

ALTERNATIVE FUELS

Using Our Resources Wisely

The United States Air Force's mission is to deliver sovereign options for the defense of the United States of America and its global interests—to fly, fight, and win in air, space, and cyberspace. This mission requires global reach and flawless performance by the most sophisticated and advanced aircraft and trained Airmen in the world. To conduct this mission, the Air Force used over 2.5 billion gallons of aviation fuel in 2007 and is the largest fuel consumer in the federal government. An assured supply of fuel is critical to sustaining the mission of air superiority, support, and global reach.

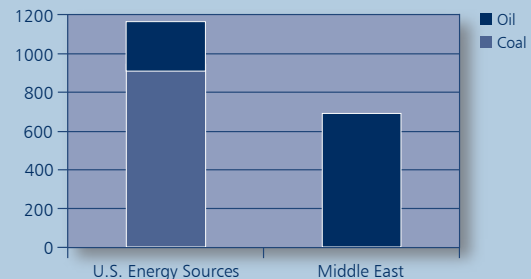
The role of largest fuel user carries a tremendous responsibility. The research, testing, and certification of new technologies have been increased to include renewable, unconventional, and traditional energy sources. This work is vital and it will allow the Air Force to expand the availability of new domestic sources of energy. Research and testing has led to an investigation of new synthetic fuel-blends that will leverage the natural energy resources found in the United States. The Air Force will certify the entire fleet to use a 50/50 synthetic fuel blend by early 2011. Ultimately, the Air Force goal is to obtain 50% of CONUS (contiguous United States) transportation

fuels by 2016 from domestically produced synthetic fuel blends from domestic sources that are produced in a manner that is greener than the fuel we use that is refined from oil.

Domestic Fuel Alternatives

Coal and biomass resources are plentiful in the United States and could account for more than 2.3 trillion barrels of fuel equivalent. Today's rising energy costs,

Available Energy Resources
(in billion barrels equivalent)



continued volatility in oil markets, and ever-present geo-political risks are a concern for the military and the nation. As technology steadily advances, it will become more cost-effective to utilize these more environmentally-friendly and assured fuels, and more importantly, reduce our dependence on foreign oil.

One quarter of the world's coal reserves are found within the U.S. The energy content of these reserves far exceeds that of the entire world's known recoverable oil. The challenge will be to take the CO₂ produced as a result of conversion to energy or fuel and safely use or recycle it.

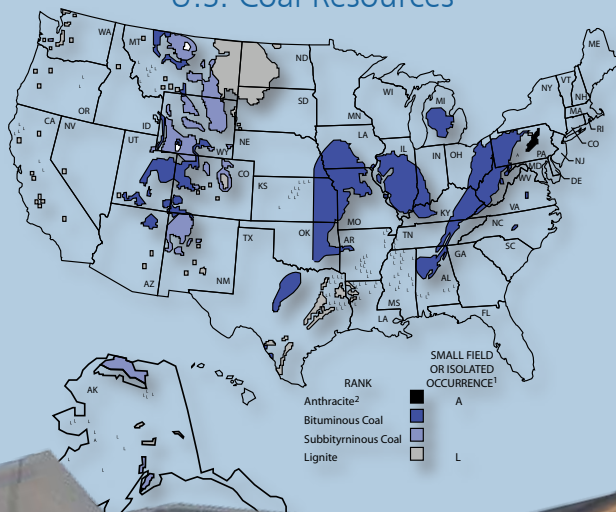
Biomass energy is an alternative that includes the gasification of any sort of vegetation—trees, grasses, algae, ocean plants, and paper mill or ethanol plant waste. Efficient gasification of biomass may yield fuel equivalent to those currently manufactured from fossil fuels.

Biomass represents a huge renewable energy source, one that also reduces pollution and greenhouse gas emissions. Biomass also could be a critical feedstock for coal-to-liquid technology to further reduce CO₂ emissions well below that of petroleum alternatives.

The F-22 Raptor's unique combination of stealth, speed, agility, precision, and situational awareness combined with air-to-air and air-to-ground combat capabilities makes it the best overall fighter aircraft in the world.

(U.S. Air Force photo)

