# Laser Ignition: A Promising Alternative for Stationary Engines

*Distributed energy technologies, such as stationary natural gas-powered reciprocating engines, offer a clean and efficient means of generating on-site electricity and heat for industrial sites, hospitals, and other facilities with high energy requirements.*

## The Challenge

Stationary natural gas-powered engines are primarily spark ignited. To take advantage of high efficiency with low emissions, these engines operate with leaner air/fuel operating conditions. Under such a mode of operation, the high gas density across the spark plug electrodes acts like an insulator that impedes reliable ignition.

## The Solution

Engineers in Argonne's Distributed Energy Research Center (DERC) are investigating laser ignition as a promising alternative to spark plugs for natural gas-powered engines. Laser ignition enables reliable ignition in ultra-lean fuel-air mixtures, which results in increased efficiency and low emissions.

*Argonne researchers designed and fabricated this fiber-coupled laser ignition setup to demonstrate performance on a single-cylinder engine.*

## The Results

Using a single-cylinder test engine, DERC researchers have shown efficiency improvements up to three percent for a given $NO_x$ emission level, and up to 70 percent $NO_x$ emission reductions for a given engine efficiency. Researchers are now expanding their laser ignition platform to a six-cylinder engine to demonstrate and optimize its performance on a larger scale.

*Argonne researchers Bipin Bihari (front) and Sreenath Gupta prepare a laser ignition system to run a 470-horsepower, six-cylinder Cummins stationary engine at the laboratory's Distributed Energy Research Center (DERC).*

***"We are focused on improving the ignition reliability for large stationary engines, which has proven to be the prime concern for engine manufacturers,"* said Argonne mechanical engineer Sreenath Gupta.**



**For further information, contact: Sreenath Gupta, sgupta@anl.gov**

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