RICH-BURN VS LEAN-BURN
NATURAL GAS ENGINES

The shift to natural gas generators for standby and energy management applications has been accelerated by the low & stable cost of natural gas, as well as the overall demand for cleaner power generation sources. Severe weather and the ensuing power outages are likely to continue accelerating natural gas generator applications in the industrial markets. A popular method for controlling and reducing emission levels out of the natural gas generator is to use air-to-fuel ratio control and catalytic reduction. However, there are two very different types of natural gas generators on the market today. Choosing between a “lean-burn” or “rich-burn” natural gas generator comes down to what the customer’s application needs are in terms of generator performance requirements, fuel flexibility, reliability, and the cost of emissions’ standards compliance.

RICH-BURN ENGINE

Rich-burn natural gas engines are associated with applications where transient load response is more critical than fuel efficiency. They are typically applied in emergency standby applications due to their quick starting & transient performance. Prime power applications with variable loads are best served with these engines.

LEAN-BURN ENGINE

Lean-burn natural gas engines are associated with high electrical efficiencies and operation on biogases. Due to the efficiency advantage they are commonly used for baseload plants and cogeneration. Many operations without the utility as a secondary power system are not possible because of the lean burn operational challenges with varying loads or transients.

THIS OR THAT:

RICH-BURN

- Rich-burn gas engines operate with the AFR at a higher concentration of fuel to air. It is a “fuel-rich” mixture. Rich-burn engines generally operate with (λ) equal to 0.995.
- With a three-way catalyst, rich-burn gensets provide the lowest emissions. A rich-burn engine with this catalyst typically has oxides of nitrogen (NOx) emissions that are an order of magnitude below the engine-out values of the most advanced lean-burn engine technologies.
- Rich-burn engines accept a block load and operate at a wide load range.
- High power-ratio rich-burn engines can deliver competitive fuel efficiency in the lower running hours of energy management applications. This can be especially true when considering part load operation.

LEAN-BURN

- Lean-burn gas engines operate with an AFR that has a higher concentration of air than what is needed to burn all of the fuel, making it a “fuel-lean” mixture. Lean-burn engines operate with (λ) anywhere between 1.5 and 2.2.
- Many lean-burn engines also require selective catalytic reduction (SCR) and an oxidizing catalyst exhaust after treatment, which are costly and require high maintenance.
- Lean-burn engines typically do not accept a block load well and perform poorly under varying loads.
- Typical industry thinking is that the fuel efficiency advantages of the lean-burn solution would favor energy management applications, but that is rarely true below 2,000 hours of annual usage.

80% OF THE GLOBAL GENERATOR MARKET IS FOR EMERGENCY STANDBY APPLICATIONS.
Along with emergency standby applications, Generac has optimized its rich-burn technology to be used in energy management applications such as demand response and peak shaving. The aforementioned benefits equate to low capital and operational costs, allowing the end user to substantially decrease their peak demand charges. Given the relatively low running hours in energy management applications, rich-burn natural gas generators are the ideal choice. The specifying engineer or customer must look at all capital and operating expenses in such an analysis to determine the optimal choice. There are many cases in which today’s advanced rich-burn natural gas generators can actually deliver competitive fuel efficiency with their lean-burn counterparts.

**WHY GENERAC?**

Generac did not become one of the largest generator manufacturers and suppliers by accident. For six decades, Generac has driven innovation in the industry by considering generators from a unique perspective – yours. We evaluated the common problems involved in specifying, configuring, installing and maintaining generators, and created unique solutions to make Generac the easy choice.

**NATURAL GAS TECHNOLOGY LEADER** – Reliable, cleaner, smarter

- Over 60 years of innovation and leadership within the power generation industry
- Generac designs and manufactures advanced gaseous powered systems
- Over 2 million natural gas gensets installed and active
- Generac assembles more natural gas generators than anyone else in the world

**BEYOND STANDBY RATINGS** – The flexibility to unlock value

- Industrial gas models designed for Energy Management applications
- Products that meet EPA certification requirements for emergency & non-emergency needs
- Only manufacturer to offer a wide range of Demand Response ready products from 16 kW to 1000 kW

**PROVEN POWER** – Response, power, longevity

- Wide range of diesel-powered generator solutions from 10 kW to 3.25 MW
- Our engines start fast and respond quickly to loads – NFPA 110 Type 10 is our norm, not the exception
- Full mobile line of diesel and gaseous generators with prime and continuous ratings

**FACTORY-CERTIFIED TECHNICIANS** – Support you can trust

- Over 4,000 certified technicians globally
- Online, classroom and hands-on product training
- Full support from the design stages through the life of the product

For more information or to learn more, visit us online or call us at:

[www.generac.com/industrial/beyondstandby](http://www.generac.com/industrial/beyondstandby)

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