictated by Einstein's famous equation, E=mc2.
Antimatter is already in use in a medical imaging technique known as positron emission tomography (PET), but its use as a potential fuel source remains in the realm of science fiction.

The problem with antimatter is that there is very little of it in the universe. It can be produced in laboratories, but currently only in very tiny amounts, and at prohibitively high costs. And even if the problem of production could be solved, there is still the knotty question of how to store something that has a tendency to annihilate itself on contact with ordinary matter, and also how to harness that energy once created.

NASA funds research into creating antimatter drives that could one day take humanity to the stars, but dreams of antimatter-powered starships as seen on Star Trek are still a long way off, all experts agree.