U.S. Coal Resources



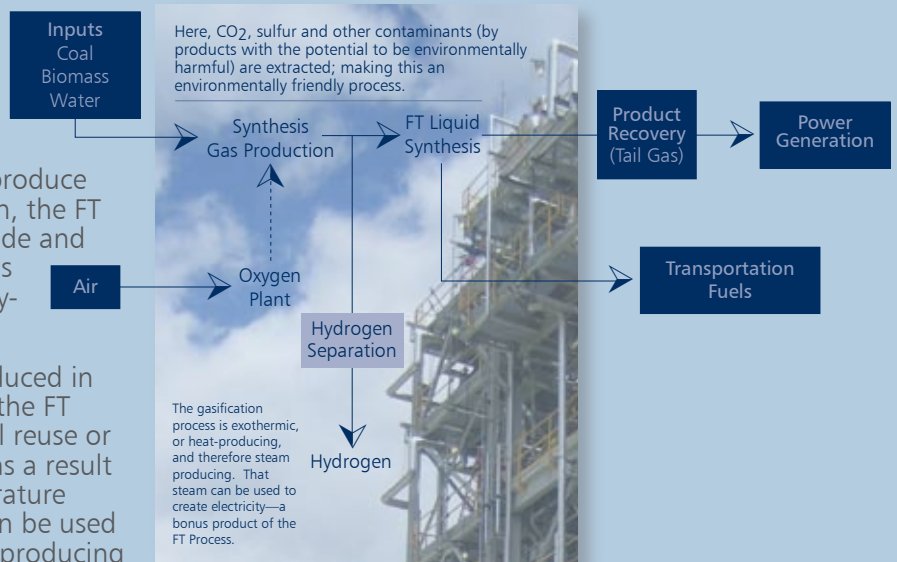
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Proven Technology: Fischer-Tropsch Fuel

The Fischer-Tropsch (FT) process is an 80-year-old process that converts synthesis gas from coal, biomass, and other fuel sources that are plentiful in the United States into usable, clean-burning synthetic petroleum. Hydrocarbon resources are first gasified to produce clean carbon monoxide and hydrogen. Then, the FT process catalytically converts carbon monoxide and hydrogen into liquid hydrocarbons of various forms to produce synthetic fuel and other by-products.

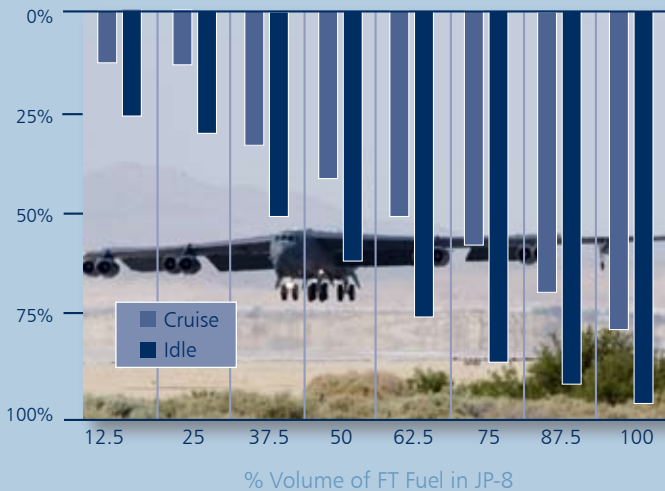
The concentrated stream of CO₂ that is produced in the gasification process is removed prior to the FT process and can be captured for commercial reuse or sequestration. Another byproduct created as a result of the FT process is steam. The high temperature used in the procedure creates steam that can be used to generate electrical power. In addition to producing a synthetic fuel, the FT process can provide much needed power to the nation.

Fischer-Tropsch (FT) Technology Process



JP-8 Jet Fuel Reduced Particulate Emissions Using FT Fuels

(percent change in particulate number density)



Note: Results are highly dependent on engine model/year and composition of baseline fuel.

Energy Performance

Benefits from FT-based fuels include significantly reduced exhaust emissions and excellent thermal stability at high temperatures. The FT fuel also possesses superior low temperature properties and will not require a change to the airplane configuration or reduce its fuel efficiency.

In addition to providing a new, domestic energy source to fuel its aircraft, the Air Force must also consider alternative fuels that are capable of supporting military base infrastructure and ground support.

FT synthetic fuels have the potential of providing a single fuel source for Navy ships. Because of its high stability, endothermic properties and reduced exhaust pollutants, FT fuel can support Army and Marine equipment. Because the fuel has no sulfur or aromatics, it has better performance in fuel cell power generation. FT fuels require no engine modifications in conventional ground vehicles.

In August 2007, Secretary of the Air Force Michael W. Wynne certified the B-52 Stratofortress as fully approved to use a 50/50 blend of traditional crude-oil based aviation fuel and the FT fuel. On December 17, 2007, the anniversary of the Wright Brothers' first flight 104 years ago, a C-17 Globemaster passed its flying tests by completing the first transcontinental flight of an aircraft using a blend of regular aviation and FT fuel. Then on March 19, 2008, a B-1 Lancer became the first Air Force aircraft to fly at supersonic speed using the synthetic fuel blend. The Air Force expects to certify the C-17, B-1, and F-22 in the near future and continue with its objective of certifying the entire fleet by early 2011.

The need for secure, clean energy is real, immediate and continues to grow. Because all branches of the Armed Forces have a vested interest in reducing our dependence on foreign oil, the Air Force continues to work in an integrated fashion on solutions that would benefit all types of military operations. By working in partnership with private industry, academia, other branches of the Armed Services, government agencies, and our foreign partners, the Air Force is continuing to soar toward its goal of having new, alternative energy solutions to provide greater sovereign options to protect our country.